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FOREWORD

Faculty of Sport and Physical Education University of Nis in its 42 years long tradition organizes a scientific conference "FIS COMMUNICATIONS". This year we are organizing 17th scientific conference "FIS COMMUNICATIONS 2014", and 2nd International scientific conference. Our profound years long experience in organizing of the conference has contributed to ever increasing high quality of the conference over years.

International scientific conference "FIS COMMUNICATIONS 2014" is organized by the Faculty of sport and Physical Education University of Nis under the auspices of the Ministry of Education, Science and Technological Development of the Republic of Serbia.

We are proud to announce the key speakers in our plenary sessions as eminent renowned experts in their field of expertise who are coming from the countries taking part in this conference for the first time.

This conference can boast submission of 98 papers in the form of abstracts and 86 full text papers. Upon the review process 74 papers were accepted and approved for the publication. Incorporating two papers of the invited speakers the total number of submitted papers is 76.

Papers are divided into five sessions depending on the topics investigated as follows:

Sport, Physical Education, Physical Exercise and Health, Corrective Gymnastics and Interdiciplinary session.

Organizers are satisfied with the participation of already renowned researchers and the young, oncoming authors following the thorny path of the scientific investigation, as well. Also a large number of foreign authors and thematic diversity have widen the horizon of the expert and scientific insights, put some new incentive for the cooperation and expression of the new creative efforts.

Enclosed you can find the Proceedings of the International scientific conference "FIS COMMUNICATIONS 2014" incorporating all the papers presented at the scientific conference.

We would like to express our gratitude to all the participants, especially to the authors of the papers and we expect that all this conference contributes to enhance and further the development of the scientific and expertise thought in the area of sport, physical education and recreation.

Chair of the Scientific Committee
Saša Pantelić, PhD, prof.

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TALENT IDENTIFICATION AND DEVELOPMENT IN SPORTS GAMES

Zoran Grgantov

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INTRODUCTION

In elite sports records are constantly being broken and performance level is being raised, and a large number of citizens of some country, as well as highly positioned government officials, identify with athletes' international achievements. Besides, elite sport is a growing business in which success and failure are public. Partly because of this, both strong excitements and painful disappointments are connected to sport. It is in the interest of national governments, sports federations and academies working with gifted athletes to achieve as high a performance level as possible in as short a time period as possible by investing as little as possible (Pearson et al., 2006). Therefore, large interest and desire to identify gifted athletes as early as possible and to direct already limited resources towards those who have the greatest chances to achieve top athletic results are not surprising. An increasing number of academies working with talented athletes are trying to make athletes reach the highest performance level in as short a time period as possible. That is why giftedness identification (IG) and talent development (TD) programs must also be based on results of scientific research and not only on decisions of experts from different sports. Numerous open questions, i.e. problems that have remained unsolved for decades, indicate that this problem has not been approached in an appropriate way. Perhaps the highest obstacle to quicker progress is the distinct division among scientists between those who think that talent is innate and those who think that talent is created by years of quality practice (nature or nurture debate). Most scientists have been unwilling to accept arguments given by "the other side", even when those arguments are substantiated by scientific evidence (Vaeyens et al., 2008). The lack of constructive dialogue and cooperation between scientists who explored this area from different aspects (genetic, neurophysiological, biomechanical, motor learning, etc.) has to a great extent prevented a multidisciplinary examination of the problem and stifled the creativity and innovation necessary for quicker progress and new findings. Therefore, the problem of IG and TD will be hereinafter examined in a multidisciplinary manner, taking into consideration to objectively analyse previous findings regardless of the "point of view".

To begin with, basic terms will be defined to decrease the possibility of misunderstanding the text and possibly coming to wrong conclusions and decisions because of it. After that, the genetic basis of talent, possibility of talent development by persistent practice, and influence of different environmental factors on TD will be analysed. The most important problems that should be taken into consideration by scientists with the aim of obtaining reliable and valid results that would improve IG and TD programs will be pointed out. The specificities of sports games will be additionally emphasised. Models that have been most frequently applied for IG and TD will be briefly analysed and based on this recommendations will be given for future research and development of those models. Next, the results of the most important studies carried out by the author of this paper and his associates will be discussed and an attempt will be made to contribute to answering some of important questions in the area of IG and TD in volleyball. After that, a quasi-longitudinal model of IG and TD will be suggested.

DEFINITIONS AND EXPLANATIONS OF BASIC TERMS

Giftedness vs Talent: most authors consider these two terms to be synonymous, but some

authors (Gagne, 2003; Gagne, 2009) define them differently

Giftedness: possession and use of high levels of natural abilities

Talent: manifesting a high performance level in a certain sport. It is a combination of giftedness, high-quality long-term training, influence of environmental factors and luck. Therefore giftedness is the basis and talent is the ultimate product of its systematic development.

Both previous definitions mention a high level of abilities i.e. performance. However, there is no consensus among authors about what is the limit of performance level which determines whether an athlete is gifted or talented. Some authors think that it refers to the top 10%, some believe it to be the top 2-3%. Some express themselves in standardised values and set the limit at 2, 3, and even 4 standard deviations (Hohmann and Siedel, 2003).

Detection: a long-term continuous process of finding potential talents among those who do not practice a certain sport or among beginners in some sport

Identification: a process in which, among those who have been practicing some sport for a period of time, those athletes are recognized that are believed to be able to achieve the required performance level in the future.

Selection: choosing individuals for competition who are believed to meet the demands of the competition. In doing so, the emphasis is put on a shorter interval between selection and competitive performance in which talent should be manifested. It is implied that this selection is made from a population that has previously been positively detected and identified.

Development: Ensuring the most adequate learning conditions with the aim of achieving full potential (reaching ultimate abilities)

Predisposition Tendency to a condition or quality, usually based on the combined effects of genetic and environmental factors. Therefore, predispositions may be genetically conditioned, but do not have to be. E.g. if we ate a lot of candy when we were children, that would not make us predisposed for dental caries, obesity, etc. at adulthood.

Genetic predisposition means you are likely to inherit a trait from your parents. Someone might have a genetic predisposition to diabetes or another illness.

Disposition - a person's inherent quality

Interdisposition: an arrangement of interrelated ontogenetic dispositions, which leads to formation of a new quality, which is not a mere direct sum of the constituent dispositions

Gene - discrete sequence of DNA that produces a biologically active product

Genotype – in a narrow sense, it refers to his or her specific DNA sequence for a known gene or DNA marker. In a broad sense, it refers to sum total of all genetic traits measured in a study

Phenotype – in a narrow sense, specific physical trait in an individual; in a broad sense, it refers to all physical traits measured in a study.

Genotype-phenotype correlation – analysis of the contribution of genetic variation at the level of the DNA sequence to physical variation at the level of the whole organism.

THE GENETIC BASIS OF TALENT

Information on the correlation between heritage and quality sports performance, proneness to injuries, level of different traits, abilities or skills important for success in sports can be obtained directly by analysing the relations of individual genes or a number of genes with some criterion related to sport, or indirectly e.g. by investigating twins or by family studies.

Candidate gene and genome wide association studies

Studies that select a specific gene or genes and correlate variation in these genes with a disease or physical trait are termed candidate gene association studies. Studies that examine DNA markers at many positions on multiple chromosomes are termed genome-wide association studies (GWAS). The ultimate goal of both candidate gene and GWAS is to establish genotype-phenotype correlations (Gibson, 2009). Most genotype-phenotype correlations for non-disease traits are rather weak. That is probably the reason why in candidate gene association studies and in GWAS the loci identified often are not replicated when larger studies are done, or when attempts are made to narrow the locus down to a specific gene (Trent and Yu, 2009). Williams and Wackerhage (2009) also conclude that genetic tests available at the moment are simply not powerful enough to provide valid data on which to base important decisions in sport. If these problems were

solved, the directly obtained data on genome (genetic profile) of athletes could be applied in sport in three ways (Williams 2014):

1 It can be determined whether an athlete's strong suit is strength or endurance and individualise the training program accordingly. E.g. Ahmetin and Rogozgin (2009) point out that a rugby club from a Sidney suburb submitted its players to genetic testing on 11 genes which are considered to be related to performance in sport and, based on the findings obtained by the testing, improved training programs for those athletes. They claim that by doing this they achieved predominance over their rivals.

2 Proneness to certain injuries or illnesses can be predicted and interventions can be made in training programs to prevent them

3 IG and TD programs can also use data obtained by genetic testing (however, this is least likely in the foreseeable future and even if it occured, the data would be merely complementary, and basic data would still be the data obtained by phenotype testing)

Both candidate gene and genome wide association studies usually analyse variants that change one chemical letter in DNA sequence. Such variants are called point mutations or single nucleotide polymorphisms (SNPs).

It has recently been discovered that a large amount of genetic differences between individuals are due neither to mutations nor to SNPs, but to duplications and deletions of genes or groups of genes (Gibson, 2009; 7). The groups of extra and/or missing DNA sequences on human chromosomes have been termed copy number variants (CNVs). The global significance of CNVs for normal physiology is not clear, but CNVs are thought to hold significant potential as a source of phenotypic variation. Indeed, the impact of CNVs on human physical characteristics may well be greater than the impact of SNPs, either at the individual or population levels.

It can be concluded that detailed genotyping that incorporates DNA markers of population ancestry and assessment of copy number variants should be the goal of studies designed to correlate performance traits with human genes.

Williams et al., (2014; 1) also emphasises great responsibility of scientists who must be certain about the accuracy of their statements and points out that firstly, researchers must recruit larger numbers of athletes for case-control study designs and identify more genetic variants that contribute to the genetic component of sport performance. That is why international cooperation of scientists is important. Secondly, researchers must conduct comprehensive research within a given sport. Grouping different sports (and even different specialities within a sport) to boost sample size theoretically brings important increases in statistical power but also other difficulties by diluting the phenotypic characteristics, selection and training practices of elite athlete groups.

Heritability

Population genetics scientists developed the technical term heritability. Heritability is the proportion of trait variation that is accounted for by genetic factors, as opposed to variation due to the environment (Visscher at al. 2008).

In such studies the percentage of genotype is assessed, as opposed to the percentage of environmental factors in variability of certain trait or characteristic in a precisely determined population under certain conditions. These values are usually obtained by analysis of variance, which calculates the ratio between genotype and phenotype variance in the total variance in certain population. Correlation and regression coefficients are also used sometimes.

The obtained values are usually expressed in proportions, percentages or correlation coefficients (e.g. the value of 100% or correlation 1 means that variability of some trait in a certain population can be fully attributed to variations in genotype). In practice, as previously mentioned, this is determined by family studies and twin studies.

Ranges of heritability values in percentages for certain traits and abilities are presented in the following table (Booysen, 2007).

Table 1. Ranges of heritability values in percentages for certain traits and abilities (Booysen, 2007)

VARIABLE	RANGE (%)
AEROBIC POWER AND CAPACITY	40-93
ANAEROBIC POWER AND CAPACITY	70-90
MAXIMUM STRENGTH	22-100
TYPE OF MUSCLE FIBER	5-100
COORDINATION	45-91
MATURATION RATE (EARLY-LATE)	80-95
SOMATOTYPE	69-90

The first problem regarding the data in the table is the large range in values of certain variables, i.e. discrepancy in the results obtained by different studies.

The second problem is not respecting the gene interaction and gene/environment interaction effects in calculations of h^2 so that estimates of heritability might be overestimated (Fowler and Whitlock, 1999; Kempthorne, 1978).

The third and the biggest problem is the false conclusion that high heritability implies that a certain trait, ability or skill cannot be influenced. High heritability only means that most of the variation in particular trait that is observed in the present population is caused by variation in genotypes (Visscher at al., 2008). In sport science and sports practice such misinterpretations of high values of h^2 can be found frequently. The result of this is the prevailing view that for example speed or coordination can be developed by training to a very small extent. Certain scientists who interpreted the results of scientific studies in a superficial and faulty manner are responsible for such a view. It brings great damage to sport because many coaches and athletes have been convinced that there is no point in developing those abilities that are basic for a number of sports, especially for sports games.

Epigenetic approach

The epigenetic approach emphasises that giftedness and talent are the result of complex interaction of numerous inherited traits. These traits consist of many components like personality, mental, physical and physiological aspects. Multiplicative interactions between these components promote above average results within a given domain (Simonton 1999, Booysen 2007). The epigenetic approach also points to the interaction of genotype and environment. Furthermore, it differentiates primary (genetics, training, psychological factors and interactions among them) and secondary (socioeconomic and other) factors of influence in explaining talent. In epigenesis, the developing organism begins in an undifferentiated state and gradually changes to a more complex state through multiple interactions.

Epigenesists therefore claim that inherited traits and characteristics do not result in manifestation of talent at birth. This manifestation depends on interaction with environment and can appear at various times. From the aforementioned it is clear that those complex and dynamic genotype-phenotype interactions cannot be explained by transversal studies, but rather by prospective longitudinal studies.

Ethical issues in genetic research of talent

As already mentioned, there are different reasons (motives) for which an individual can personally undergo or subdue others to genetic testing. However, genetic testing also reveals numerous ethical issues related to it (Williams and Wacherhage, 2009). E.g. there have been cases where athletes underwent genetic testing and only years later it was discovered that variations on that gene increase chances of developing some serious illness. That is why it is important to inform athletes about this beforehand. In another case, a club wanted to subdue an NBA player to genetic testing following doctor's recommendation because of increased chances of heart disease. He refused and went to a club that did not demand this. The previous examples may sound absurd to some, but sometimes an athlete does not want to know if he/she has increased chances for some serious disease or sports injury and it is ethically questionable whether he/she can be forced in these cases and if his/her privacy and "right not to know" are being disturbed. Also, the results obtained by

genetic testing at a very young age can be used to prevent access to a certain sport or to sport in general. We might raise a question: who has the right to choose a sport instead of a child and who has the right to deprive a child of sport? We must not forget that there is a very real possibility that the results of genetic testing are not correct, which additionally confirms that important decisions in sport should not be made solely based on those results.

TALENT DEVELOPMENT ENVIRONMENTAL FACTORS IN SPORT

Numerous environmental factors affect talent development in sport (Baker at al., 2003; Li at al., 2014). They can generally be divided into three components: milieu, individuals, and provisions. After a short chapter that explains the importance of long-term practice in sport from the neurophysiological aspect, the importance of different environmental factors will be briefly explained, and somewhat greater attention will be paid to quantity and quality of practice as probably the most important factors in talent development.

Neurophysiological bases of skill development

From the previous chapter on the genetic basis of talent it can be concluded that genes are kind of a blueprint based on which our body and brain are built. But how to create a design of behaviour and skills in an unpredictable world in which we exist on a daily basis? Genes play a certain role in this. To a certain extent, they determine our impulses, affinities, instincts, etc. Guided by these adapted neurological programs, we are moving towards the solutions for certain situations. This primarily refers to resolving simple situations, but it does not apply to much more complex situations such as e.g. some tactical task in sports games.

In those situations it is biologically too demanding (too expensive) to program the genes for solving them beforehand. Also, from generation to generation, even within the same generation, in different cultures different higher order skills are necessary. To survive for millions of years we could not have gambled in this way.

How do we perfect complex skills in sport then?

Studies carried out by neuroscientists proved that practice causes changes in grey and white matter (Zattore et al., 2012). Changes in grey matter have been much more investigated, whereas for decades researchers have shown little interest for changes in white matter. They considered the myelin to be mere insulation and the cables inside it little more than passive passageways. Theories about learning, memory and psychiatric disorders cantered on molecular action inside the neurons and at the famous synapses — the tiny contact points between them (Fields, 2008; 54). However, modern MRI techniques shed new light and revealed very important functions of not only grey, but also of white matter. Myelin sheaths around the axons are coated in the brain and spinal cord by oligodendrocytes, and in other nerves in the body by Schwann cells. Many axons, especially the smaller filaments, are not coated at all. And even along insulated fibres, gaps in the insulation appear every millimetre or so. The bare spots came to be known as nodes of Ranvier and nerve impulses travel by jumping from one Ranvier node to another.

Nerve impulses travel up to 100 times quicker along myelinated axons. Without myelin, the signal leaks and dissipates. At birth, myelination can be seen only in some body regions. Myelination generally proceeds in a wave from the back of the cerebral cortex (shirt collar) to its front (forehead) as we grow into adulthood. The front part of the brain is responsible for making decisions. Some researchers (Fields, 2005; 2008) have speculated that skimpy forebrain myelin is one reason that teenagers do not have adult decision-making abilities. Such observations suggest that myelin is important to intelligence.

However, what is the role of white matter and myelin sheaths in perfecting sports skills?

Bengtsson et al. (2005) used a new brain-scanning technology called diffusion tensor imaging (DTI) to investigate the brains of professional pianists. They discovered that in top pianists certain regions of white mater important for playing piano were more developed than in non-musicians. They also determined that myelination was more prominent in those regions when a musician practiced more hours a day over time. Scientists also believe that it is not a coincidence that some axons are myelinated and some are not. When performing complex skills (such as in sports games), it is important for impulses from regions at different distances to reach neurons at the same time. This is

possible only if their speed of conducting impulses is not the same.

That study of accomplished pianists revealed an additional finding: white matter was more highly developed throughout the brains of individuals who had taken up the instrument at an earlier age. In people who learned after adolescence, white matter development was increased only in the forebrain — the region that was still undergoing myelination.

It can be concluded that man has always "myelinated" during childhood by quality long-term (persistent) learning of certain skills. Thus, instead of programing complex skills, which is expensive and inflexible, genes create oligodendrocytes in the brain which isolate those axons that conduct impulses between neurons and in this way stimulate the perfection of those skills that will be necessary to us. This is a very flexible, economic, but also complex and lengthy process (Fields, 2008).

Provisions

Provisions include all forms of TD services and programs such as a balance training program (Gagné, 2003; 2009; Li at al., 2014).

Training quantity

The results of previously mentioned studies in the chapter on neurophysiological bases of skill development also have a very important implication on imporvement of sports skills and they confirm the view of those scientists who believe that talent can be developed and that this process should be started as early as possible. Long-term development from beginner to top athlete is in a way outlined with the "10-year rule" (Simon and Chase, 1973. in Baker at al., 2003). The authors set this rule based on the studies investigating expert chess players and chess players at lower quality levels.

The theory of deliberate practice (Ericsson et al., 1993) extends Simon and Chase's work. In his research, first on musicians and later on athletes as well, he determined that it takes 10 years and 10000 hours of deliberate practice to become an expert. For Ericsson et al., the term deliberate practice denotes very organised practice oriented towards defined goals and assumes a very high level of motivation and a very high level of invested effort in every exercise in every training session, as well as during competition. In other words, certain excellence and discipline in approach to training and competition must be constantly present. Ericsson et al. also state that later in a career it is very hard to make up for the hours of practice lost in earlier phases of career.

However, nowadays it is not easy to reach the quality standards of deliberate practice set by Simon and Chase, and later extended by Ericsson. Some recent studies in the area of sport (Côté, 1999; Côté et al., 2007; Bailey and Collins, 2013) indicate that those 10000 hours in 10 years do not have to include only organised and supervised practice. Indeed, there is a large amount of evidence (Coyle, 2009; Bailey and Collins, 2013) that point to the importance of free creative play for improving performance in certain sport.

Aware of the importance of long-term persistent practice, many countries have initiated and/or adopted systems of long-term development of athletes (Baker and Schorer, 2010). The main goal in the first stages of long-term development of athletes is to form so called physical literacy which represents an essential precondition for high-quality development of sports skills, i.e. talent. Physical literacy is acquired through three phases. The first phase is active start and it begins practically at birth and finishes around the age of 6 years. In the first part of this phase parents and other people who take care of children play a great role because they are expected to practice with children in a fun and safe way. Later on, a child becomes more and more independent and practices under supervision of parents, educators or coaches. This phase is followed by the phase of development of fundamental movement skills which lasts approximately until the age of 8 years for girls and until the age of 9 for boys. This phase is followed by the phase of development of fundamental sports skills which ends approximately at the age of 11 for girls and at the age of 12 for boys. Baly et al. (2010) point out that physical literacy is extremely important because without the development of physical literacy, many children and young people withdraw from physical activity and sport and turn to more inactive and/or unhealthy choices during their leisure time.

Training quality

Motivation is a necessary precondition for someone to train and compete regularly and with maximum engagement (with quality) in a sport for

years. It has a positive influence, i.e. increases both components of practice (quantity and quality). Duckworth and Quinn, (2009) point out that grit in achieving long-term goals, despite interferences and difficulties, is crucial for school success, but also for success in sport and numerous other professions. The authors did not answer the question whether grit could be developed or not. However, Dr Carol Dweck from Stanford University has been studying motivation for 30 years and she proved that motivational appraisal (invested effort was praised) during performance of simpler tasks was very important for persistent and high-quality performance of more demanding tasks that followed. She also determined that some other types of appraisal during performance of simple tasks (e.g. praising subject's intelligence) can cause frustrations and poor performance of more complex tasks.

Coyle (2009) in his book The Talent Code emphasises the importance of sports models that can serve as sort of an initial trigger for development of certain sport in some country, i.e. as an incentive to a large number of children to start with systematic training. A typical example for this is the one of Russian tennis player Anna Kournikova. When she appeared on top of the world tennis at the end of the 20th century, 3 Russian tennis players were placed among the first 100 players of the ATP list. About ten years later (the time period required for young tennis players she inspired to start playing tennis to reach top performance level) there were 17 players among the first 100.

When children begin with training, coaches also play an important role because they have to develop interest and love for the sport in children. For coaches working with children in the first phase of their career, those characteristics are even more important than the level of expert knowledge.

In the previous chapter it was explained that the amount of time spent in deliberate practice was an important predictor of success. However, in the analysis of practice history profiles of professional, semi-professional and amateur players less attention was paid to quality of that practice.

Williams and Hodges (2005; 640) also point out these problems "Although researchers who have documented the practice profiles of elite performers have contributed to our awareness of the significant investment of time and effort required to reach elite levels of performance (i.e. the macrostructure of practice), there remains a lack of knowledge about the specific practice activities (i.e. the microstructure of practice) that players undertake on the road to excellence In particular, research is required to determine the ''what'' and ''how'' of practice and how these interact with the instruction process".

To determine "how" of practice, we could use the attitudes of leading world experts from the area of education, basic principles of motor learning and data gathered by observing and interviewing elite athletes and their coaches.

One of the leading experts in the area of education, Ken Robinson, criticises the contemporary educational system which does not stimulate individuality, curiosity and creativity as 3 basic values upon which children's potential is developed. Just the opposite, the system is based on uniformity, standardisation and testing, which constrains those basic values (Robinson, 2006; 2010; 2013). Success in sports games is unconceivable without individuality, curiosity and creativity, and if these are not systematically stimulated during training, it will surely have a negative impact on TD.

Sports games are very unpredictable and success in a rally with the opponent is much more likely to occur if we make creative and innovative decisions. Decision making is a skill that can be developed (Williams and Hodges, 2005). There are two main teaching styles used to develop those skills. The first one is instructional (explicit) in which the coach not only defines the skill and expected outcome, but also defines the stimulus and response. The advantage of this teaching method is its uniqueness and time effectiveness, and its great disadvantage is that it stifles independence and creativity and develops "addiction" to coach's instructions in players. The other one is problem oriented (implicit) in which coaches define the skill and expected outcome for the player, but they effectively leave it to the athlete to determine how to do that on their own or to figure out to what information they must attend. A great advantage of such teaching is the development of independence and creativity, while a disadvantage is that some players may take a long time to understand what they have to do (some may not understand at all). That is why innovative coaches in sports games often use a so called guided discovery teaching style. This style includes good sides of explicit and implicit teaching. In it, as in implicit teaching, a coach defines the skill and expected outcome, but also, by questions set in a quality manner, directs an athlete to detect a cause-effect relationship between his technical-tactical decisions on the court and the consequences of those

decisions. This also expedites the decision making process so this model is more economic in terms of the time spent in relation to the implicit approach (Williams and Hodges, 2005).

Furthermore, in sports games the optimization of transfer from practice settings to competitive performance is highly dependent upon the principle of specificity. This means that in sports games a much better skill transfer from practice settings to competitive performance is achieved when practice simulates the competition conditions. Although the previous statement sounds logical, inexperienced coaches are often misled by a paradox in the theory of motor learning. The main paradox in the theory of motor learning refers to the fact that constant and blocked practice enables better progress in practice settings in relation to variable and random practice caused by a short-term decline of skills in that practice, but has a far better skill transfer to competitive settings (Williams and Hodges, 2005). To better understand this paradox, it is necessary to clarify the ways of practicing that were mentioned.

In constant practice each repetition of an exercise is performed in the same conditions, e.g. shooting a basketball 20 times from the same position on the court and by the same shooting technique. In variable practice the conditions are changed during practice. An example of such practice is shooting a basketball 20 times, but by different techniques and from different positions on the court.

Blocked practice is such practice in which we know exactly what we will do in the following repetition (e.g. it is predefined that a player will kick the ball 5 times with his right foot, then 5 times with his left foot).

In random practice several skills (or variations of the same skill) are performed randomly during practice, so a player does not know beforehand what skill (technique) he will have to perform in the following repetition of the exercise. In sports games at a competition all players find themselves in such conditions almost always. E.g. a spiker in volleyball does not know what type of spike he will perform until the last moment because it depends not only on the ball trajectory, but also on opponents' blockers and players in the field, but also on his experience from previous similar situations.

The consequence of the previously explained paradox in the theory of motor learning is that a great majority of coaches think that constant blocked practice has better transfer on competitive efficacy. However, scientific research has not confirmed these assumptions. Yet, rather opposite has been proven – the effect of constant blocked practice is short-term and over time, the level of skills acquired by such practice decreases relatively quickly. Expert coaches also know this, which is confirmed by a study of coaching expertise in volleyball (Cobley 2001; in Baker at al., 2003). He determined that athletes were active in drills over 92 percent of the scheduled practice time and the intensity level was equivalent to that faced in matches. The emphasis in practice was to engage the players in drills that closely simulated game conditions and that had a high probability of occurring against a future opponent. All of the aforementioned is consistent with the saying "game teaches game", and it is also the presumption for development of creativity in sports games.

When we answer the question "what" of practice, we must keep in mind the complexity of sports games and multidimensionality of talent in sport. That is why during practice it is important to influence different dimensions of athletes' anthropological status. These include physiological variables, psychological attributes, physical performance, and sport skills. More importantly, the various trainable skills must be developed in an integrated manner. For example, physical skills can be trained together with perceptual and decision-making skills to enhance their transfer to a game situation. Unfortunately, most TD programs are dominated by development of physical abilities and skills, whereas much less attention is paid to psychological and perceptual – decision making skills (Booysen, 2007). However, to successfully perform tactical tasks in sports games, one needs perceptive (quickly noticing situations on the court), cognitive (e.g. anticipation and decision making) and motor skills (performance technique). Also, the fact is that in traditional training methods much more attention is paid to the improvement of motor components, and perceptive and cognitive components are neglected. There are several possible reasons for this, e.g. the opinion that these skill components are inherited and cannot be affected by practice, or the lack of information on how to develop them by practice.

Studies have shown that these skills are not only important for success (experts perform them better than non-experts), but also that they can be trained (Williams, 2000). This has particularly been investigated for perceptive skills (noticing the situation) and cognitive skills (anticipation that

precedes perception and decision making that follows perception). There is also a possibility that by developing these methods the time period necessary for reaching top performance level could be significantly shortened (10 years – 10000 hours).

Milieu

Milieu refers to macroscopic physical factors (e.g. birthplace), social-cultural factors (e.g. popularity of a sport within a culture), and a socioeconomic status (e.g. family income) (Li at al. 2014 in press). Importance and tradition of some sport in a certain country has a very big influence of talent development. The examples of high popularity of a sport in some country are e.g. skiing in Austria, table tennis in China or ice hockey in Canada. Besides popularity and tradition of a sport in some country, talent development is also affected by government policy or strategy, socio-economic status of athlete's family, as well as the place where he/she grew up. The school which athlete attended is particularly important because schools offer numerous sports activities. Talent development of individual athletes involved in those activities depends on their type, quantity and quality. Flexibility of school systems is also very important because school and sports responsibilities are not easily coordinated and many talented athletes give up sports precisely because of inflexibility of the education system (Li at al., 2014).

Individuals (significant others)

Individuals refers to those people or significant others who may impose positive or negative impacts on the process of athletes development. Parents surely play a very important role in their children's career development. That role must be stimulating and never burdening for children, which may occur when parents are overly engaged in their children's career and "live vicariously" through them. Of course, coaches are also very important for successful talent development. Providing high-quality training programs and sessions including informational support is the main task for a coach. Besides quality training, a coach may also fulfil roles in providing tangible support and building a good relationship with athletes. Besides the coach, other members of the expert team also contribute to sports talent development. Brothers (sisters) and friends can also have significant influence both on selecting the sport and persevering in sport or giving up.

OTHER IMPORTANT ISSUES IN IG AND TD PROGRAMS

Inefficiency of one-off IG programs

Many IG programs that are currently being applied cause early (de)selection of many young athletes who are evaluated as not talented enough. As previously pointed out in the chapter on genetic bases of talent, such approach is inhumane and unethical. Besides, such models based on one-off measuring during pre-puberty are inefficient for a number of reasons:

- because they do not take biological maturation and its impact on IG and TD into consideration. E.g. Malina et al. 2004 determined that children who mature early are stronger, more powerful and quicker, have better aerobic capacity and power, are taller and have greater body mass than their peers who mature later. This is particularly emphasised in the period between the ages of 13 and 15 years. That biologically more mature children have the advantage is indirectly indicated by the effect of relative chronological age. In numerous studies that investigated this effect (Barnsley et al., 1985, Musch and Grondin, 2001; Vincent and Glamser, 2006), it has been recorded that children born in the first months of any year are more frequently selected for competitive teams (identified as gifted). This can be explained by positive correlation between biological and chronological age.
- because some traits, abilities and skills that are good in differentiating more efficient and less efficient athletes do not come to the fore at all until post puberty. E.g. Paerson et al. (2006) point out that anthropometric measures, motor and functional tests are important at the beginning of a sports career when athletes' giftedness cannot be evaluated by the level of their technical-tactical skills (at the beginning of the IG and TD program). However, as time goes by, competitive efficacy is increasingly affected by the level of technical-tactical skills, tempo of development of those skills, as well as some cognitive abilities (perception,

decision making, etc.) and psychological characteristics.

- for now, there is no clear evidence that would confirm significant correlation of results in tests at the beginning and efficacy at the peak of a career. Correlation of predictive tests and efficacy of young athletes at the same time point does not have predictive value for predicting their ultimate reach (Hohmann and Siedel, 2003; Gagne, 2009; Bailey and Collins, 2013).
- because of the proven instability of numerous traits, abilities and skills, especially in puberty (Booysen, 2007). E.g. in a cross-sectional study on different age groups, e.g. 13, 16, 19, 22 years, it can be determined that e.g. a low level of cognitive anxiety is important for success. However, without longitudinal studies, we cannot be certain that an athlete A has a low level of cognitive anxiety at the ages of 13, and 16, and 22.
- because of the inability to assess the reaction on training stimuli. Only by longitudinal monitoring of athletes in practice and competitive setting in certain sport, we can assess their "capacity for improvement". Harre (1982, in Booysen 2007) gives four indicators based on which those athletes' capacities are assessed during their exposure to specific training programs: 1 Reaction (adaptation) of the organism on demanding training stimuli; 2 Level (tempo) of progress in performance; 3 Final level they reached in TD program; 4 Their stability of performance in different practice and competitive conditions.

OTHER SPECIFICITIES OF SPORTS GAMES

Evaluation of efficacy in sports games (defining the criterion variable)

Efficacy in sports games can be evaluated in different ways. These can be generally divided into two groups: general and precise. General evaluations are usually used to create a criterion (discriminative) variable which helps us predict the effects of separate predictors or to differentiate more efficient and less efficient athletes. Some examples of such variables are "win – lose", difference by which someone won or lost, competition rank, starters vs. non-starters, team placement at a competition (e.g. the first 4 vs. the last 4 or ordinal scale with teams' placement (1^{st}, 2^{nd}, 3^{rd}, etc.). Those criteria of team efficacy can also be combined with the evaluation of players' quality within their team (Grgantov, 2005).

In sports games, different types of more "precise" or more detailed ways of evaluation of competitive efficacy are used. Some of them are notational analysis (e.g. Eom and Schutz, 1992), evaluation of actual player quality (e.g. Trninić et al., 1999) or artificial neural network (e.g. Perl, 2002). Each of them has its advantages and disadvantages. E.g. by notational analysis an experienced statistician can, with the use of specialised software packages, gather a large number of useful information in real time. The disadvantages of this analysis are in the fact that only actions with a ball and individual events are recorded, and there is no insight into players' actions without the ball and into cause-effect relationships between separate actions during play. When evaluating actual player quality, a group of judges – sports experts defines the criteria system in certain sport (or uses previously defined criteria). Those experts also determine the importance of each criterion for evaluation of actual player quality at some position during play, but also evaluate players on separate criteria. The overall player quality score is calculated by multiplying the sum of those evaluations with corresponding weights. By criteria for evaluating actual player quality one can evaluate situations from the game that cannot be recorded by notational analysis (e.g. in invasive sports games, some of the criteria are players' cooperation in defence, level of pressure in defence, ball control, ability to play at different positions, etc.). Disadvantages of such evaluation are in the fact that the objectivity of the gathered data depends on expert knowledge. Apart from that, necessary engagement of experts who have to spend a lot of time defining the criteria, weighting them and finally evaluating players, makes this method pretty demanding and unavailable. Because of the aforementioned, it is understood that data cannot be gathered in real time. Gathering data by artificial neural networks enables the clustering of mutually similar events in a match from a large number of similar events. The greatest advantage of this approach is the identification of tactical patterns of each team as well as their efficacy. Unfortunately,

this method is not suitable for ranking players according to situational efficacy.

From the aspect of scientific analysis, a major problem of all the aforementioned methods for detailed evaluation of efficacy is that they only take into consideration players who play at competitions (players who did not play do not have the statistics), which can literally cut the sample in a study in half.

Selection of predictor variables

Predictor variables must meet several important conditions required. First of all, they must have good metric characteristics (reliability, homogeneity, sensitivity and validity) because on the contrary, the obtained results would not be authentic. If those variables are used to identify giftedness, then the necessary precondition is for them to be dominantly under the influence of genetics. Apart from that, predictor variables should also be good predictors of efficacy, i.e. they should have satisfactory pragmatic validity. Previous explanation is additionally complicated because it has been noted that in sports games tests for assessing basic motor abilities have good predictive validity for assessing efficacy in the first phases, but not at the peak of a career (Booysen, 2007; Bailey and Collins, 2013). That is why it would be desirable to also include tests for assessing specific technical-tactical skills into the set of predictor variables. We must not forget that simplicity, cost-effectiveness and implementation speed are often very important characteristics of tests. Otherwise, despite high-quality tests, testing could be unsuccessful due to fatigue or loss of motivation, but also the lack of time (Hohmann and Siedel, 2003).

Analysis of inter-positional and intra-positional differences

In competitive team sports players are specialized for their specific position. Thus, research in team sports must take into account the specifics of particular positions (Duncan at al., 2006; Marques at al., 2009; Boone at al., 2012; Matthys at al., 2013). On one hand, this provides a more homogenous sample, which has a positive impact on statistical power, but at the same time, we reduce the sample size, which has a negative impact on statistical power. Williams (2014; 1) points out that, the net effect of purifying the sport phenotype versus limiting sample size, both of which affect statistical power but in opposite directions, is currently unknown. We can conclude that scientists in sports games should take into account the specificities of separate player positions, but they should not do it on small samples. The minimum sample of participants depends on several factors, e.g. predicted level of significance and statistical power, ratio of number of participants and variables depending on the method of data analysis, expected effect size, etc.

Compensation phenomenon or equifinality

In sports games the same skill can be performed by two players with equal efficacy by using different combinations of traits, abilities, knowledge and skills. In other words, players compensate their disadvantages in something that is important for success by advantages in something that also has a positive impact on performance (compensation phenomenon). E.g. someone dominantly uses their advantage in body build, others use excellent motor and functional abilities, others perceptual - decision making skills. Closely related to this phenomenon is also the question whether to use unidisciplinary or multidisciplinary studies. In unidisciplinary studies predictor variables are selected only from one scientific discipline (e.g. sport science), whereas in multidisciplinary studies e.g. psychological, sociological or other variables are used. According to Gagne (2009), giftedness of an individual, including also giftedness of an athlete in sports game, can be manifested in six different domains: intellectual, creative, social, perceptual, muscular and motor control. The compensation phenomenon is somewhat differently explained by Superlak (2006), who points out that skills of players in complex game situations are conditioned by the range and level of their ontogenetic dispositions, which are usually classified into psychological, intellectual, coordinative, fitness-related, organizational and social. A player's highly developed dispositions may form new qualitative complexes of dispositions, called interdispositions, being effects of the player's dispositional synergy. The same author (Superlak 2008) criticises the so-called "championship model" for particular sports. This model implies that achieving the critical values of the "championship model" was necessary and entirely sufficient to

ensure success in sports competition. The author further explains that this assumption can be accepted in some sports, e.g. individual sports, but not in team sports, where cooperation and interaction in changing situations as well as social and organizational effects are involved. The championship model approach excludes the phenomenon of "equifinality" thanks to which players with different structures of traits, abilities and talents achieve similar sports results.

If we do not take the compensation phenomenon or phenomenon of equifinality into account, there is a real possibility that we might overestimate current or ultimate abilities of some athletes and underestimate those of others.

E.g. to select players for some important competition we choose only variables assessing body build and motor-functional abilities. Athlete A might have high results in the analysed variables, and athlete B might have average. Based on these results we come to a conclusion that athlete A should be selected positively, and athlete B negatively. However, perceptive-cognitive skills (quickly notices the situation of the court and makes correct tactical decisions) of athlete B are extremely above average and he has excellent technique by which he easily puts his tactical ideas into action. Apart from that, he has leader abilities, low level of cognitive anxiety and high level of confidence that allow him to control his emotions in stressful situations at competitions. Athlete A is the exact opposite to athlete B in those variables. From the previous example it is obvious that athletes can compensate, i.e. substitute their disadvantages in one domain in different ways, by above average results in some other domain (and vice versa).

Methods of data analysis

In scientific studies data can be analysed by univariate and multivariate methods. The obvious disadvantage of univariate methods is that differences between talented and less talented athletes are analysed only in one variable, which is not specific for sport (especially for team sports in which many factors and their mutual interrelations affect success). Those disadvantages are annulled to a large extent in multivariate studies which take into consideration the interrelation of those variables, as well as their specific contribution in explaining criteria. Discriminant analysis can also be used for data analysis, as well as canonical or logistic regression analysis. The advantage of the discriminant and the logistic regression analysis in that criterion variables (in case of logistic regression analysis also predictor variables) do not have to be on an interval or ratio scale, but they could also be ordinal and nominal variables, which makes the defining of those variables much easier.

HISTORICAL OVERVIEW OF TALENT IDENTIFICATION AND DEVELOPMENT MODELS

In this chapter, the most important models of IG and TD will be presented and their advantages and possible disadvantages will be analysed. This will serve as the basis for the proposal of the "ideal" IG and TD model.

According to Booysen (2007), two original studies of this problem are those carried out by Du Randt et al., (1992), who analysed 12 IG and TD models, and Regnier et al. (1993), who analysed 10 IG and TD models. Booysen (2007) gives a more detailed explanation of 5 models that have been mentioned most frequently in literature. These are models by Gimbel (1976), Harre (1982), Havlicek et al. (1983), Bompa (1985) and Regnier (1987). Even though each of these programs has its specificities, what most of them have in common is that they succeeded in integrating the IG and TD phases into unique models in a quality manner. This is achieved not only by testing athletes' beginning level in the selected predictor variables, but also, very importantly, by longitudinal monitoring of athletes' reactions to specific training programs. In order to even be able to construct high-quality training programs and select the appropriate predictor variables, in the first phase of the mentioned models sport-specific requirements of a particular sport are identified (estimated). All criteria and requirements that play a role in efficient performance in a particular sport must be determined precisely. In doing so, different types of analysis of sports activity (e.g. structural analysis, notational analysis, time-motion analysis) are used. Based on these analyses, it is evaluated not only what is currently important for success in that sport or each player position, but also, more importantly, what will be important for success in the future. Data gathered by testing, interviewing and surveying elite athletes in different phases of their career is also used in this evaluation.

Most high-quality IG and TD programs take children's biological maturity into account, as well as multidisciplinarity of sports games. In some models (e.g. Havlicek et al., 1983; in Booysen, 2007) the importance of cooperation between sports and schools is also emphasised, with the goal of animating as many children as possible to engage in sports. Based on the testing results, but also by monitoring child's reactions to specific sports programs, children are firstly oriented towards the group of sports for which they are gifted (e.g. sports games). Naturally, children's wishes and interests are taken into consideration, as well as those of their parents. This is followed by specialisation for a particular sport and player position within that sport. Parallel with this process, prediction of efficacy for each individual athlete is made.

FINDINGS FROM OUR RESEARCH TEAM

In a doctoral dissertation written by Grgantov (2005), on a sample of 245 female volleyball players (32 players U13 age group, 147 players U15 age group, 49 players U17 age group and 17 players U19 age group), some anthropological characteristics, motor abilities and quality of elemental volleyball technique were measured for each age group.

Latent structure in the space of anthropometric characteristics and motor abilities for each age group of volleyball players was obtained by factor analyses. Groups of players according to their technique quality were formed by applying taxonomic analysis. Differences between volleyball players of different technique quality and different individual player value in the measured variables were analysed by a series of discriminant analyses. For the purposes of this study, an original and simple way of evaluating the overall player quality in volleyball was designed (Table 2).

Table 2 Categorisation of individual player value (Grgantov, 2005)

Team value	Individual player value			
	Members of the national team	The most efficient players in the team	Average players in the team	The least efficient players in the team
3	5	5	4	3
2	5	4	3	2
1	5	3	2	1

As previously mentioned, the overall player quality in competitive athletics is sometimes defined by comparing the ranking of different teams in a competition and sometimes by comparing individual player quality within a team (e.g. starters/nonstarters). By combining these criteria, greater sensitivity, and therefore a better evaluation of the overall player quality in sports games is achieved.

In this system of evaluating overall player quality, a grade of 1–5 was assigned to each player regarding two criteria (Table 2):

1. Team ranking in a competition: All teams that participate in a competition are classified into 3 groups based on their ranking in the championship. E.g. if there were 12 teams in a competition, the first group includes those that were ranked between 1st and 4th place; the second group includes those that were ranked between 5th and 8th place; and the third group includes those that were ranked between 9th and 12th place.

2. Player quality within the team (as assessed by the coaches). Each coach divided the players of her/his team into three groups (the most successful – the most efficient players, average – other starters and non-starters who contribute to game quality; and the least successful – non-starters who very rarely or never enter the game).

All members of the national team are evaluated by the grade 5 regardless of their team's competition ranking.

By univariate analyses of variance, significant differences were found between volleyball players of different age in the space of anthropometric characteristics, motor abilities and technique of volleyball elements. Based on the obtained results, it was determined that more efficient volleyball players have more prominent longitudinal

dimensionality of the skeleton, are more explosive and agile, and have better elemental technique of all volleyball elements, especially of spike and block. The most prominent differences between the groups in body build, motor abilities and technical performance of volleyball elements were recorded in U15 and U17 age group.

Except in the new way of defining overall player quality, scientific value of this study is also reflected in defining the factor structure of anthropometric characteristics and motor abilities, as well as in determining the contribution made by separate factors obtained by differences in situational efficacy. The analysis of the projections of each test on factors enabled the selection of high-quality tests for assessing individual factors.

Also, from the aspect of IG and TD, a great advantage of this study is that it included tests for assessing elemental technique of volleyball elements into the battery of tests.

By analysis of interrelations of independent and dependant variables in different age groups, an important set of information was obtained on whether the same variables discriminate female volleyball players of different efficacy in different age groups.

However, this study also has several limitations. Impact of biological maturity on the applied variables was not analysed. Furthermore, the predictor set did not include variables for calculating somatotype, for assessing perceptive-cognitive skills and for assessing individual and team psychological characteristics. Differences between players of different overall player quality were analysed on the whole sample (inter-positional and intra-positional differences were not taken into consideration).

Because of this, in the following studies carried out by our team (Milavić, 2013; Jurko, 2013; Milić 2014), much attention was paid to some of the aspects that were not analysed in Grgantov's study (2005) and which limited the quality of the obtained results.

Because of the great importance of individual and team psychological characteristics in IG and TD in doctoral dissertations written by Milavić (2013) and Jurko (2013), questionnaires for assessing those characteristics were constructed and validated. The existing questionnaires for assessing individual and team psychological characteristics were also translated and validated. Then age, gender and positional differences in the applied variables were analysed.

In a study carried out by Milavić (2013) on a sample of 295 male and female volleyball players of youth and junior age group, a multidimensional measuring instrument for testing individual psychological characteristics (anxiety, motivation, concentration, self-confidence, perceived competence for volleyball and usage of certain techniques for state self-regulation) was constructed and validated. The existing questionnaires were also validated (*ACSI–28 – Athletic Coping Skills Inventory-28*– multidimensional instrument; *PSIS–Y - Psychology Skills Inventory for Sports – Youth version* – multidimensional instrument; *CSAI-2 – Competitive State Anxiety Inventory-2* – multidimensional instrument for measuring anxiety and self-confidence; *SMS – Sport Motivation Scale* – multidimensional instrument for measuring sports motivation). It was determined that all the questionnaires had good metric characteristics.

By analysing gender differences it was determined that male volleyball players had significantly higher *playing competence*, *self-confidence*, *extrinsic motivation* and *determination motivation*, and lower *cognitive anxiety* than female volleyball players.

A small number of significant inter-positional differences among both male and female volleyball players was obtained. In both analysed age groups, among male and female volleyball player, significant intra-positional differences in overall player quality in the applied variables were found. More efficient players have a higher level of self-confidence, concentration and perceived player competence, and a lower level of cognitive anxiety than less efficient players.

In a study carried out by Jurko (2013) on a sample of 273 male and female volleyball players of youth and junior age group, a measuring instrument for testing *group properties* (*cohesion*, *perceived collective efficacy* and *coaching behavior*) in volleyball was constructed and validated. The existing questionnaires for assessing group properties were also translated and validated: GEQ (*Group Environment Questionnaire*) and the team orientation scale from the PSIS-Y questionnaire (*Psychology skills inventory for sports – youth version*) for assessing cohesiveness, as well as LSS (*Leadership Scale for Sport*) and CBS-S – (*Coaching Behavior Scale for Sport*) questionnaires for assessing coaching behaviour. Based on the analysis of metric characteristics and relation to the existing scales for assessing cohesion, the newly constructed

questionnaire can be recommended as a concise orientation measure for team properties. Age and gender differences, as well as inter-positional and intra-positional differences in the applied variables were analysed. By analysis of variance applied on the subsamples of male and female volleyball players who play at different player positions, no significant differences were found in the level of *group properties* measured by the newly constructed questionnaire.

By analysis of variance and discriminant analysis among players of different player quality, no significant differences were found in the level of any of the 6 constructed measures of *team properties*. Female players with a lower index of individual player value had a significantly higher perceived level of *perceived task cohesion* and *collective competence – readiness* than players with the highest index of individual player value. Apart from that, female players with the best evaluations assessed their coach's communication style as least acceptable. The same conclusions among female players can also be drawn based on the analysis of the results obtained by discriminant analysis.

Some other aspects important for IG and TD were analysed in a dissertation written by Milić (2014). In this study the subject sample included 204 female youth volleyball players from whole Croatia, who participated in the open Croatian volleyball championship in 2014. The independent variable set in this research consisted of 11 anthropometric measures, 10 motor tests (five for assessing non-specific agility and explosive power, and five for assessing specific agility and explosive power) and 3 questionnaires of psychological characteristics (hope, optimism and perfectionism). As new questionnaires for measuring athletes' psychological characteristics were constructed in the previously mentioned dissertations (Jurko, 2013; Milavić, 2013) and relations of psychological constructs with variables of age, gender and situational efficacy were determined, psychological characteristics in this study were selected based on a studies carried out by Gould, Dieffenbach and Moffett (2001, 2002). These authors interviewed 10 Olympic champions (winners of 32 medals at the Olympics) from the United States of America, with the aim of determining their psychological characteristics, but not their development. Recommendations given by Williams and Krane (2001) were also taken into consideration. They point out that in investigations of athletes, the usage of relatively "new", previously rarely used variables of psychological characteristics should be considered: *perfectionism, dispositional hope and optimism*.

Dependent variables in this research included player role and competitive efficacy. The subjects were divided into 5 sub-groups according to their player roles: setter, opposite hitter, passer-hitter, middle blocker and libero players. According to team placement in the competition and quality of each player in their team, volleyball players were divided into two groups: more efficient and less efficient.

From 11 anthropometric measures the following were calculated: *body mass index*, *somatotype* according to the Heath-Carter method and age from *peak height velocity* (APHV). To assess APHV a method of Mirwald et al. (2002) was used, which is very simple and requires only 3 measures: height, sitting height and body mass (along with information on gender and chronological age). The prediction of how far an individual is from their APHV is based on the differential growth and timing of leg length and sitting height. Legs grow first and are followed by sitting height growth.

Based on the deviations of APHV values of each subject from the average APHV value of all the subjects, and by adding or subtracting the obtained deviations from chronological age, the indicator of biological age of young female volleyball players was calculated.

By analysing the means of subjects' biological age, inter-positional and intra-positional differences were found. Liberos (13.70 years) and setters (13.82 years) are biologically the youngest. Opposite hitters (14.17 years) and passer-hitters (14.21 years) are somewhat biologically older. Middle blockers are biologically the oldest (14.54 years). More efficient players at all positions are also biologically the oldest. These differences range from averagely 3-5 months (setters, liberos and passer-hitters) to almost a year (opposite hitters and middle blockers).

To neutralise the influence of biological age on inter-positional and intra-positional differences of young female volleyball players in the variables assessing morphological characteristics, motor abilities and psychological characteristics, analyses of covariance are applied with the indicator of biological age variable as covariate.

Inter-positional differences

Based on inter-positional differences in anthropometric measures it can be inferred that middle blockers are significantly taller than the

other player positions, whereas libero players are the shortest, followed by setters. Liberos and setters are the most endomorphic, liberos are the most mesomorphic, and opposite hitters and middle blockers are the most ectomorphic.

By analysing the inter-positional differences in proportions of separate somatotype categories it was determined that passer-hitters do not differ from setters and liberos. Libero players have a significantly higher proportion of the endomorphic mesomorph category in comparison to other player roles. Middle blockers and opposite hitters have a significantly higher proportion of the balanced ectomorph category than setters and liberos.

In the overall sample, as well as the subsample of more efficient players, passer-hitters have the best results in most motor tests. Efficient setters and liberos are characterized by good performance of agility tests, and compared to the other player positions they have somewhat lower average results in spiking speed. There are no inter-positional differences in psychological characteristics

Among the anthropometric measures, the indicator of biological age significantly affects the inter-positional differences in height, body mass and body mass index in the overall sample, whereas in a more homogenous sample of more efficient volleyball players it does not affect the inter-positional differences. In the overall sample the indicator of biological age affects inter-positional differences in all the motor variables, and in the subsample of more efficient volleyball players in most variables. In the space of psychological characteristics the indicator of biological age does not affect inter-positional differences neither in the overall sample nor in the subsample of more efficient players.

Intra-positional differnces

By analysis of covariance in the space of anthropometric measures only one significant intra-positional difference is found. More efficient setters are significantly taller than less efficient ones. There are no significant differences in proportions of separate somatotype categories between more efficient and less efficient female volleyball players with different player roles. More efficient setters, passer-hitters and opposite hitters did better in most tests assessing motor abilities in comparison to less efficient players at the same position. The differences are most prominent in tests assessing spiking speed. At libero position, more efficient players are significantly better than less efficient players only in the performance of side steps, and at middle blocker position, more efficient players are better only in the two tests assessing spiking speed.

There are no significant intra-positional differences in psychological characteristics found for player positions of setters and opposite hitters. More efficient passer-hitters have a lower perception of parental expectations and coach pressure than less efficient players at the same position. The *hope* variable is significantly higher in more efficient middle blockers, and *optimism* and *hope* variables are significantly more expressed in more efficient libero players, whereas their *perfectionism – organization* variable is significantly less expressed than in less efficient liberos.

In all player positions the indicator of biological age significantly affects intra-positional differences in body height and body mass between more efficient and less efficient female volleyball players. Additionally, it affects intra-positional differences in the endomorph somatotype component in setter position, whereas it affects the mesomorph somatotype component in middle blockers. In the motor abilities space the indicator of biological age as covariate significantly affects the intra-positional differences in most of the motor abilities.

In the psychological variables space the indicator of biological age affects intra-positional differences in the organization variable in liberos and middle blockers, the hope variable in middle blockers and opposite hitters, and perceived parental pressure and perceived coach pressure variables in passer-hitters.

Originality of this study is reflected in:

- The calculation of somatotype components and categories
- The application of tests for assessing specific agility and explosive power
- The analysis of inter-positional and intra-positional differences in the applied variables
- The validation of a questionnaire for assessing optimism, hope and sports perfectionism
- The assessment of indicators of biological age by a non-invasive method by Mirwald et al. (2002)
- The application of analysis of covariance (with the indicator of biological age variable as covariate) with the aim to neutralise the

influence of biological age on inter-positional and intra-positional differences in the applied variables

RECOMMENDATIONS FOR FUTURE IG AND TD STUDIES

The previously mentioned studies carried out by our research team represent only the first step in developing a high-quality model of IG and TD in volleyball. Based on the obtained results, a set of predictor variables with good metric characteristics could be formed. The selected variables are reliable, valid, and good in differentiating young female volleyball players between and within player positions. In future studies, this predictor set should also include some variables for assessing perceptual and decision making skills. It should be emphasised that in all the mentioned studies a simple and sensitive method of determining situational efficacy was applied. Multivariate methodological procedures for the analysis of the obtained results were also defined. Significant influence of indicators of biological age in the obtained inter-positional and intra-positional differences was also proven.

A disadvantage common to all these studies is the cross-sectional study design. As previously mentioned on several occasions, information on stability and dynamics of the applied predictor variables could only be obtained by longitudinal studies. Morris (2000) also comes to a conclusion that longitudinal or quasi-longitudinal research is essential to determine whether the same variables are important for outstanding performance throughout the process of development and whether variables measured during adolescence can predict outstanding performance in adulthood. Also, to assess the ultimate potentials of an athlete, it is not enough to be familiar with his initial level of traits, abilities and skills. It is of great importance to assess athletes' capacity for improvement as well, and this is possible only if they are included in high-quality TD programs in particular sports and their progress is monitored over a certain period of time. However, longitudinal studies of IG and TD also have their disadvantages. Given the fact that it takes 10 years for athletes beginners to reach top performance level, longitudinal studies should also last that long. However, it is hard to get the finances for such long and demanding studies. Besides, in such a long period, the number of participants would undoubtedly greatly decrease, and it was previously mentioned already that intra-positional differences should be analysed in sports games, which makes the sampling even more difficult. It is therefore obvious that longitudinal studies are not the likely solution either. That is why Morris (2000) suggests a somewhat modified version of sliding population principle from the study carried out by Regnier 1987 (in Booysen 2007), as an acceptable compromise that combines good sides of cross-sectional and longitudinal studies. In this approach, children of different age groups, e.g. U12, U14, U16 and U18 age groups, are tested in parallel by the same battery of tests. In each age group a large sample of children is required and, naturally, high-quality predictor and criterion variables must be selected. In the first phase of the study, based on the results on the criterion variable (competitive efficacy) and predictor variables, models of efficacy are formed for each age group. The second phase includes longitudinal monitoring that lasts for 2 years. By this kind of study, stability of the predictors, i.e. stability of their relative impact on the criterion can be determined for every age group analysed (except the youngest). This is achieved by comparing the results of two groups of the same age (e.g. children that belonged to the U14 age group at the beginning of the study belong to the U16 age group at the end of the study and their results can be compared to the results of the U16 age group in the first measurement). Stability of results (rank analysis) of participants in particular predictors over time can also be determined. In the interpretation of the results in periods in which the children are still growing and developing, it is important to take biological maturity into consideration, e.g. as it was done in the study carried out by Milić (2014). It is very likely that children that develop at a later time will have lower overall player quality and that is why it is important not to bring any rash decisions regarding their (de)selection, but to carefully monitor their further progress and reactions to practice in the following two-year period.

In order to carry out such demanding studies in a quality manner (referring primarily to the analysis of a sufficiently large subsample of players at particular positions), it is necessary to set up international research teams. It is important to mention that experts in this area think that model values for IG and TD are current for only 2-4 years (Booysen, 2007), which points out the necessity of continuous revision of previous findings.

CONCLUSION

The area of IG and TD is a very controversial area that has been attracting scientists and experts' attention, but also the attention of government and sports organisations for a long time. A multidisciplinary, multivariate and quasi-longitudinal approach is recommended in studies, keeping in mind participants' biological and training age. Because of the real possibility that the results of genetic testing may not be correct, but even more importantly because of numerous ethical issues related to that testing, important decisions in sport should not be made solely based on those results.

In sports games, studies should be conducted with taking into consideration the specificities of particular player positions and the compensation phenomenon. Quasi-longitudinal design study is recommended as the ideal IG and TD research method as it includes the advantages of both transversal and longitudinal studies.

All findings obtained by one-off testing of athletes should be used for talent development, and not for early (de)selection of athletes.

Unfortunately, in our society, there is still a prevailing opinion that talent is something inherited, God-given, something that is developed without much effort. Thus, in constant search for mysterious talent, many young athletes give up sports as soon as they encounter first obstacles and first mistakes occur.

We all have a very important task to change that system of values and set up a new one in which long-term, hard-working, dedicated, systematic and high-quality work will be appreciated. In this system of values mistakes are merely pieces of information that help us stay on the right track.

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HOW TO MOTIVATE SEDENTARY PEOPLE TO BECOME (MORE) PHYSICALLY ACTIVE IN THE LONG RUN?

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INTRODUCTION

In this keynote, I will give an overview of a number of recent intervention studies that we have conducted at the KU Leuven to promote physical activity among different target groups. These interventions are inspired by the Self-Determination Theory (SDT; Ryan & Deci, 2000), which is currently the most dominant motivational framework within the domain of exercise psychology. SDT assumes that individuals possess three basic psychological needs that are essential for their growth and well-being: 1) the need for autonomy (i.e., the desire to be the origin of one's own behavior); 2) the need for competence (i.e., the desire to experience mastery and success), and 3) the need for relatedness (i.e., the desire to have meaningful relations with other people). According to SDT, the more the social context provides an environment to satisfy these basic needs, the more individuals will experience autonomous forms of motivation. These autonomous forms of motivation have been found to facilitate sustained behavioral change, in contrast to controlled forms of motivation, which only lead to short-term adherence.

In a first intervention study, we developed and tested a cost-efficient need-supportive individual counseling program to stimulate sedentary university employees to become more physically active (Van Hoecke, et al., 2012). Ninety-two participants received 4 months of coaching by bachelors students in kinesiology who were specializing in health-related physical activity (n = 30). The program consisted of a limited number of individual contact moments (i.e. an intake session, three follow-up contacts and an out-take session), either face-to-face, by phone or by e-mail. Various measures were assessed both in the coaching group (n = 92) and in a control group (n = 34) at three moments: before the intervention (i.e., pre-test), after the intervention (i.e., post-test), and 1 year after pre-test measurements (i.e., follow-up test). The results revealed that while the control group remained stable from pre- to post-test, the coaching group increased significantly in moderate and strenuous physical activity. Additionally, the coaching group increased significantly in mild, moderate, and strenuous physical activity from pre- to follow-up tests, whereas the control group did not change. This study provided evidence for the long-term effectiveness of a need-supportive physical activity program that might be efficient at the community level.

In a second intervention study, we developed and tested a need-supportive walking program for the elderly (Pelssers et al., 2013). This structured walking program "Every Step Counts!" took place within a community-based senior organization and lasted for 10 weeks. The program prescribed pedometer-defined walks in weekly walking schedules, which were fitness-tailored and structured in walking load (intensity/volume) according to the principles of training progression. In addition, the program was offered as a social activity at meeting points of the organization to satisfy their the basic needs. Twenty-nine meeting points (n = 432) constituted the intervention condition, while ten meeting points (n = 148) formed the wait-list control condition. Measurements were organized at the start of the intervention (pretest) and at the end (posttest). Intention-to-treat linear mixed models showed small positive intervention effects on physical activity, fitness, and aspects of well-being. These results confirm the effectiveness of structured walking interventions with systematic

training progression for the elderly and underscore the value of community-based senior organizations as intervention settings.

In a third intervention study, besides supporting individuals' personal needs, we also targeted participants' social identity to further facilitate lasting behavioral change. One-hundred ninety-six sedentary adults aged 55 to 70 years (n = 169) were randomized into three identity-based PA promoting interventions: (1) a personal identity need-supportive condition (PI), in which participants' personal self was targeted during need-supportive counseling based on SDT; (2) a social identity condition (SI), in which participants' social self was targeted during counseling based on the Self-Categorization Theory; (3) a joined identity condition (JI), in which participants' personal and social self were targeted at the same time. Participants completed measures of physical activity (i.e., pedometer-based steps, pedometer-based aerobic minutes, self-reported) before (pre-test), immediately after (i.e., post-test) and one year after (i.e., follow-up) the six-week intervention. Mixed models showed significant increases in pedometer-based and self-reported PA from pre- to post-test, and from pre-test to follow-up, with no differences in changes over time between the conditions. There results suggest that in order facilitate behavioral change in the long run, one can either support individuals' basic needs or focus on the norms associated with their social identity.

The general implications of these three studies will be discussed.

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Sport

DIFFERENCES IN SOME GENERAL AND SPECIFIC MOTOR SKILLS OF DIFFERENT WEIGHT CATEGORIES AMONG MACEDONIAN BOXERS

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SUMMARY

Introduction: Boxing belongs to the group of poly-structural acyclic sports in which dominate unpredictable movements where the result is usually a binary variable (win-defeat) and the movement is performed and limited in direct collision with an opponent in order to carry out an attack or avoid attack from the opponent.

Methods: On a selective sample of 102 male examinees, boxers at the age of 18 to 33 years realized a research to determine whether there are differences in some general and specific motor abilities between boxers from different weight categories. The sample is divided into three sub-samples according to the weight of the boxers and that is: 28 boxers in the lightweight category (49, 52, 56 and 60 kg), 30 boxers in the medium category (64, 69 and 75 kg) and 29 boxers in the heavyweight (81, 91 and +91 kg). For estimation of motor skills a system of 21 motor test for estimation of general motor skills and system of 8 motor tests for estimating specific motor skills is applied. The differences in general and specific motor tests between boxers from different weight categories was determined by analysis of variance.

Results: On the basis of the obtained results it can be concluded that the heavy category boxers in average achieve better results in motor tests: "tapping with foot", "tapping with hand in frontal plain", "shooting at a target with long stick", "shooting at a target with short stick", "shoulder and wrist flexibility", "long jump out of place", "throwing medicine ball of 1kg in a position lying on back" and "throwing medicine ball from chest by sitting in a chair". Boxers form the lighter categories achieved better results in the test for estimating agility "t-test".

Conclusion: Boxers from the different weight categories do not differ statistically significantly in specific motor tests. The results of this research can help coaches properly to plan and program the work with boxers from different weight categories.

Keywords: motor skills, boxers, weight categories

INTRODUCTION

Boxing belongs to the group of poly-structural acyclic sports in which dominate unpredictable movements where the result is usually a binary variable (win-defeat) and the movement is performed and limited in direct collision with an opponent in order to carry out an attack or avoid attack from the opponent. In any martial Olympic sport, as in boxing, the fight between two opponents is not so real, rough, tough and dangerous because boxing unlike the other martial sports, which are characterized by poly-structural acyclic movements does not aim only symbolic but the factual destruction of the opponent which gives the basic hallmark of the sport.

Modern boxing requires from the boxer to take place in a very fast pace and to form large number of technical and tactical activities but dominant role in the specific motor abilities have the speed, coordination, precision, agility, explosiveness and repetitive strength and speed-force endurance. Different types of speed (speed of reaction, the segmental speed of movement, frequent speed), allow the boxer to respond in a timely manner to the opponent action and to apply appropriate defensive technique, fast execution of individual strokes, perform a larger number of strokes in series, fast movement in the ring in all directions and effective use of techniques od counterattack.

For the boxers where the weight category is exactly limited, arises the question, where is the boundary of the regulation of proper weight. This

question has an individual approach and depends primarily on the age of the boxer, the stability of physical development. In the young organism that is growing should strictly reject the process of regulating the weight after uncontrolled-unnatural way. Indicator for stable weight is following the weight on a long period of time. Loss of liquid in a short period of time, dehydration with sauna is ruthlessly bloodstream stress and loss of minerals especially potassium and sodium ions (in cases where the necessary weight is brought before the fight after a "violent" way). During dehydration the deposit of glycogen in the muscles is complicated because the deposit of one gram of glycogen binds three grams of water.

The fights in boxing take place in the following weight categories: paper (49kg), fly (52kg), bantam (56kg), light (60kg), p. velter (64kg), velter (69kg), medium (75kg), p. heavy (81kg), heavy (91kg), s. heavy (+91kg).

The main goal of this research is to determine whether there are differences in some general and specific motor abilities between boxers from different weight categories.

METHODS

Sample of examinees

The research was realized on a selective sample of 102 male examinees, boxers at the age of 18 to 33 years. The sample is divided into three sub-samples according to the boxer's weight and that is 28 boxers in lightweight category (49 kg, 52 kg, 56kg and 60kg), 30 boxers in the medium category (64 kg, 69 kg and 75 kg) and 29 boxers in the heavier category (81 kg, 91 kg and +91 kg).

Population from which the sample is extracted is defined as the population of active sportsmen-boxers of all categories, participants, competitors in the league system on the state championship of the Republic of Macedonia and participants on international tournaments clinically healthy without physical disabilities and abberant events in motor space.

The basic criterion on the selected respondents is to actively attend to boxing at least one year, to be included in the system of the competition and to have minimum three trainings a week.

Sample of measuring instruments

For assessment of motor skills following variables were applied, i.e. motor tests: "t-tests" (MTTEST), "eights by titling" (MOSNAV), "steps on side" (MCEKTS), "standing on one foot on the beam length with eyes opened" (MSGOCD), "standing on one foot on the beam lenght in width with eyes opened" (MSTGOS), "standing on one foot on the beam length with eyes closed" (MSGZOD), "taping the foot" (MTAPNO), "taping a hand in the frontal plain" (MTAPRF), "taping a hand in sagittal plain" (MATPRS), "shouting at a target with long stick" (MSTMDS), "shouting at a target with short stick" (MSTKST), "shouting at a boxing bulb by hand" (MSTBKR), "deep bend on a bench" (MDLPRK), "shoulder and wrist flexibility" (MISPAL), "deep bend in sitting position" (MDLPSE), "keeping the trunk in a horizontal position lying with the belly down" (MZTHPM), "raising the trunk in 30 seconds" (MP30SE), "pull-ups upward the shaft" (MZGIVI), "long jump out of place" (MSKDAM), "throwing medicine ball of 1kg on a position lying on back" (MFMPGR), "throwing medicine ball from chest 1kg sitting on a chair" (MFMGST).

For estimation of specific motor skills following variables were applied, that is motor tests: "rope skipping – skip 10 seconds" (SKI10S), "speed of execution of 100 direct strokes per bag" (BR100K), "speed of execution 100 strokes per bag" (BR100K), "feet skipping 10 seconds and execution left/right jab" (SUNPOD), "feet skipping 10 seconds and executing left/right hook " (SUNPOK), "feet skipping 10 seconds and executing left/right upper-cut" (SUNPOA), "defense form left/right jab with stepping back and placing six counter strokes on the hands of the coach" (OBROTK), "a series of the 100 combined strokes on the hands of the coach" (SER100).

Statistical procedures

The differences in general and specific motor tests between boxers form different weight categories were determined by analysis of variance. Previously the normality of the result distribution on the applied variances is verified with the Kolmogorov and Smirnov method.

RESULTS

The data from the Kolmogorov and the Smirnov proceedings show that most of the results of general and specific motor tests do not deviate from the normal allocation, i.e. statistical significant level of 1% correspond with the theoretical curve of that allocation, which was methodical correctly possible to perform further data processing.

Table 1. Differences in some general and specific motor abilities among Macedonian boxers from different weight categories

Variables	Light (1)		Medium (2)		Heavy (3)		F	Q	Post hoc		
	Mean	SD	Mean	SD	Mean	SD			1-2	1-3	2-3
MTTEST	107,58	5,31	114,64	8,13	113,48	7,11	6,28	,00	>	>	ns
MOSNAV	198,00	9,69	200,82	15,72	206,21	12,90	2,33	,10	ns	ns	ns
MCEKST	102,26	10,04	101,21	10,17	103,76	9,41	,55	,58	ns	ns	ns
MSGOCD	47,16	16,79	53,95	19,33	56,79	19,37	1,53	,22	ns	ns	ns
MSTGOS	32,89	8,78	34,59	13,51	32,62	12,94	,24	,78	ns	ns	ns
MSGZOD	27,58	7,90	26,77	5,73	26,34	5,79	,22	,80	ns	ns	ns
MTAPNO	25,68	1,53	26,38	1,63	27,07	1,81	4,00	,02	ns	<	ns
MTAPRF	33,68	2,79	35,79	3,16	36,34	3,35	4,37	,02	ns	<	ns
MATPRS	32,74	3,14	35,36	2,94	36,10	3,99	6,07	,00	<	<	ns
MSTMDS	77,05	4,21	80,08	4,10	82,31	3,64	10,05	,00	<	<	ns
MSTKS	79,95	3,78	82,56	4,81	85,07	3,99	8,12	,00	ns	<	ns
MSTBKR	9,53	0,51	9,72	0,46	9,83	0,38	2,61	,08	ns	ns	ns
MDLPRK	36,26	5,38	38,56	3,82	37,97	4,69	1,69	,19	ns	ns	ns
MISKPAL	92,58	10,77	101,05	8,12	106,76	9,93	13,18	,00	<	<	<
MDLPSE	51,05	16,69	64,15	6,15	59,14	11,86	8,90	,00	<	<	ns
MZTHPM	75,11	22,65	68,87	25,89	75,48	19,83	,83	,44	ns	ns	ns
MP30SE	31,58	4,03	32,21	3,90	30,76	2,98	1,30	,28	ns	ns	ns
MZGIVI	11,74	5,79	14,13	5,35	14,59	5,05	1,79	,17	ns	ns	ns
MSKDAM	193,42	11,05	212,67	16,33	220,62	14,95	19,58	,00	<	<	ns
MFMPGR	1057,63	167,07	1287,69	105,64	1457,59	162,12	46,46	,00	<	<	<
MFMGST	724,21	88,96	812,79	75,70	951,03	126,90	33,20	,00	<	<	<
SPJ10S	15,87	1,95	15,50	1,84	15,64	1,57	,27	,76	ns	ns	ns
SB100U	18,92	1,34	18,71	1,88	18,62	2,46	,13	,88	ns	ns	ns
SB100K	20,50	2,09	20,55	2,81	20,60	2,63	,01	,99	ns	ns	ns
SSPLDD	17,05	0,85	17,13	0,80	17,10	0,90	,05	,95	ns	ns	ns
SSPZDK	16,63	0,68	16,64	0,74	16,93	0,96	1,26	,29	ns	ns	ns
SSPLDA	16,95	0,85	16,90	0,82	16,97	0,82	,06	,94	ns	ns	ns
SOLDDK	20,74	2,21	20,00	2,40	20,24	2,28	,65	,53	ns	ns	ns
S100RT	22,29	2,69	21,73	3,33	21,84	3,72	,18	,83	ns	ns	ns

The results of the applied univariant analysis of variance determined between group differences in general and specific motor tests with boxers from different weight categories is shown in the table 1.

Statistically significant univariant intergroup differences are determined in the motor tests MTAPNO (F= 4,37, p=,02), MTAPRF (F= 4,37, p=,02), MATPRS (F= 6,07, p=,00), MSTMDS (F= 10,05, p=,00), MISPAL (F= 13,18, p=,00), MDLPSE

(F= 8,90, p=,00), MSKDAM (F= 19,58, p=,00), MFMPGR (F= 46,46, p=,00), MFMGST (F= 33,20, p=,00).

From the values of the arithmetical means and the level of statistical significance of the Post hoc tests clearly indicate that the boxers of the lightest weight categories on average achieve better results in the general motor test "t-test" regarding boxers of medium and heavy categories there are not statistically significant differences in this test.

Boxers from heavy categories on average achieve better results in terms of boxers from light categories in motor tests: "tapping with foot", "tapping with hand in a frontal plain", "tapping with hand in a sagittal plain", "shooting at a target with long stick", "shooting at a target with short stick", "shoulder and wrist flexibility", "deep bend in sitting position", "long jump out of place", "throwing medicine ball of 1kg.in a position lying on back" and "throwing medicine ball from chest by sitting in a chair".

Boxers from heavy categories on average achieve better results in terms of boxers from medium categories in motor tests: "shoulder and wrist flexibility", "throwing medicine ball of 1kg in a position lying on back" and "throwing medicine ball from chest by sitting in a chair".

Boxers form medium categories on average achieve better results in terms of boxers from light categories in motor tests: "tapping with hand in a sagittal plain", "shooting at a target with long stick", "shoulder and wrist flexibility", "deep bend in sitting position", "long jump out of place", "throwing medicine ball of 1kg in a position lying on back" and "throwing medicine ball from chest by sitting in a chair".

DISCUSSION

On the basis of the obtained results it can be concluded that the speed of alternative movements statistically significantly differ among boxers by weight categories. This leads to the fact that Macedonian boxers speed footwork and speed work with arms depend on the weight categories that belong, as opposed to research of Savić (1986a) who found no differences in these motor skills among Yugoslav boxers.

The heavier boxers showed better results in tests for assessing the explosive power of the lower and upper extremities. Probably the reason for more successful performance of the tests in which dominate the explosive strength in heavier boxers is indirectly related to the total body mass, which in this sample can be understood as an active mass primarily defined by the height and weight of the body. The active mass has a positive effect on driving tasks that require locomotion of the body in space or action of external objects. Also, the longer levers facilitate the execution of these tests that allow greater length during the jump and throwing the apparatus. Absolute power is more pronounced among heavier boxers because of the larger body mass and on the other hand the big body mass is an obstacle (due to greater inertia) for successful execution of tests in which a fast moving body in space by change of the direction such as "t-test" therefore heavier boxers achieve poorer results in this test.

The heavier boxers achieve better results in tests for assessing of placement, especially in the test "shooting at a target with a long stick". Also the reason for this is probably the longer levers that extremities of the respondents facilitate the execution of this motor task.

Boxers from different weight categories do not differ statistically significantly in specific motor tests, i.e. mobility of the cranial and caudal part of the body and speed force endurance of the upper extremities. That abilities of boxers require to perform feet jumping (jumping with two legs simultaneously) and perform specific boxing strokes jump, which expresses the ability to quickly perform feet jumping and tasks with structure of movements (direct, hook and uppercut) for 10 seconds. On the other hand speed force endurance of the upper extremities of boxers require in the shortest time interval to place powerful and precise strokes to the head and body of an opponent. This indicates that the Macedonian boxers was applied a training process in learning the technical-tactical elements resulting in a good adaptation in all categories. Unlike our research Savić (1986a) found a difference in the specific motor tests among Yugoslav boxers.

The better results in tests for assessing the flexibility, especially the test "shoulder and wrist flexibility" among boxers in the heavier categories is most likely due to the differences in longitudinal dimensionality (arm's length) with boxers from different weight categories. The correlation between this test and the length of the arms is equal to .31. This indicates that future research should apply another test to assess the flexibility of the upper

extremities or use this test to take into consideration the length of the arm.

The results of this research could help coaches properly to program and to plan the work of boxers with different morphological structure, even greater level of development of motor skills that they most correspond to the specific morphological structure of each sportsman, a better development of the general and specific motoric among sportsman due to unfavorable morphological structure have a poorly developed motor ability, a better development of other positive anthropological dimensions namely to reduce the negative anthropological dimensions that may be important in relation to motor skills with direct or indirect specific dimensions for different types of morphological structure.

CONCLUSION

On the basis of the obtained results it can be concluded that the heavy category boxers on average achieve better results in motor tests: “tapping with foot”, “tapping with hand in frontal plain”, “tapping with hand in sagittal plain”, “shooting at a target with long stick”, “shooting at a target with short stick”, “shoulder and wrist flexibility”, “deep bend in sitting position”, “long jump out of place”, “throwing medicine ball of 1kg in a position lying on back” and “throwing medicine ball from chest by sitting in a chair”. Boxers from the lighter categories achieve better results in the assessment of agility test “t-test”.

Boxers from different weight categories do not statistically significantly differ in specific motor tests.

The results from this research can help coaches properly to plan and to program the work with boxers from different weight categories.

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FACTORS DETERMINING SUCCESS OF THE SPORTS ACTIVITY

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SUMMARY

Introduction: The objective of the present development is to take to the front some e x t e r n a l (objective) and i n t e r n a l (subjective) factors on which the successes in the sports activity depend to a greater degree. They are reduced mainly to the following ones:

External factors:

- the climatic conditions under which the training sessions and the competition take place, particularly for the sports, where the achievements are to a greater degree dependents on them;
- the material and technical basis and the organization of the training sessions and the competition;
- optimal volume and intensity of the training loads;
- the challenge and variability of the arisen situations and the compliance with them;
- state of the terrain;
- being a host as a factor favoring the wished results;
- the lot as one of the main precondition about successful classification;
- the audience as an invariable part of achieving the wishes results;
- informational provision, etc.

Internal factors:

- the nature of the sports motivation;
- very high, i.e. "extra motivation" or lower motivation for taking part in the competition;
- the personal pretensions and expectations;
- striving towards personal manifestation;
- optimal physical, sport and technical and will preparation;
- high degree of having built up the personal qualities;
- wish to preserve the positions acquires till that moment;
- rivalry; and etc.

Conclusion: Our attention in the present paper is directed to more complete presentation of the "architectonic" of the basic internal and external factors, impacting the success of the sports-training and competitive activities. For the purpose we are falling back on the information from the theoretical study of the issue, on expert observations from various sports events, as well as on numerous conversations with well known coaches, having achieved "top" results at European and World championships and Olympic Games.

Keywords: objective and subjective factors, sports achievements, qualities of will, pedagogical competence

INTRODUCTION

Sport is an inevitable part of the society general culture. At the same time modern sport, mainly professional one, is one of the most expensive "business products" in sport-technical and media aspect. Countless subjects are taking part in it – athletes, coaches, managers, doctors, masseurs, experts in information provision, sports intelligence, etc.

Sport is an exceptionally complex and dynamic phenomenon. It is a fact we are permanently

witnessing today a reconfirming tendency of continuous improvement of the records – republican, intercontinental, world, Olympic ones. Word goes about achievements which have been unthinkable recently. That is determined to a greater degree by the effect of a range of factors which influence directly or indirectly the effectiveness of the sports events.

In the context of what has been said herein above, the o b j e c t i v e of the present paper is to take to the front some main factors which influence the success of the sports activity. We are reducing them to the following:

F i r s t, e x t e r n a l (objective) f a c t o r s:

- the c o n d i t i o n s under which the training and competitive processes take part, particularly in sports where the achievements depend of them to a greater degree. For example - the t i m e when these events take place, particularly the a s t r o n o m i c time, the t e m p e r a t u r e – normal, low or high; h o t or c o l d weather; wind, rain, snow; above s e a l e v e l h e I g h t; a t m o s p h e r I c p r e s s u r e, etc.
- the m a t e r i a l – t e c h n i c a l b a s e s under which the training and competitions take place, as: the s t a t u s of the t e r r a i n – even, no even, iced, without ice, flooded, without water; n o r m a l in s i z e s halls, stadium, mat, ring, water pool, track, normal lightening, noise; m o d e r n o u t f i t – shoes, leotards, bathing suits, balls, bands, hoops, ropes, helmets, etc.
- the o r g a n i z a t i o n of the training and competitive activity which takes to the front the observance of certain r e g i m e both during the preparation and during the hours prior the concrete competition (light training, meals, rest). That is a precondition about the optimal use of the physical resources and qualities of the participants in the competition
- a p p r o p r i a t e as volume and intensity training loads during the various periods of the sports of the team or athlete preparation including the time prior a concrete competition.
- w e l l s e l e c t e d sports calendar in dates and periods of preparation as well as periodic control competitions.
- c o m p l i a n c e with the complexity, dynamics and variety of the arisen situations during the competition.
- the l o t as one of the basic preconditions for the success.
- being a h o s t which very often proves to be a key factor for achieving the wished result.
- the a u d i e n c e and the d e c i s i o n s of the j u d g e s as invariable part of the competition.
- the i n f o r m a t i o n a l p r o v i s i o n. Information provision as key factor for achieving success. Indisputable is the fact that the development of the modern technologies hides rich possibilities for securing the needed and reliable information. Word goes mainly about written, audio visual and statistic information related to the status, the way a given team or a competitor is playing at a given moment, the weak and strong sides, the expected variations and tactics of the game in various situations – intentional or not intentional. It has been proved that this is a good way to envisage the subsequent actions and moves of the opponent as well as a selection of optimal strategies for action and counter action.

S e c o n d, i n t e r n a l (subjective) f a c t o r s:

- the n a t u r e of the sports motivation related to the separate competitors and teams in the sports events.
- e x c e s s ("excess motivation") or lower motivation for participating in the sports activity.
- realistic personal pretensions and expectations.
- presentiment about success or failure for the coming activity.
- leadership and possibility for personal manifestation.
- confidence in the own strength and abilities for successful presentation in the competition.
- effective self control in relation to the personal behaviour, particularly under unexpected, nonstandard and extreme sports situations.
- sufficiently high concentration prior and during the competition.
- confidence related to the good physical, sport-technical and will preparation prior important competitions.
- high degree of established personal qualities which is a precondition about successful manifestation.

- psychological comfort within the systems of "coach-competitors", "competitors-co players", "competitors-opponents", "competitors-judges", etc.
- composure, emotional upsurge, high realistic expectations towards success.
- strong wish to preserve the positions that have been achieved up to that moment, even on the price of a risk.
- ability to manage stress situations.
- adaptation abilities of the participants in the competition, etc.

It is known that in the modern conditions, the athletes are of nearly equal abilities as physical, tactical and technical preparation and the will preparation is very often decisive for the sports victory. A range of examples of the most outstanding sports events – European, world and Olympic competitions - testify that.

Within the context of the information herein above, we consider it necessary to pay special attention to the issue related to the w i l l in the e d u c a t i o n of the athlete. Word goes about the paramount precondition for achieving higher and higher objectives in modern sport nevertheless the difficulties that have to be overcome.

A central moment for the will education appear to be the w i l l q u a l i t i e s. The theoretical study of the problem related to the athlete's preparation of will, as well as the various expert observations of the training and competitive process provide sufficient reason to state that the b a s i c q u a l i t i e s of w i l l needed for effective or successful sports activity can be differentiated into t w o g r o u p s:

F i r s t, will qualities which are more g e n e r a l l y valid for all kinds of sports. They are: purposefulness, initiativeness, discipline, determination, courage, persistence, self-command, confidence in his/hers own strength, will stability, will towards victory, etc.

S e c o n d, will qualities determined by the specificity of the concrete sport – high speed and intensive rate of game, readiness to a risk, stability of the manifestations related to factors accompanying the competition (referees, audience, fens), swiftness and economy of the actions in concrete situations "speed technique", optimal decision making what to do, etc.

Will is established within the process of overcoming expected and unexpected d I f f I c u l t I e s depending on the specificity of the sport, various in nature and strength. According to us the sports pedagogue has got the decisive role in that aspect but not less important is the activity of the athlete alone to establish and affirm his/her own "I",i.e., self education of the will.

CONCLUSION

In c o n c l u s i o n we are going to underline that in the sports activity it is imposing to give an account of the e f f e c t s and the m o d i f i c a t i o n s provoking the i n t e r n a l and e x t e r n a l factors determining the high sports results and achievements. It is indisputable that at a certain stage, certain internal and external factors or their combination can be the "key" factor for the success. Yet more often and often the conclusion is imposed that the timely fixing of their influence as well as the selection of optimal strategies for each concrete case, is of priority or is the "deed" of the sports pedagogue mainly. Hence the requirement for the coach's solid pedagogical competence directed to timely limitation of the negative impact of some factors mentioned hereinabove and their maximum use as serious "advantage" against the opponent, even a "benefit" in the name of the victory.

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STUDYING THE EFFECT OF HURDLES EXERCISES USE IN JUNIOR TRAINING PROCESS

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SUMMARY

Introduction: Athletes training process is long educational process. In this regards with its multifaceted impact the hurdle exercises are among recommended means that can be successfully used for achieving certain objectives in the training process for juniors.

Methods: Based on a perspective we aimed at studying the effect of predominantly use of hurdle exercises in training process of adolescent athletes. Object of our study are adolescent athletes – aged 12 – 13 years (50 children). Subject of the research are indexes revealing the level of physical abilities development and the impact of predominantly use of hurdle exercises in their training process.. In the study we used 19 indexes. The control group of children were training using the Unified program of Bulgarian athletic Federation (1985). The experimental group used a training program developed based on developed by us experimental training model with predominantly use of hurdle exercises.

Results: A comparison of the data from control and experimental groups reveals no significant differences in the beginning of the experiment. Comparing the results from the re-testing between the control and experimental groups and analyzing the first six indexes, we see significant difference in favor of the experimental group in the index presenting the flexibility in hip joints. Comparative analysis of performance in the other nine indexes revealing athletic type of information – there advantage of the children from the experimental group is undeniable. The correlation between dynamic flexibility index with indexes X1 – X6 is statistically significant. There is also reliable correlation between indexes X14 and X19. The results from the control group are below the critical limit for statistical significance.

Conclusion: In accordance with the purpose and tasks of the study were differentiated the following conclusions showing the performance of the experimental methodology and its efficiency. In conclusion on the basis of the successful sport – pedagogical experiment, result analysis and justified conclusions, we believe that the predominantly use of hurdle exercises can successfully be used in adolescents training process in order to achieve better development of basic motor skill and athletic abilities.

Keywords: adolescents, hurdle exercises, experimental methodology

INTRODUCTION

Athletes training process is long educational process aimed at forming, developing and perfecting motor skills and abilities, educating and development of physical and volitional qualities including enriching knowledge for tactics involved in sports. In this regards with its multifaceted impact the hurdle exercises are among recommended means that can be successfully used for achieving certain objectives in the training process for juniors.

Based on a perspective we aimed at studying the effect of predominantly use of hurdle exercises in training process of adolescent athletes. For solving this problem, we had to resolve the following problems:

1. Examine the training level of adolescent athletes involved in training process in sport groups for beginners
2. Study the experimental methodology effect with predominantly use of hurdle exercises in adolescents training process
3. Revealing interrelation changes between studied indexes showing the level of physical abilities variation of athletes from control and experimental groups

METHODS

Object of our study are adolescent athletes (beginners) – aged 12 – 13 (50 children). Subject of the research are indexes revealing the level of physical abilities development of beginner adolescent athletes and the impact of predominantly use of hurdle exercises in their training process. The main experiment had duration of one year as in the study were included 19 indexes (see Table 1). The control group of children was training using the Unified program of Bulgarian athletic Federation (UP) edition 1985.

The experimental group used a training program developed based on developed by us experimental training model of adolescent athletes with predominantly use of hurdle exercises.

Table 1. Research indexes

test	name	measured in
X1	Running 30 m (standing start)	sec.
X2	Standing long jump (forward)	cm
X3	Standing vertical jump (with both legs)	cm
X4	Throwing medicine ball (2 kg) with two hands over head	m
X5	Running 150 m (standing start)	sec.
X6	Male splits	cm
X7	Running 15 m (standing start)	sec.
X8	Running 15 m (flying)	sec.
X9	Running 30 m (between cones)	sec.
X10	Long jump from 8 running strides	cm
X11	Vertical jump from three running strides (from convenient foot)	cm
X12	Vertical jump from three running strides (from inconvenient foot)	cm
X13	Throwing medicine ball (2 kg) with two hands over head backwards	m
X14	Running 15 meters 10 times (shuttle running)	sec.
X15	Changing left and right cross lunge 10 times	sec.
X16	Agility coordination index	
X17	Speed - strength characteristic index	
X18	Jump asymmetry index	
X19	Speed endurance coordination index	

RESULTS

As seen from Figure 1, a comparison of the data from control and experimental groups reveals no significant differences in the beginning of the experiment.

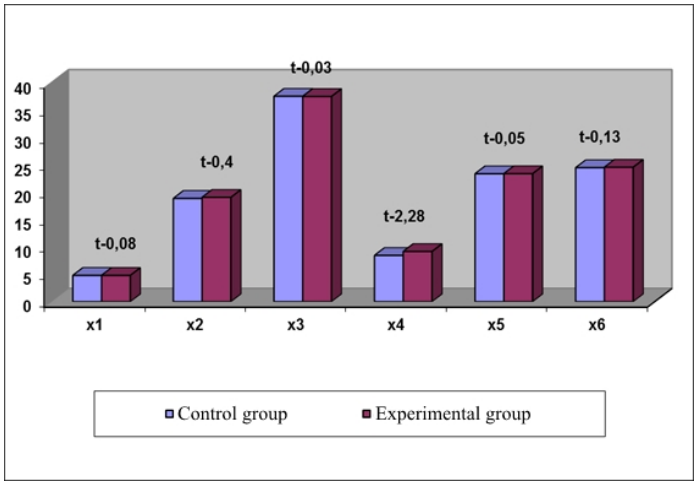

Figure 1. Average performance of adolescents from control and experimental group in the begging of the experiment

In Tables 2 and 3 we present the data comparing the average results from testing in the beginning and in the end of the experiment for indexes from X1 to X6. Table 2 presents the data for the control group and Table 3 the values for the experimental group. According to the empirical values of Students t-test for dependent samples, all established values are statistically significant and show improvement – this is valid for control and experimental group.

Table 2. Variation analysis and improvement reliability of absolute (d) and relative (%) values – showing the performance of the control group

test	statistical index	Control group		increase		t – emp	t – tabl α=0,05
		beginning	end	d	%		
X1	X avg	4,8	4,67	-0,13	2,7	12,36	2,06
	Sx	0,16	0,14				
	V%	3,38	2,97				
X2	X avg	188,76	196,4	7,64	4,05	75,8	2,06
	Sx	15,22	12,53				
	V%	8,06	6,38				
X3	X avg	37,52	39,47	1,95	5,2	35,11	2,06
	Sx	4,29	4,38				
	V%	11,44	11,09				
X4	X avg	8,45	8,72	0,27	3,17	6,87	2,06
	Sx	0,93	0,88				
	V%	11,05	10,07				
X5	X avg	23,37	23,11	-0,26	1,12	9,64	2,06
	Sx	0,65	0,68				
	V%	2,77	2,96				
X6	X avg	24,48	22,48	-2	8,17	6,67	2,06
	Sx	1,9	2				
	V%	7,74	8,91				

Table 3. Variation analysis and improvement reliability of absolute (d) and relative (%) values – showing the performance of the experimental group

test	statistical index	Control group		increase		t – emp	t – tabl α=0,05
		beginning	end	d	%		
X1	Xcp	4,8	4,66	-0,14	2,98	18,4	2,06
	Sx	0,17	0,16				
	V%	3,44	3,39				
X2	Xcp	190,64	196,16	5,52	2,9	6,13	2,06
	Sx	17,68	16,72				
	V%	9,28	8,52				
X3	Xcp	37,48	39,04	1,56	4,16	4,7	2,06
	Sx	5,33	5,25				
	V%	14,23	13,44				
X4	Xcp	9,17	9,45	0,28	3,08	7,34	2,06
	Sx	1,26	1,23				
	V%	13,76	13,04				
X5	Xcp	23,38	23,05	-0,33	1,43	10,3	2,06
	Sx	0,67	0,72				
	V%	2,87	3,14				
X6	Xcp	24,56	21,12	-3,44	14,01	8,34	2,06
	Sx	2,27	1,64				
	V%	9,26	7,77				

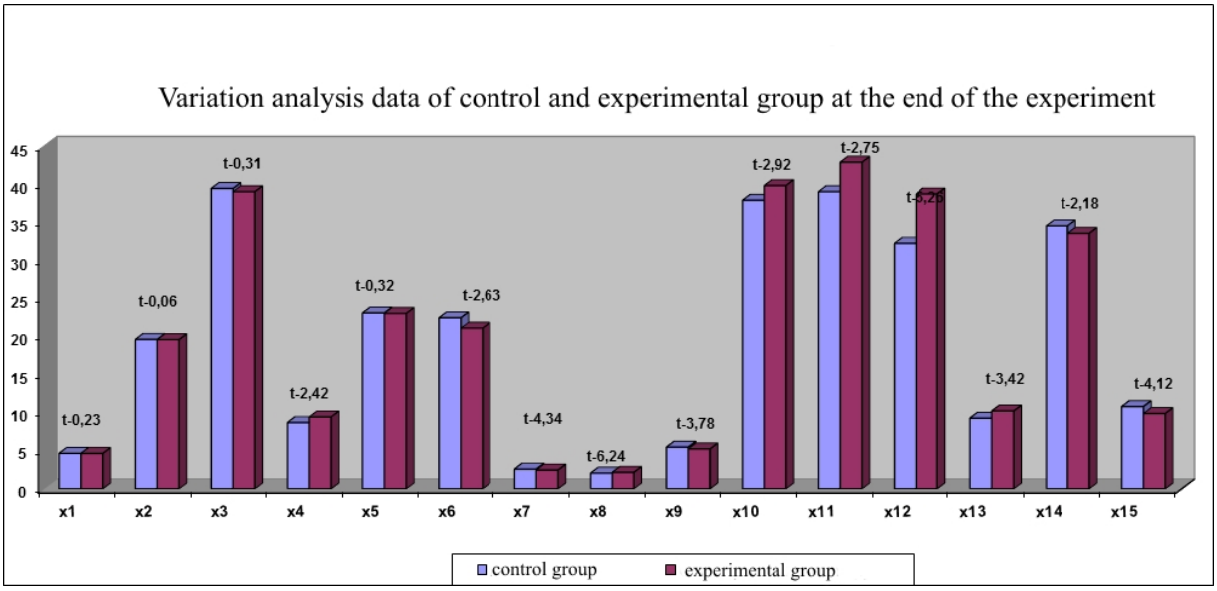

Figure 2

Comparing the results from the re-testing between the control and experimental groups and analyzing the first six indexes, we see significant difference in favor of the experimental group only in the index presenting the flexibility in hip joints. This advantage is not surprising, because hurdle exercises help the improvement of flexibility. Another reliable difference among the first six indexes is strength of arms and shoulders of children from the experimental group (but we also found advantage in this index during the first testing).

Comparative analysis of performance in the other nine indexes revealing more athletic type of information – there the advantage of the children from the experimental group is undeniable.

The adolescents from the experimental group were ahead of the control group in index X12 – we explain this fact by the impact of hurdle exercises applied in the experimental group. From this perspective, we believe that there is a basis for use of hurdle exercises as a mean to overcome asymmetry in adolescent athletes.

We also find advantage of the children from the experimental group in the following indexes: X13, X15, X10, X11 and X12. Better results compared to the control group we find also in indexes X7, X8 and X9. Although not so highlighted but faithfully observed advantage we find in indexes X14 and X15 performance.

According to the variation analysis results and Student's t-test there were not relevant and reliable differences between the control and experimental groups in these indexes in the first testing. Logically therefore do not exist significant differences in the correlation levels between indexes in the first testing.

On the correlation matrixes presented on Tables 4 and 5 we see the changes in the interrelations between the performance in the same six tests carried out with the control and the experimental groups – before and after the experiment.

Table 4. Correlation analysis results before and after the experiment for the control group (r=.37, p=0.95%)

index									
Before the experiment		X1	X2	X3	X4	X5	X6		After the experiment
	X1		-0,839	-0,824	-0,899	0,956	-0,249	X1	
	X2	-0,907		0,829	0,8	-0,853	0,289	X2	
	X3	-0,875	0,903		0,771	-0,846	0,108	X3	
	X4	-0,911	0,84	0,806		-0,909	0,128	X4	
	X5	0,98	-0,917	-0,873	-0,904		-0,206	X5	
	X6	-0,149	0,037	-0,011	0,231	-0,185		X6	

There are no significant interrelation changes in the control group. The correlation gradation level in the terms of interrelations between indexes remains (see Table 4).

In the experimental group the correlation changes after the experiment, as well as those in the control group do not lead to changes in the established and already analyzed gradation of interdependence between examined six indexes.

We should note that unlike the control group, here the correlation between the index presenting flexibility and the other five indexes is statistically reliable.

Table 5. Correlation analysis results before and after the experiment for the experimental group (r=.37, p=0.95%)

indexes								
Before the experiment		X1	X2	X3	X4	X5	X6	After the experiment
	X1		-0,881	-0,88	-0,956	0,946	0,38	X1
	X2	-0,95		0,908	0,926	-0,958	-0,441	X2
	X3	-0,908	0,951		0,852	-0,897	-0,375	X3
	X4	-0,961	0,927	0,877		-0,939	-0,423	X4
	X5	0,951	-0,958	-0,937	-0,942		0,394	X5
	X6	0,093	-0,157	-0,037	-0,108	0,004		X6

Tables 6 and 7 present the correlation matrixes corresponding to the control and experimental group with the results from the second test.

Table 6. Correlation matrix of control group – testing after the experiment

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19
X1	1																		
X2	-0,839	1																	
X3	-0,824	0,829	1																
X4	-0,899	0,8	0,771	1															
X5	0,956	-0,853	-0,846	-0,909	1														
X6	-0,249	0,289	0,108	0,128	-0,206	1													
X7	0,951	-0,84	-0,847	-0,825	0,943	-0,231	1												
X8	0,907	-0,7	-0,656	-0,856	0,819	-0,227	0,732	1											
X9	0,966	-0,844	-0,819	-0,856	0,953	-0,178	0,918	0,875	1										
X10	-0,889	0,779	0,811	0,822	-0,934	0,296	-0,896	-0,734	-0,891	1									
X11	-0,846	0,814	0,938	0,789	-0,855	0,208	-0,852	-0,699	-0,853	0,85	1								
X12	-0,849	0,811	0,949	0,84	-0,869	0,117	-0,84	-0,722	-0,84	0,84	0,959	1							
X13	-0,878	0,788	0,749	0,971	-0,874	0,164	-0,791	-0,856	-0,836	0,816	0,776	0,816	1						
X14	0,125	-0,215	-0,286	-0,165	0,145	-0,108	0,139	0,085	0,104	0,042	-0,206	-0,217	-0,065	1					
X15	0,927	-0,828	-0,868	-0,867	0,946	-0,182	0,901	0,812	0,923	-0,943	-0,889	-0,897	-0,836	0,095	1				
X16	0,828	-0,768	-0,733	-0,719	0,856	-0,072	0,788	0,75	0,945	-0,805	-0,778	-0,747	-0,7	0,068	0,827	1			
X17	0,447	-0,5	-0,556	-0,315	0,527	-0,101	0,701	0,028	0,432	-0,547	-0,519	-0,477	-0,265	0,115	0,472	0,371	1		
X18	-0,55	0,544	0,595	0,4	-0,532	0,349	-0,59	-0,407	-0,592	0,583	0,754	0,537	0,419	-0,11	-0,567	-0,586	-0,439	1	
X19	-0,206	0,081	0,009	0,15	-0,202	-0,036	-0,188	-0,199	-0,226	0,364	0,091	0,085	0,238	0,94	-0,233	-0,228	-0,068	0,075	1

We can note from Table 7 (presenting data for the experimental group) the correlation between dynamic flexibility index with indexes X1 – X6 (all these correlations are significant). There is also reliable correlation between indexes X14 and X19. The results from the control group are below the critical limit for statistical significance for correlation (r=0.37). From this fact we can conclude that the use of predominantly of hurdle exercises has a positive effect on the development of these physical abilities.

Another example for differences between control and experimental groups is associated with the strength correlation coefficients – concerning index X18. Almost all correlations concerning this index are below the critical value. This gives us the reason to believe that the influence of the experimental

model reduced the impact of asymmetry on the motor skills display.

Significant differences between the groups were observed on correlation between the following indexes: X6, X10, X14, X18 and X19. With the first three of the indexes, we do not find statistically significant correlations with the control group. With X18 there is statistically significant correlation. These results are in contrast to the established correlation with false statistical significance in the experimental group.

Table 7. Correlation matrix of experimental group – testing after the experiment.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19
X1	1																		
X2	-0,881	1																	
X3	-0,88	0,908	1																
X4	-0,956	0,926	0,852	1															
X5	0,946	-0,958	-0,897	-0,939	1														
X6	0,38	-0,441	-0,375	-0,423	0,394	1													
X7	0,985	-0,828	-0,84	-0,933	0,913	0,302	1												
X8	0,96	-0,913	-0,879	-0,936	0,946	0,359	0,899	1											
X9	0,961	-0,875	-0,81	-0,952	0,93	0,344	0,962	0,911	1										
X10	-0,939	0,955	0,903	0,932	-0,972	-0,444	-0,908	-0,934	-0,927	1									
X11	-0,908	0,91	0,934	0,892	-0,906	-0,319	-0,895	-0,869	-0,896	0,928	1								
X12	-0,925	0,91	0,968	0,893	-0,918	-0,308	-0,905	-0,891	-0,878	0,927	0,972	1							
X13	-0,957	0,915	0,841	0,968	-0,944	-0,31	-0,933	-0,937	-0,953	0,929	0,879	0,887	1						
X14	0,954	-0,921	-0,856	-0,946	0,955	0,376	0,94	0,922	0,969	-0,947	-0,929	-0,902	-0,939	1					
X15	0,934	-0,902	-0,841	-0,932	0,948	0,371	0,908	0,92	0,938	-0,94	-0,9	-0,883	-0,921	0,956	1				
X16	0,556	-0,575	-0,38	-0,631	0,588	0,266	0,593	0,499	0,764	-0,595	-0,575	-0,482	-0,631	0,689	0,643	1			
X17	0,801	-0,562	-0,619	-0,73	0,682	0,177	0,89	0,602	0,809	-0,686	-0,729	-0,725	-0,73	0,757	0,701	0,564	1		
X18	-0,223	0,286	0,168	0,278	-0,238	-0,143	-0,244	-0,193	-0,353	0,298	0,424	0,199	0,247	-0,395	-0,349	-0,541	-0,246	1	
X19	0,78	-0,682	-0,621	-0,773	0,697	0,275	0,8	0,703	0,845	-0,723	-0,785	-0,7	-0,748	0,878	0,783	0,72	0,73	-0,573	1

CONCLUSION

In accordance with the purpose and tasks of the study were differentiated the following conclusions:

1. As the established in practice training system based on the UP and the new experimental model for training adolescent athletes lead to substantial and reliable development of basic motor and specific athletics abilities in children.
2. The results from the sport – pedagogical experiment proved positive effect of the applied experimental model for training adolescent athletes with predominantly use of hurdle exercises.
3. The positive contribution from the use of our experimental model is linked with statistically reliable development of physical abilities in terms of speed in sprint running, speed – strength abilities, coordination abilities, and the ability to overcome the asymmetry in jumping from one leg.

In conclusion on the basis of the successful sport – pedagogical experiment, result analysis and justified conclusions, we believe that the predominantly use of hurdle exercises can successfully be used in adolescents training process in order to achieve better development of basic motor skill and athletic abilities.

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MODELING TECHNICAL ABILITIES OF ELITE SHOT PUT THROWERS

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SUMMARY

Introduction: Shot put discipline emphasized to both technical and physical capacity of the thrower. The technical characteristic of the discipline presume highly developed coordination abilities under definite conditions according to the physical abilities, leading to full realization.

Methods: The aim of the following research is to improve the management of shot put throwers preparation with the use of modeling technical abilities of elite shot put throwers and its immediate application in sports practice. The study analyzes nine key indexes of shot put technique observed in 46 attempts of 16 throwers, used glide throwing technique

Results: The average value of the sport result is 20,68 m which indicates the high qualification level of the researched athletes. The investigated 46 cases range is 3,51 metes. This values present changes in sport and technical abilities of shot put throwers from early years in sport to elite sport in world aspect. The distance between the shot and support in the begging of the throwing (X1) correlates marginally with the sport result – r=0,319. A similar situation is observed with index X7 – r=0,112, X8 – r=-0,215, and X9 – r=-0,023. The shot put thrower technique modeling is made with the help of regression method. All research indexes having significant correlation (r>0,5) with the sport result.

Conclusion: With the increase of sport result from 19 to 22.50 meters, we observed changes in motor act which will be very useful to sports practice.

The improvement of shot put throwers training process requires:

1. Development of individual models for technical evolution in qualification aspect of throwers reached world level sport results.
2. Expanding and enriching the research set of indexes used for technical potential control of the motor act from beginning to the final effort of the throwing.

Key words: shot put, men, modeling technical abilities

INTRODUCTION

Shot put discipline emphasized to both technical and physical capacity of the thrower. The technical characteristic of the discipline presume highly developed coordination abilities under definite conditions according to the physical abilities, leading to full realization.

The problem of development of technical and speed – strength capabilities of elite shot put throwers as a precondition for success in the discipline is an interest to both coaches and athletes. Sport theory and practice has a large amount of data in this area stored over the centuries during the development of modern shot put. Knowledge continuously enriches grows and explains the progress and development of the discipline throughout the world – the first world record of 15,09 meters (set by R. Rose in 1909), reached 23,12 meters in 1988 (set by R. Barnes).

Shot put technique is also undergoing continuous development and revolutionary changes to reach its present state – shot put throwing glide and spin technique, as we know them today. Till now the best results in the discipline were achieved by athletes throwing by two ways: first 23,12 meters (R. Barnes)

– spin, and second 23,06 meters (D. Timmermann) – glide.

Our focus is on the technical abilities of shot put throwers (shot put throwing glide) – to be researched, get into individual characteristics, knowledge and modeling for immediate implement in sports practice.

METHODS

The aim of the following research is to improve the management of shot put throwers preparation with the use of modeling technical abilities of elite shot put throwers and its immediate application in sports practice.

The study of the technical abilities of the shot put throwers was made by analyzing nine key indexes of shot put technique observed in 46 attempts of 16 throwers, used glide technique (see Table 1).

Table 1

Shot put throwers included in the study	
U. Bayer	A. Bagach
T. Mayevski	G. Todorov
D. Strol	V. Hristov
W. Gunter	V. Stoev
Al. Andrey	M. Kyoshev
R. Matson	N. Hristov
R. Virastyuk	R. Despotov
O. Sv. Buder	

We used nine indexes to get into the nature of the technical potential of shot put throwers (see Table 2). They give current information about motor action quality in shot put throwing.

Table 2 Examined indexes of shot put throwers technical potential.

index	*title*	*measured in*	*accuracy*
Y	Sport result	m	0,01
X1	Distance between the shot and support point at the beginning of pushing	cm	1
X2	Distance between the shot and support point at the begging of the final effort	cm	1
X3	Difference between: X2-X1	cm	1
X4	Height of the release of shot	cm	1
X5	Difference between the height of release of the shot and height of the thrower	cm	1
X6	Angle in the right knee joint at the beginning of pushing	degrees	1
X7	Angle in the right knee joint at the beginning of the final effort	degrees	1
X8	Trunk bent at the beginning of the final effort	degrees	1
X9	Shot release angle	degrees	1
X10	Stride length during the final effort	cm	1

For achieving the aim of the following study, we used the following research methods:

1. Methodological analysis of scientific literature.
2. Film and video analysis.
3. Sports and pedagogical analysis.
4. Statistical analysis:

- variance analysis – to assess the mean (Xavg), minimum (Xmin) and maximum (Xmax) values of the examined parameters, standard error of estimate (Mx), the coefficients of kurtosis (e), skewness (a), variation (Vx), range (R) of the result in the corresponding index;
- Correlation analysis;

- Graphical analysis;
- Regression method – for creating models for speed – strength development and quantitative assessment of the corresponding ability.

RESULTS

In Table 3 is presented the research data variation analysis. The average value of the sport result is 20,68 m which indicates the high qualification level of the researched athletes. The investigated 46 cases vary between 19,13 (Xmin) and 22,64 (Xmax) – Range (R=3,51). This values present changes in sport and technical abilities of shot put throwers from early years in sport to elite sport in world aspect. This suggests the ability to track changes in other indexes included in our study in relatively wide range.

The coefficient of variation attests that in all indexes we observe high level of data homogeneity – V% range is between 2,69% and 13,58%.

The data homogeneousness is also confirmed by the coefficients of kurtosis (Ex vary between -0,69 and 1,25) and skewness (As ranges between -1,12 and 0,29).

Table 3 Variance analysis of shot put throwing – glide.

	Y	*X1*	*X2*	*X3*	*X4*	*X5*	*X6*	*X7*	*X8*	*X9*	*X10*
Xavg	20.68	81.87	123.00	41.37	218.72	27.33	115.13	138.48	51.28	38.00	115.78
Mx	0.12	0.80	1.33	0.83	0.78	0.54	0.46	1.37	0.29	0.23	1.07
Me	20.50	81.00	125.00	42.00	218.00	27.00	115.00	141.00	52.00	38.00	116.50
Mo	20.13	81.00	130.00	42.00	217.00	26.00	115.00	145.00	53.00	38.00	110.00
Sx	0.84	5.42	9.04	5.62	5.30	3.63	3.10	9.29	1.95	1.58	7.27
Sx2	0.70	29.40	81.69	31.57	28.12	13.20	9.63	86.30	3.81	2.49	52.89
Ex	-0.47	0.47	-0.55	0.24	-0.32	-0.38	-0.69	1.25	1.09	1.68	-0.50
As	0.29	0.21	-0.58	-0.53	0.41	0.20	-0.24	-1.12	-1.02	-0.99	-0.51
R	3.51	25.00	35.00	24.00	21.00	15.00	12.00	45.00	9.00	8.00	26.00
Xmin	19.13	70.00	101.00	27.00	209.00	20.00	110.00	110.00	45.00	33.00	100.00
Xmax	22.64	95.00	136.00	51.00	230.00	35.00	122.00	155.00	54.00	41.00	126.00
Vx%	4.05	6.62	7.35	13.58	2.42	13.30	2.69	6.71	3.80	4.15	6.28

So given the variation analysis of the research data allows us to apply the relevant statistical methods for modeling the technical preparation of shot put throwers.

The results from the correlation analysis is presented on Table 4.

On Figure 1 is presented the correlation model of sport technique reflecting the degree of interdependence between sport result and indexes presenting technical potential. In the following, we analyze these relationships.

The distance between the shot and support in the begging of the throwing (X1) correlates marginally with the sport result – r=0,319. A similar situation is observed with index X7 (angle in the right knee joint at the beginning of the final effort) – r=0,112, X8 (body incline at the beginning of the final effort) r=-0,215, and X9 (release angle of the shot) r=-0,023.

The low level of correlation between some of the indexes does not mean that those indexes are not essential for the athlete throwing technique. In the researched sample are included athletes with high sport qualification who perform these technical elements with very small deviations in space.

Table 4 Correlation matrix of shot put throwing – glide.

	Y	*X1*	*X2*	*X3*	*X4*	*X5*	*X6*	*X7*	*X8*	*X9*	*X10*
X1	0.319	XXX									
X2	0.494	0.779	XXX								
X3	0.437	0.312	0.817	XXX							
X4	0.584	0.253	0.311	0.227	XXX						
X5	-0.203	-0.608	-0.428	-0.130	0.090	XXX					
X6	-0.414	-0.239	-0.379	-0.355	-0.402	0.128	XXX				
X7	0.112	0.174	0.207	0.149	0.006	0.190	-0.092	XXX			
X8	-0.215	0.193	0.112	0.015	-0.495	-0.020	0.306	0.332	XXX		
X9	-0.023	0.031	0.072	0.118	0.056	0.295	-0.077	0.362	0.469	XXX	
X10	0.646	0.337	0.391	0.316	0.674	-0.065	-0.394	0.020	-0.292	0.161	XXX

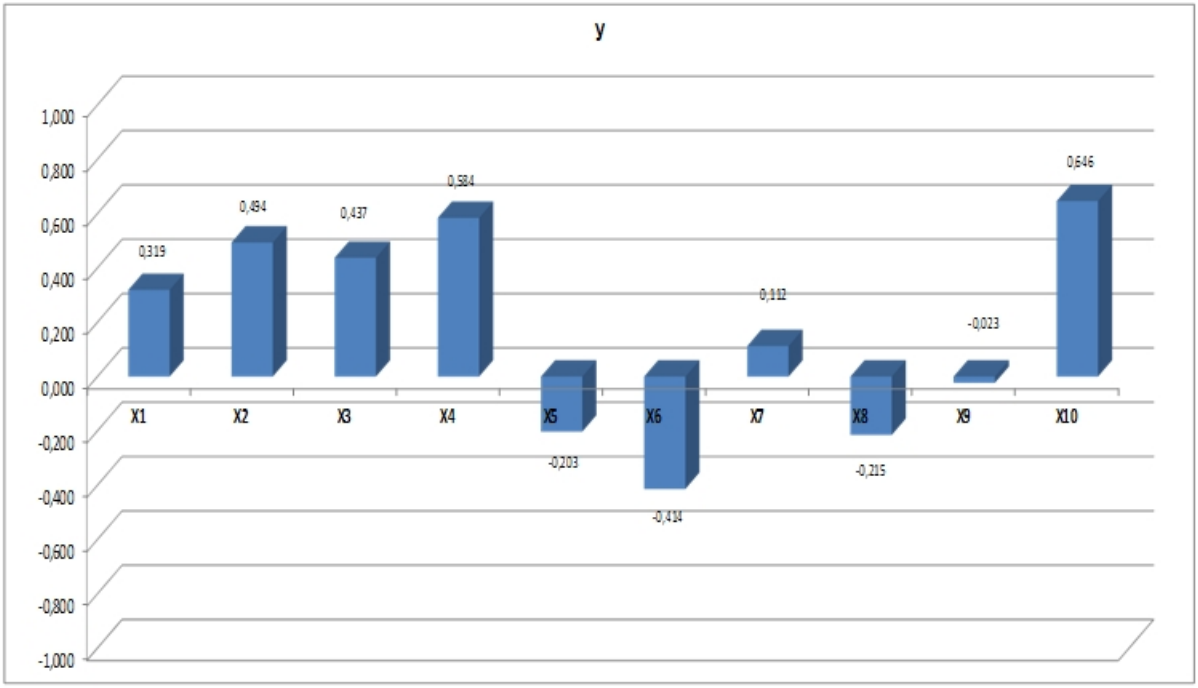

Figure 1. Correlation model of sport result – shot put throwing.

The technical mastery between the area of world elite and the top world elite can be found in the other five indexes. The correlation degree between these five indexes and the sport result is significantly higher.

The distance between the implement and the support (X2) correlates with the sport result with r=0,494. Similar is the situation with the next index – X3 (difference between X- and X1) – r=0,437. These two relations show that with the increase of sport result is observed also "straightening" of the athlete before the most important part in the throwing – the final effort which somehow contradicts with biomechanical logic. Obviously, there is influence of other factors, especially the speed of motor act, which is increasing with the athlete qualification. Perhaps here we should seek reserve in shot put technique – increasing the incline as a precondition for a longer impact on the implement afterwards.

The release height (X4) is crucial to throwing in which the throwing distance is not so great. Therefore such a degree of correlation (r=0,584) is easily explainable.

Here we must add the next interdependence between the sport result and X5 (difference between implement release height and athlete height) – r=-0,203. This insignificant degree of correlation (with negative sing) is explained with similar to X2 and X3 arguments.

The last high degree of correlation with sport results we find in index X10 (stride length during the final effort) r=0,646. This is confirmation for the

important role of the long impact in the implement during the final effort. This in its essence is primarily transitional by the direction and the increase of stride length leads to increased impact on implement.

The reduced number of significant interdependence links between related or derived indexes does not require explanation and interpretation.

The shot put thrower technique modeling is made with the help of regression method (see Table 5). Technical abilities are modeled on the basis of all research indexes having significant correlation (r>0,5) with the sport result. In our case we model all indexes, as shaded indexes are those with coefficient of correlation level reaches or exceeds 0,5. These indexes are X2 (distance between the implement and support in the beginning of final effort), X3 (difference between X2 and X1), X4 (implement release height), X6 (angle in the right knee joint at the begging of the throwing) and X10 (stride length during final effort).

Table 5 Regression models of shot put throwing – glide.

Regular models		*r y/x*	*Reverse model*	
Y = a + b.X	***S y/x***		***X = a + b.Y***	***S x/y***
Y = 16.642+ 0.049.X1	0.802	0.319	X1 = 39.097+ 2.069.Y	5.197
Y = 15.053+ 0.046.X2	0.736	0.494	X2 = 12.734+ 5.333.Y	7.948
Y = 17.981+ 0.065.X3	0.761	0.437	X3 = -19.348+ 2.937.Y	5.110
Y = 0.512+ 0.092.X4	0.687	0.584	X4 = 142.172+ 3.702.Y	4.352
Y = 21.951-0.047.X5	0.829	0.203	X5 = 45.533-0.881.Y	3.598
Y = 33.516– 0.112.X6	0.770	0.414	X6 = 146.839-1.534.Y	2.857
Y = 19.273+ 0.010.X7	0.841	0.112	X7 = 112.682+ 1.248.Y	9.335
Y = 25.403-0.092.X8	0.826	0.215	X8 = 61.648-0.501.Y	1.927
Y = 21.140-0.012.X9	0.846	0.023	X9 = 38.899-0.043.Y	1.595
Y = 12.067+ 0.074.X10	0.646	0.646	X10 = -0.323+ 5.616.Y	5.613

In the Table 5 we present the regression models, standard deviation (Sy/x) and correlation coefficient (ry/x).

CONCLUSION

With the increase of sport result from 19 to 22.50 meters, we observed the following changes in motor act indexes:

- distance between the shot and support in the begging of the throwing – from 70 to 95 centimeters;
- distance between the shot and the support in the begging of the final effort – from 100 to 135 centimeters;
- difference between the distance between the shot and the support in the beginning of the throwing and in the begging of the final effort – from 27 to 51 centimeters;
- implement release height – from 209 to 230 centimeters;
- difference between implement release height and thrower height – from 20 to 35 centimeters;
- angle in the right knee joint at the beginning of the throwing – from 122 to 110 degrees;
- angle in the right knee joint at the begging of the final effort – from 110 to 155 degrees;
- body incline at the begging of the final effort – from 45 to 54 degrees;
- shot release angle – from 33 to 41 degrees;
- stride length at the final effort – from 100 to 126 centimeters.

The improvement of shot put throwers training process requires:

1. Development of individual models for technical evolution in qualification aspect of throwers reached world level sport results.
2. Expanding and enriching the research set of indexes used for technical potential control of the motor act from beginning to the final effort of the throwing.

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NORMS OF SPECIFIC PHYSICAL WORKING CAPACITY WITH FEMALE COMPETITORS IN MIDDLE-DISTANCE RUNNING

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SUMMARY

Introduction: Training of highly qualified athletes in middle distance is a complex systematic process of building a high functional abilities which could be implemented in high sports results. The maximum oxygen uptake is one of the physiological factors associated with endurance. The efficiency of the work is determined by the achievement of reaching high speed running with lower oxygen uptake, therefore with increasing speed and maintaining the level of oxygen uptake observed economization.

Methods: The subject of the research is the determination of the specific physical performance in lab conditions. Object of the research are 33 highly qualified woman runners in middle distance. The athletes were subjected to maximum tiered test to failure of treadmill of increasing load for evaluation of aerobic capacity.

Results: Compared to other similar researches, Bulgarian middle distance woman runners showed high levels of VO_2max/kg and Smax. This high aerobic power is materialized in a high speed, which means-effective in specific physical performance. Therefore, we can define the economy in spending on energy resources, respectively aerobic potential, as one of the main advantages of the woman runners in middle distances.

Conclusion: Achieving high levels of VO_2max/kg is directly related to increasing running speed; Maximum speed and maximum oxygen uptake are reliable marks of the specific physical performance in female athletes of middle distances; The effectivities of the training process is determined by the achievement of a higher speed in a lower consumption of oxygen; Developed standards are for assetements and control of the effectivities of the training process and should be scored together and to be consistent with data from lab tests of one of them.

Keywords: track and field, maximum oxygen uptake, maximum speed

INTRODUCTION

Training of highly qualified athletes in middle distance is a complex systematic process of building a high functional abilities which could be implemented in high sports results.

The maximum oxygen uptake is one of the physiological factors associated with endurance. In addition the maximum oxygen consumption assessment of the level of resistance depends on the economy of running [4].

The efficiency of the work is determined by the achievement of reaching high speed running with lower oxygen uptake, therefore with increasing speed and maintaining the level of oxygen uptake observed economization.

Some authors [1, 2, 7] found that athletes with the same level of the VO_2max have significant differences in sports achievements and the opposite - athletes with identical or very small differences between the achievements show different levels of VO_2max [1, 7].

Economy of running allows athletes to run with lower energy stocks at the same speed. Competitors with a more economical running can reach higher speeds at the same energetic cost [11].

Di Prampero found that increasing of economy by 5% in the middle-distance runner sports results increases by 3.8% [8].

Some authors have demonstrated that African runners had an advantage over European because of the economy of running [5]. According to Larsen et al. [2003] this economy comes from the lower mass of the legs.

Other authors have also established the economy of African runners. Research in this area suggests

that African runners exhibit more economical running, developing a higher speed with lower oxygen uptake [14].

VO_2max criterion is not only the capacity of systems to transport oxygen, but does its performance in a more generic aspects of the concept. That is why high aerobic capacity is a prerequisite for high sports result not only in athletics, but in all sports. [1]

The degree to which VO_2max can be increased depends on the training. Some authors consider that VO_2max is genetically predetermined. According to them, the passage of this genetic ceiling is almost impossible and yet further increase the intensity and volume of training effects not observed effects on aerobic power [6].

Upon reaching the plateau VO_2max further improvements in performance depend on training. This is because the athlete is able to maintain VO_2max for a longer period of time. [12] There are two main reasons for this improvement in anaerobic threshold and economization. Therefore reach a maximum speed of running is the other criteria for specific physical performance, as different players can have the same level of aerobic energy, but can reach it at different speeds.

According to most authors investigating VO_2max, maximum values in women is between 56-65 ml / kg. Similar studies of V. Heyward [1997] estimated maximum assessment VO_2max / kg is over 55.9 ml / kg.

The purpose of this research is concluded of increasing the efficiency of the training process for female competitors of middle distance, by establishing standards for the evaluation and control of specific physical performance in laboratory conditions.

The objective implies the following tasks:

1 Study of the functional abilities of middle distance female runners in the laboratory.

2 Preparation of tables with norms for their specific physical performance.

METHODS

The subjet of the research is the determination of the specific physical performance in lab conditions.

Object of the research are 33 highly qualified woman runners in middle distance.

The athletes were subjected to maximum tiered test to failure of treadmill of increasing load for evaluation of aerobic capacity (by I. Iliev). During the entire loading gas analyzing apparatus, reactions on the respiratory and cardiovascular systems.

Later in the results of the functional research was used individual maximum speed (Smax), associated to the maximum oxygen uptake (VO_2max / kg).

The data were systemize to statistical processing programs by IBM SPSS Statistics 21.0 and Microsoft Excel.

In the processing and interpretation of the data we applied the following statistical methods:

1 Variation analysis.

2 Sigmal method for developing regulations.

3 Comparative Analysis.

RESULTS

Table 1. shows the analysis of variance of the results of VO_2max/kg (ml)

Table 1. Variance analysis of *VO_2max/kg (ml)*

n	Xmin	Xmax	R	□□	S	V	As	Ex
33	51.0	64.3	13.3	58.2	3.5	6.04	-0.44	-0.53

The number of athletes is 33. VO_2max / kg (ml) varied between 51.0 and 64.3 ml / kg. The average value of the indicator is 58.2 ml / kg, and the coefficient of variation V = 6.04% shows that the scattering of the values is small. Coefficients of asymmetry and excess, which in absolute value are less than 1, shows that the distribution of the variable is normal. Sample is big enough (n> 30), making the correct application of sigmal method for developing regulations.

The maximum running speed of athletes is between 16.8 and 20.0 km / h (table 2.). The average is 17.9 km / h and the coefficient of variation (V = 5.11%) indicates that research contingent persons homogeneous in this mark. The values of the coefficients of asymmetry and excess shows a normal distribution of the variable. Sample is big enough (n> 30), which makes the correct application of sigmal method for developing regulations.

Table 2. Variance analysis of Smax

n	Xmin	Xmax	R	□□	S	V	As	Ex
33	16.8	20.0	3.2	17.9	0.9	5.11	0.33	-0.73

Table 3. presents estimates developed VO_2max / kg (ml). Excellent evaluation value is VO_2max / kg (ml) over 63.80 ml / kg, very good from 60.65 to 63.80 ml / kg, good from 55.75 to 60.65 ml / kg, the middle from 52.60 to 55.75 ml / kg and less than 52.60 ml / kg.

Table 3. Norms of VO_2max / kg (ml)

Norms of VO_2max / kg (ml)	
Low	less than 52.60
Middle	from 52.60 to 55.75
Good	from 55.75 to 60.65
Very good	from 60.65 to 63.80
Excellent	over 63.80

Table 4. shows marks of the maximum speed of woman runners. Excellent assessment is reaching speed more than 19.34 km / h, very good from 18.53 to 19.34 km / h, good from 17.27 to 18.53 km / h, middle from 16.46 to 17.17 km / h and less than 16.46 km / h.

Table 4. Norms of Smax

Norms of Smax (km/h)	
Low	less than 16.46
Middle	from 16.46 to 17.27
Good	from 17.27 to 18.53
Very good	from 18.53 to 19.34
Excellent	over 19.34

DISCUSSION

Table 5. Distribution of researched woman athletes with mark VO_2max/kg(ml)

	Assessment		n	%
VO_2max/kg (ml)	Low	Less than 52.60	4	12
	Middle	from 52.60 to 55.75	3	9
	Good	from 55.75 to 60.65	19	58
	Very good	from 60.65 to 63.80	6	18
	Excellent	over 63.80	1	3

VO_2max/kg. Table 5. shows real assessment of the maximum oxygen uptake of the researched woman athletes.

In the majority of athletes - 19 (58%) of the IRP is in the range of 55.75 to 60.65 ml / kg (good), 4 of them (12%) VO_2max are less than 52.60 ml / kg, 3 of them (9 %) are below the average score on this indicator (52.60 - 55.75 ml / kg), 6 athletes (18%) received very good score (60.65 - 63.80 ml / kg) and one athlete has the VO_2max over 63.80 ml / kg, which is the highest score.

Smax. Table 6. shows the estimates of the actual top speed of the tested athletes.

Table 6. Distribution of researched woman athletes with mark Smax

	Assessment		n	%
Smax (km/h)	Low	less than 16.46	0	0
	Middle	from 16.46 to 17.27	11	33
	Good	from 17.27 to 18.53	15	46
	Very good	from 18.53 to 19.34	6	18
	Excellent	over 19.34	1	3

It comes to my attention that none of the researched woman runners is not with "low" assessment. 11 of them (33%) received "middle", and almost a half (46%) reached a top speed in the range of 17:27 to 18:53 km / h, which puts them "good" evaluation. Six runners (18%) reached a maximum speed of between 18.53 and 19.34 km / h, which according to the normative tables "very good" evaluation. Only one researched woman runner managed to reach the maximum score (over 19.34 km / h).

Compared to other similar researches, Bulgarian middle distance woman runners showed high levels of VO_2max/kg and Smax. This high aerobic power is materialysed in a high speed, which means-effective in specific physical performance. This fact could be seen from the data presented in Table 6. Therefore, we can define the economy in spending on energy resources, respectively aerobic potential, as one of the main advantages of the woman runners in middle distances.

CONCLUSION

- Achieving high levels of VO_2max/kg is directly related to increasing running speed;
- Maximum speed and maximum oxygen uptake are reliable marks of the specific physical performance in female athletes of middle distances;
- The effectivities of the training process is determined by the achievement of a higher speed in a lower consumption of oxygen;
- Developed standards are for assessments and control of the effectivities of the training process and should be scored together and to be consistent with data from lab tests of one of them.

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ANALYSIS OF KINEMATIC PARAMETERS OF THE TSUKAHARA LAYOUT VAULT

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SUMMARY

Introduction: The aim of this study was to determine correlations between kinematic parameters of the first flight phase and maximal height of body's center of gravity in the second flight phase during Tsukahara layout vault.

Methods: The study sample consisted of 12 male Serbian gymnasts, competitive, international level, including 4 seniors (mean ± SD: age 22.5 ± 2.8 years, body mass 67.5± 5.4 kg and body height 171.5 ± 3.1 cm) and 8 juniors (mean ± SD: age 16.13 ± 1.1 years, body mass 57.1 ± 10.3 kg and body height 163.8 ± 11.6 cm). Each gymnast performed three attempts of the vaults and the best attempt was taken for further analysis. The following kinematic parameters were analyzed: flight time (s), contact time with one hand (s), contact time with both hands (s), hand distance (m), elbow angle (deg), shoulder angle (deg), hip angle (deg) and the height of the body's centre of gravity (HBCG) in the second flight phase (m).

Results: There is a significant correlation between hand distance on the vaulting table (r=-.654, p=.021) and body center of gravity height in the second phase, and also strong correlation between elbow angle at contact phase and body center of gravity height in the second flight phase (r=.869, p=.000). Selected kinematic parameters explained over 87% of the body's centre of gravity in the second flight phase. The height of the body center of gravity in the second flight phase can be considered as one of the important parameters that can provide progress in achieving success on this apparatus.

Conclusion: The main value of this investigation is that it provides results for every gymnast separately and enables a discussion between coaches and gymnasts individually about mistakes and possibilities for their corrections. Every gymnast should have insight at the weakest points of his techniques and correct them during preparation period. The vault is an apparatus that gives possibility to progress fast and without special conditions and financial factors, unlike other apparatus.

Keywords: gymnastics, flight phase, contact time, vaulting table

INTRODUCTION

There are a lot of investigations about factors that influence the vault jump in gymnastics, such as morphological characteristics of the gymnasts, run velocity, length of flight on the springboard, duration of board contact, position of feet from springboard edge, duration of the first flight phase, duration of support on table phase, duration of the second flight phase, height of jump, moment of inertia in x and y axis, distance from take-off second flight phase, and landing (Čuk & Karácsony, 2004; Atiković, 2012). The gymnast builds up kinetic energy during a sprint and that energy is partitioned into linear and angular momentum during the springboard phase. Numerous investigations focus on run-ups for vault (Čuk, Bricelj, Bučar, Turšič & Atiković, 2007; Veličković, Petković, & Petković, 2011). Run-up characteristic and set springboard vaulting table distance dictate the linear and angular momentum carried into the vaulting table. While having contact with the vaulting table, the gymnast interacts with it and thus refines the post flight linear and angular momentum requirements to achieve the vault's desired distance, height and rotations. To enable the gymnast's safe landing and prevent additional steps or a fall, landing with the correct body angle increases the chances of "sticking" the landing by

enabling the gymnast to successfully utilize the ground reaction forces in stopping rotation and therefore, achieves less relying on musculature (Atiković, 2012). Of course, the ideal performance of vaults with rotations in the second flight phase implies fully completed rotation before landing.

The lack of height of second flight phase implies a specific deduction for execution of vault and lower final score, therefore this parameter was accented in researches. Optimization of the table contact phase technique showed that there was very little potential for improvement in post-flight height with an increase of only 0.05 m. When the touchdown configuration was varied along with table contact phase technique there was more potential for improvement in second flight height with an increase of 0.14 m. This increase was achieved through a higher orientation angle at contact and a more open shoulder angle (Jackson, Yeadon, & Hiley, 2011).

The aim of this study is to investigate correlations between kinematic parameters of the first flight phase, contact phase and maximal height of body's center of gravity in the second flight phase during Tsukahara layout vault performed by Serbian male gymnasts. This vault is considered as basic for performing complex vaults with rotation around longitudinal axe in the second flight phase that will produce higher difficulty value of the vault.

METHODS

Participants

The study sample consisted of 12 male gymnasts, competitive, international level, including 4 seniors (mean ± SD: age 22.5 ± 2.8 years, body mass 67.5± 5.4 kg and body height 171.5 ± 3.1 cm) and 8 juniors (mean ± SD: age 16.13 ± 1.1 years, body mass 57.1 ± 10.3 kg and body height 163.8 ± 11.6 cm). The gymnasts performed the Tsukahara layout vault on the training sessions. The gymnasts performed three trials, but for the analysis we choose technically the best performed, according to two international gymnastics judges' opinion.

The protocol of the study was approved by the Ethical Committee of the Faculty of Physical Education and Sports, University of Nis and according to the revised Declaration of Helsinki. The investigation was performed during the preparation period. The coaches were informed about the experimental procedures and the possible benefits of the project.

The study protocol was applied for every subject. In addition to the results, the basic anthropometric parameters (body height and body weight) and the age of the gymnasts were registered in the study protocol.

Measures

We calculated next kinematic parameters:

Flight time (FT): The time between leaving the springboard and the first contact of the gymnast's hand with the vaulting table, expressed in seconds (s).

Contact time with one hand (CH): Duration of support with one hand on the table phase, expressed in seconds (s).

Contact time with both hands (CT): Duration of support on table phase with both hands, expressed in seconds (s).

Hand distance (HD): Distance between positions of hands on the vaulting table, expressed in meters (m).

Elbow angle (EA): The angle of the elbow joint of the first contact hand and vaulting table contact, expressed in degrees (deg).

Shoulder angle (SA): The angle of the shoulder joint of the second contact hand in the moment of support on the vaulting table, expressed in degrees (deg).

Hip angle (HA): The angle of the hip joint in the moment of support on the vaulting table, expressed in degrees (deg).

Height of Body's centre of gravity (HBCG): The maximal height of the body's centre of gravity during second flight phase in relation with vaulting table height (m).

Body height and body mass were measured according to the instructions of the International Biological Program–IBP (Weiner & Lourie, 1969). A GPM anthropometer (Siber and Hegner, Zurich, Switzerland) was used for measuring to the nearest 0.1 cm. Body mass was measured by a precision scale (Bilance SALUS, Milan, Italy) to the nearest 0.1 kg.

The gymnasts performed three trials of Tsukahara layout vaults during training. The trials were filmed and the best technically performed trial was chosen for the analysis. Vaults were filmed with Casio FX Camera at speed of 300 frames in a second.

Camera was positioned lateral to the direction of vault performance and 5 meters from the edge of the vaulting table. Parameters were calculated using software for 2D Kinematic Analysis "Human", version 6.0 (2005), HMA Technology.inc, Canada.

Statistical Analysis

The Statistical Package for Social Studies SPSS (v11.0, SPSS Inc., Chicago, IL) was used for the statistical analysis. Descriptive statistics were calculated for all experimental data and reported as Minimum, Maximum, Means, Standard Deviations, Skewness and Kurtosis. Pearson's coefficient of correlation was calculated in order to determine the correlation between parameters and a linear regression analysis between selected kinematic parameters HBCG in the second flight phase (method Enter). The statistical significance was set at $p < 0.05$ and 0.01 levels.

RESULTS

Descriptive statistics is presented in Table 1. The results of the Pearson correlations between parameters are presented in Table 2. height of Body's centre of gravity (HBCG) which is statistically significant and in correlation with the two parameters: hand distance (HD) and elbow angle (EA). There is not significant correlation between chosen time parameters: duration of the first flight and contact of hands and vaulting table.

There is statistically significant correlation between chosen parameters of the first flight phase and parameters of the table contacts (Table 2).

Table 1. Descriptive Statistics

	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
FT (s)	.04	.15	.09	.04	.157	-1.417
CH (s)	.07	.21	.14	.04	-.483	.035
CT (s)	.15	.24	.17	.03	1.589	2.864
HD (m)	.44	.80	.63	.11	-.129	-.297
EA (deg)	96.00	157.00	127.75	16.33	-.321	.330
SA (deg)	72.00	120.00	100.83	12.79	-.688	1.378
HA (deg)	126.00	158.00	145.66	9.07	-.787	.526
HBCG (m)	1.15	1.33	1.25	.06	-.093	-1.267

Table 2. Correlation between parameters

	FT	CH	CT	HD	EA	SA	HA
CH	**-.622***						
	.031						
CT	031	-.152					
	.924	.637					
HD	-.247	**.650***	-.067				
	.439	**.022**	.837				
EA	-.308	-.185	.137	**-.656***			
	.330	.566	.671	**.021**			
SA	-.248	-.280	.400	-.439	**.710****		
	.437	.377	.198	.153	**.010**		
HA	**.608***	-.188	-.054	.064	-.342	**-.586***	
	.036	.558	.866	.843	.277	**.045**	
HBCG	-.391	-.196	-.020	**-.654***	**.869****	.493	-.278
	.209	.542	.952	**.021**	**.000**	.104	.382

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3. Regression analysis (method Enter), predicted HB

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.128	.345		3.266	.022
	FT	-.680	.442	-.431	-1.538	.185
	CT	-.150	.459	-.062	-.328	.756
	HD	-.260	.167	-.439	-1.559	.180
	EA	.002	.001	.588	1.649	.160
	SA	-.001	.002	-.117	-.353	.738
	HA	.001	.002	.142	.514	.629

R=.934, R^2=.872, Adjusted R^2=.718, Sig.=**.038**

DISCUSSION

The aim of this study was to investigate correlations between some parameters of the two phases of the vault jump and HBCG in the second flight phase. There is significant correlation between hand positions distance (HD) (r=-.654, p=.021) and HBCG in the second phase, and also strong correlation between elbow angle (EA) and HBCG (r=.869, p=.000). HBCG can be considered as one of the most important parameters that can provide progress in achieving success on this apparatus.

The Coefficient of multiple correlations (Table 3) between selected variables and HBCG were statistically significant and very high (0.93). Selected kinematic parameters explained over 87% of the HBCG. It was interesting to observe that the kinematic variables separately were not significant predictors of HBCG, but together explained high percent of the variance. HBCG depends on compliance of the parameters in the preceding phases.

The mean value of time of the first flight was 0.09 ± 0.04 seconds, which was little longer than average flight time of the Tsukahara vaults performed on the World Championship in Debrecen 2002 (Čuk & Karácsony, 2004). The authors stated that when compared with other types of vaults, the Tsukahara vaults have the shortest time of the first flight. The minimum value of the time of first flight was 0.04 seconds of vault performed by medalist of the World Cup. This parameter can be taken as a good predictor of success. Čuk & Karácsony (2004) reported that the average time of first flight for Tsukahara vault was 0.06, Handspring vault 0.10, Yurchenko vault 0.13 and Nemov vault 0.10 seconds. The same authors reported the mean contact time with vaulting table for every type of vault, and for Tsukahara vault it was 0.26 seconds. In our sample the mean contact time was much shorter (0.17 seconds). There was negative correlation between the contact time with one hand and the flight time of the first phase (r=-.622, p=.031) which shows that gymnasts who had to shorten flight time in the first phase, had an optimal time of support on the vaulting table which can provide better second phase of the vault.

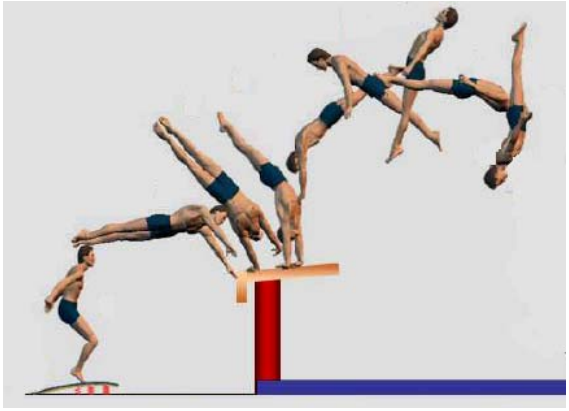

Figure 1. Analyzed phases of the Tsukahara layout vault

Hand distance correlated with contact time of the first hand (r=.650, p=.012). We didn't found this measure in the literature, but the hand positions distance in the Handspring was 0.43 m, and the width of the gymnast's shoulders was 0.42 meters. In contrary of that, for the Tsukahara vaults hand positions distance is much longer than for the Handspring and Yurchenko vaults. Heinen, Mandry, Vinken, & Nicolaus (2013) reported that positioning of hands on the vaulting table varied as a function of the position of the vaulting table. Combined manipulation of both the position of the springboard and the position of the vaulting table led to differences in feet positioning during the approach run and during takeoff, as well as to differences in hand positioning during the repulsion phase and differences in the duration of the second flight phase. A brief contact time on the table is likely to translate the gymnast's approach and take-off velocity into a longer post-flight time and distance, allowing the gymnast more time to perform more complex actions in the air (Bradshaw, 2004).

Also, there are differences between the angles of the body segments in different types of vaults. Shoulder angle at the time of support was 100 degrees; the elbow angle 127 degrees and the hip angle 145 degrees. We found that the elbow angle of the first contact hand had the strongest correlation with the height of the second phase (r=.869, p=.000). Penetiate, Sands, McNeal, Smith, & Kimmel (2010) reported that support phase duration ranged from 0.234, ±0.048 and 0.224, ±0.035 s for right and left hands, respectively. The force-time curves showed that hand contact forces occurred in two phases, high values on impact followed by a longer and lower magnitudes that produced a forward-downward push. Average normal (vertical) peak force was 1.4, ±0.3 x body mass. Hand contact differences in initial impact, duration, peak values and impulse showed marked differences between left and right hands. The results of this study indicate that hand contact force and time characteristics varied, that symmetrical performance was not common and magnitudes could meet those necessary to injure the wrist and forearm. This first study of directly measured hand contact forces showed a lack of symmetry, and force-time curves that consisted of two distinct phases.

The height of the Body's center of gravity was 1.25 meters from height of the vaulting table. If we took the height of the vaulting table of the 1.35, HBCG from the mat would be 2.55 meters. For future investigations, it is important to provide more data about anthropometrics measures of the gymnasts in order to have better results.

CONCLUSION

The main value of this investigation is that it provides results for every gymnast separately and enables a discussion between coaches and gymnasts individually about mistakes and possibilities for their corrections. Every gymnast should have insight at the weakest points of his techniques and correct them during preparation period. The vault is an apparatus that gives possibility to progress fast and without special conditions and financial factors, unlike other apparatus.

Acknowledgements

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THE CHALLENGE SYSTEM IN VOLLEYBALL – FOR THE FIRST TIME IN SERBIA

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SUMMARY

The Administrative Board of the FIVB made the decision to introduce the "Challenge System" at the final tournaments of the 2013 World Championship and Grand Prix, while national federations now have the opportunity to use the "challenge system" in Intercontinental Rounds. At the final tournament of the male championship league in Lodz, Poland, the new system of checking questionable referee's decisions was tested experimentally. The aim of this paper is to clarify and explain in more detail how the challenge system works in volleyball, where modern technology was introduced with the aim of checking referee's decisions. The paper deals with the general characteristics of the system, the technical characteristics of the hardware and software, as well as their implementation. It will also discuss system integrity or reliability, the rules of the game and the system, as well as the pioneer efforts made in using the challenge system in Serbia. In addition, the shortcomings of the system will also be outlined. The current experience of trainers, players and referees are highly positive and it is expected that the challenge system in volleyball will continue to develop, improve and search for better and more sophisticated solutions.

Keywords: challenge, system, volleyball

INTRODUCTION

The challenge system in tennis has proven to be very successful (it is used, for example, in cricket or American football), as it has in some other sports, including soccer. The first time it was used in the game of volleyball was at the final tournament of the Championship League for men, which was organized in the Polish town of Lodz by the VC "Belhatov" was held on March 17 and 18, 2012. After some positive experiences, the Administrative Board of the FIVB made the decision to introduce the "challenge system" at the final tournaments of the 2013 World Championship and the Grand Prix, while national federations can now use the challenge system during the Intercontinental Round of the competition. The challenge system (Hawk-Eye), represents the possibility to, at request, through replayed video footage, check for any possible errors. The experimental application of the challenge system represented a historical moment in a sport such as volleyball, which over the past decades has experienced the most dynamic changes in terms of the rules of the game, compared to other sports. The changes over the last few years were guided by the ideas of "keeping the ball flying". In other words, everything in volleyball, including the changes to the rules of the game, were organized so that the players could show everything they knew, and the audience could enjoy volleyball as much as possible. The paper will deal with the challenge system, that is, the video system used to check the referee's decisions in volleyball. More specifically, it is an Italian version of this system, which they named the Video Check System – VCS, and which was developed by the DataProject company, by the designers of the well-known DataVolley software. The first section of the paper will deal with the technical characteristics and the application of this system in volleyball. In Serbia, the challenge system was used for the first time at the games of the FIVB World Championship 2014, when our national team played against the Russian national team on May 30 and 31 in Niš. The game will be discussed in more detail later in the text.

THE GENERAL CHARACTERISTICS OF THE CHALLENGE SYSTEM

The system represents a complete hardware and software solution which enables the referees to check their decisions using high-speed cameras. In its basic setup of 12 cameras, the system allows one to check:

- the boundary lines of the court,
- the vinyl tape top binding of the net
- the antennae.

The system consists of only one rack which holds the complete equipment. It is exceptionally compact and portable, which is very important under the circumstances. The system includes:

- a work station,
- a UPS unit which enables at least 10 minutes of independent use in the case of any problems related to attaching 12 (plus 1) cameras and lenses to the electrical current,
- the necessary network cables for the cameras, with an overall length of approximately 400m,
- the tripods and protection for the cameras and
- 3 walkie-talkies for the rapid and unimpeded communication of the operators during a match.

Image 1. The complete system packaging

Image 2. The Italian system of video surveillance

SYSTEM SETUP, HARDWARE AND TECHNICAL CHARACTERISTICS

About 5 or 6 years ago, the Italian volleyball league began to look into the possibility of checking referee decisions. They also considered the possibility of the various ways in which they can realize the project, and one of the possibilities was the use of special sensors in the flooring and the hawk eye Hawk-Eye triangulation, most frequently used in: tennis). However, volleyball is much more complex, with many events on the court (specifically a larger number of players), and so the solution including high speed cameras on the boundary lines was at the same time the simplest and most effective method of implementation.

The system consists of a great number of components. However, it is clear that based on their sensitivity and delicacy, and the tasks of the system itself, the **cameras** are the most important element. Their setup is at the same time the most extensive and demanding, and delicate part of the process. As previously mentioned, in its basic version the system uses 12 industrial IP cameras. All of the cameras which are used to make decisions (10 of them) are high-speed cameras. They are positioned in the manner shown in image 3, marked by numbers ranging 1 to 8 sand A and B. The software was

designed in such a way so that it could be used by individuals who are not referees themselves.

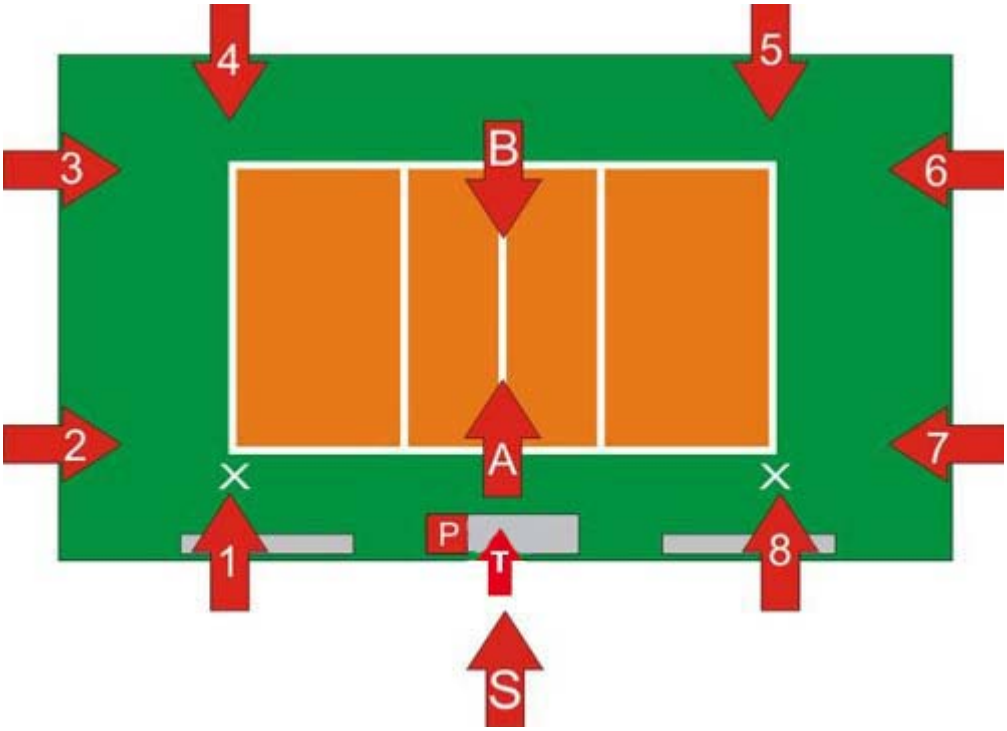

Image 3. The distribution of the 12 cameras

Cameras T and S are not high-speed cameras. Camera T monitors the score, so that at every point it is possible to know which part of the match is being played. Camera S is a "scene" camera and it monitors the overall match, just like the main camera in a television recording. The operator uses it for orientation, to identify the situation (moment) which is being challenged. P marks the place where the operator and the workstation are.

Every high-speed camera has its own "twin", that is, a camera observing the same object from the opposite angle, for example cameras 1 and 4, 2 and 7 are twins and so on. What is important is that the sidelines are not completely covered from both angles, due to their length and focus, and instead there is overlap only in the space between the attack lines. Thus, the space between the base lines and the attack lines are covered by only one camera.

Cameras 1 and 8 need to be clearly marked (for example with panels) so that the team members who are on the bench could be reminded not to stay too close to the cameras. In addition, in the Italian championship there are two lines 80cm long used to mark a large X in the space in front of them, so as to indicate to the trainers not to stay in the area for too long.

High-speed cameras record at 180 frames per second, that is, they record one image at intervals smaller than 6 milliseconds. Bearing in mind that a ball can travel at speeds up to 120km/h, these high-speed cameras are absolutely necessary. A high quality lense is attached to each camera, and the lighting, depth, focus and so on can be adjusted both using the hardware and software. Hardware adjustments can be "locked" (using very small screws), so as to decrease the possibility of any accidental changes in the adjustments. A lot of care is taken when selecting the network equipment. The cameras are attached to the system by means of cables. At first glance, this may seem as an unnecessary additional workload for the operators, as the cables need to be set up before the game and are needed during the entire game. However, if we were to take into consideration wireless connections, the cables are a more reliable means of data transfer, considering the numbers of visitors and the network devices in the sports hall itself, which would be operational during the match, and thus obstruct the system signal. High quality category 6 cables are used because of the distance (to reach camera B and the first referee we need up to 80m of cables) and any possible interference. Low quality cables can affect the reliability of the system.

The cameras are powered using a switch, that is, using a network cable, so an electrical outlet is not needed in the vicinity of each camera. There are three types of racks used to set up this system. Some of them resemble a cage, all with the aim of protecting the camera from any possible hits.

Image 4. A high-speed IP camera and lens

A workstation consists of a multi-processor computer, numbering 6 processors in total. If only the high-speed cameras were taken into consideration, in the basic version 180 images would have to be processed, coming in from 10 cameras, which amounts to 1800 images per second. This is a large amount of data, and so the computer is equipped with a high capacity hard disc. It sometimes happens that during a match, 1TB of data is collected. The hard disc works in a "loop", or in other words, when it becomes full, it starts recording from the beginning, erasing all the existing images on it. During tournaments, in the case of an extended first game, it sometimes happens that the second game in the second/third set is taped over the first one. In addition, the workstation has a switch for connecting the IP cameras. Of the remaining hardware devices, another interesting piece of equipment is the video converter, used to deliver the video signal to the other "interested" parties (TV stations, large screen TVs in the sports hall, and so on). The lower resolution display is also worth mentioning, as it is the first one that the referee sees on his platform, and which he uses to monitor the situation which is being challenged.

Experience from the Italian league tells us that it takes 2-3 hours to set up the entire system.

This usually takes place at the very end, when the court is fully set up, preferably in agreement with the TV crew because cameras need to be positioned on tripods. We should also mention the possibility of using 16 cameras, although in Italy only 12 were used. The additional 4 cameras are used to monitor the line of attack and the antennae (from the side lines not from the tripods). The question is: "Only 16? What should we do if for instance FIVB, in addition to all the aforementioned, also asks for the center lines to be monitored?" The answer lies in the fact that 16 is the maximum number that the system can handle at the moment, and that it is possible to relocate cameras 1 and 8 to the center line, as they are otherwise frequently blocked. In this kind of situation, cameras 4 and 5 would no longer have their twins. In addition, the monitoring of the center line was tested, but it did not offer satisfactory results since it was quite often the case that, due to the camera position (next to the post within the protective cage) and the "crowds" in that area, the recording could not guarantee one hundred percent accuracy in terms of the decision, and the challenge often caused more dispute than it offered solutions.

THE SOFTWARE AND ITS IMPLEMENTATION

The platform that was used was a simplified version of the Windows 7 Slim operating system (OS), with the aim of improved efficiency. It is a familiar environment and presented no problems for our operators. Three partitions were used, the first

one with the OS, on the second with a challenge system application, the settings and logos, and the third where the recorded video files were stored.

The challenge system consists of three applications:

- For camera selection
- For the challenge process itself, which takes places during the match (the Video Check program),
- For working on the archived recordings from the previous matches.

Updates for these applications are free. The software used to adjust the camera can be used at a workstation, but also on a laptop which is directly connected to the camera, so that the process could be completed more quickly. For the referees of course, the most interesting program is the one used for the challenge during the match itself, otherwise known as the Video Check.

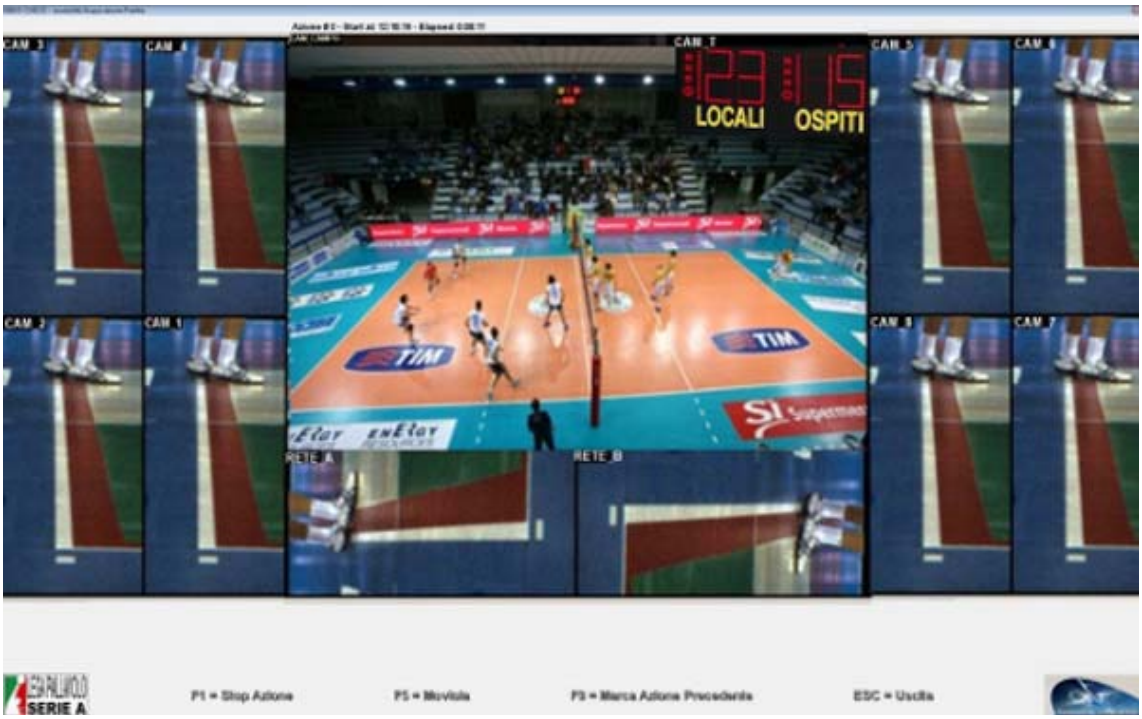

Image 5. The overview in the main window of the Video Check program during recording (a "false" image, The same image is shown several times so that the camera distribution could be seen)

Once the cameras have been connected and set up, some basic data regarding the game that is being recorded should be entered into the system. Then we enter the main screen of the program. The program has three work modes:

1. recording a match (SM),
2. rough slow motion footage (GUS) and
3. precise slow motion footage (PUS).

In the **record match** mode there is a very small number of functions which can be performed. The aim was for the system and operator to be unburdened as much as possible. They include: stopping the action, marking the previous action and transfer to slow motion. The basic idea behind the system in this mode is the following: the operator uses the F1 key to mark the "action". Everything recorded between two presses of the F1 key is referred to as an action. It is natural for every action to refer to only one rally, that is, for the operator to stick to this principle. The action also has its physical representation, since each action is stored in a separate file. Thus, when the operator hits the F1 key, everything recorded between that and the previous press of the F1 key is stored in a single file, and recording in a new file begins automatically. The actions are automatically incrementally enumerated.

The marking of the action has as its aim to facilitate locating interesting rallies following the game. These actions are marked red in the program, and the file system has, along with its generic name, the word "marked" on it.

The shift to **rough slow motion footage** is achieved by pressing key F5. The shift to this work mode is necessary for the analysis of recorded

actions, and while the program is in this mode, there is no recording. Nothing will be recorded while the previous actions are being shown, recording takes place solely in the SM regime.

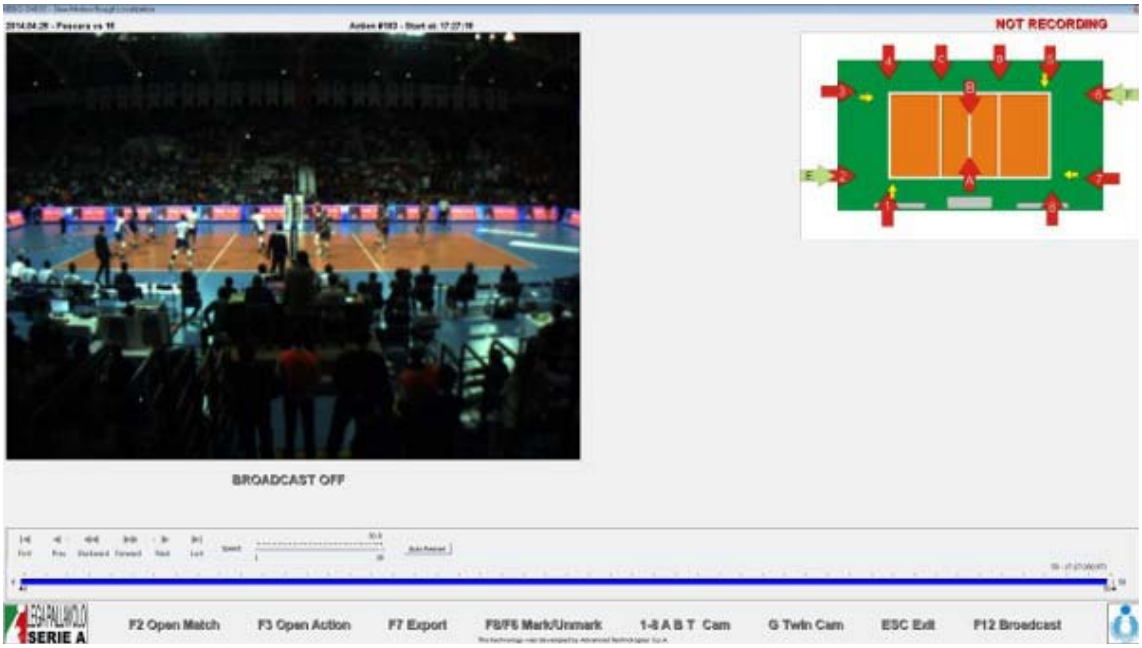

Image 6. The appearance of the program in the rough slow motion footage mode (GUS)

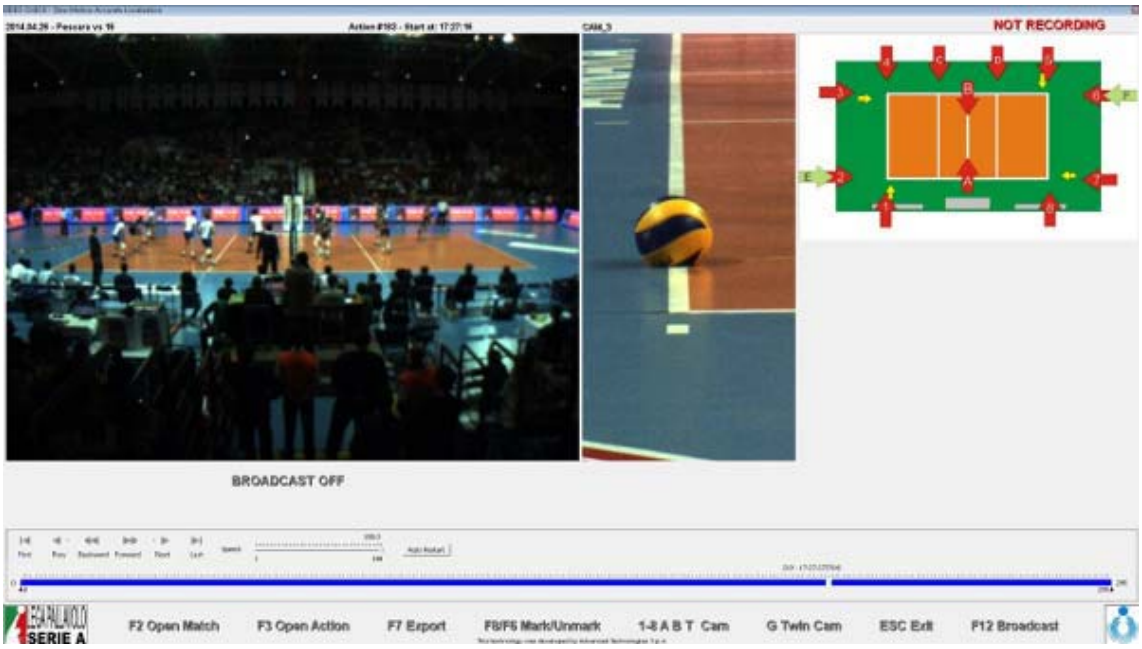

Image 7. The appearance of the program in the precise slow motion footage mode (PUS)

Even in this mode there are very few operations which can be executed, but enough to get the work done. It is possible to do the following: to select which of the previous actions we would like to observe, export the footage for the selected action and mark the action. It is possible to move through the actions in the GUS and to roughly locate (on the timeline) the moment when the problematic situations arise with the help of the recording of the scene camera. When the operator finds himself in such a situation, the selection of a suitable camera, the shifts is made into the **precise slow motion footage** mode.

In the PUS it is possible to, in addition to the aforementioned operations available in GUS, show a selected camera on the TV stations and on video screens in the sports hall. Of course, this display option is enabled only after a decision is made. Prior to that, only the referees (including the first referee using the small display) can see the challenge process.

Future plans for the development of this system include:

- Control of contact with the ball in a block
- The connection of this system with the other DataProject software solutions, primarily the electronic ledger. This would enable the automatic recording of actions (the system "presses key F1" by itself) and the more sensible naming of the action (a score rather than the automatically generated number).

THE INTEGRITY AND RELIABILITY OF THE SYSTEM

Irrespective of the fact that the system was intensively used during the entire ongoing season, the question of the reliability of the system remained open. The main topic of discussion were, of course, the cameras, since they are "scattered" all over the hall and are difficult to protect. If it happens that one of the cameras moved (either being hit by a ball or accidentally moved by someone), it is necessary to react quickly and return it to its original state.

The cables are an even bigger challenge, and their replacement, in the case of damage, is time consuming, and this is unacceptable if we take into consideration that the request for a challenge can occur at any moment.

The reliability of the software system is still an open question, even though our current experience indicates that there were no system failures or objective reasons for a system restart.

The system restart can certainly happen, and we cite the example when the operator got confused because of a message from the UPS and in a panic restarted the system. The time needed to restart the system is estimated at approximately 30 seconds, and the operator can immediately continue where he stopped, there is no need for any renewed settings except for the balance of the color white on the cameras.

The challenge system and the rules of the game

There is still no standard in the design and application of the challenge system in volleyball, everything is left to the organizers of the competition itself. This also refers to the rules of its use and application in terms of the official rulebook.

It has already been mentioned which parts of the court are covered by the high-speed cameras. Thus, in the 12-camera setup, the official rulebook guidelines adhered to during the Italian championship were:

- ball in/out,
- the player serving touches the base line when performing the serve and
- errors in the upper part of the net (touching the vinyl tape top binding or the antennae).

Based on some of the recordings, it might seem that the angle of the camera located on top of the tripod is not good enough to be used with one hundred percent certainty in every situation, to determine the proper decision when contact is made with the antennae. The second issue is the interpretation of the recordings themselves. The rule that the ball is in only if it touches the field is clear, but there are different interpretations of which moment counts. In Italy, the entire footage (or just one frame) is reviewed, and if flattening of the ball causes it to touch the line, it counts as the ball being in. On the other hand, FIVB did not want to monitor the recording, and instead wanted only one image (a frame) to be used during the challenge, the one where the ball "first" touches the surface, which means that the flattening of the ball did not count.

When the error of contact with the net occurs, it is necessary to use a recording (a full animation), and not only one frame, since in practice it was determined that the frame can mislead the judges and is confusing for the public. The challenge covers certain rules of the game, but there is no standard regarding which situations it is used in. For example, in Italy, it was possible to request a challenge for errors made on the upper part of the net only for the final situation in the rally, that is, it is not possible to check whether there was contact with the net at the beginning of the rally, but only during the final action on the net. There is no standard way of asking for a challenge (a specific hand gesture), or even who asks for one (the team captain or the trainer). For now, every competition has its own rules regarding the

issue. The challenge must be requested immediately (within 5 seconds) following the rally.

Another change which the system could introduce is the removal of any sideline referees from some matches. If they are present, the slide line referees must constantly try not to block the camera, even by accident, with their flag. In addition, there is the question of how to solve situations where a challenge is needed at the moment when the system is down for any reason. In Italy, in such situations, the operator uses a gesture to indicate that it is not possible to make a decision (hands crossed across the chest, like a sideline referee). Such a situation has never happened so far.

Interestingly, statistics have shown that during the last season in Italy, the referees were correct in 70% of the cases.

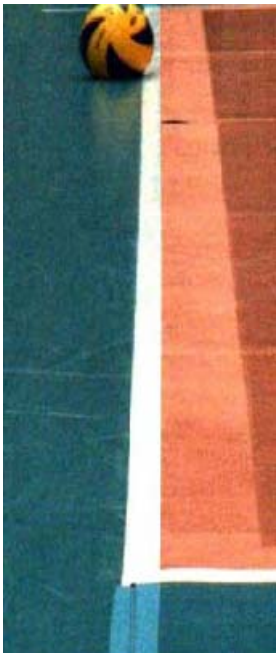

Image 8. A flattened ball

Image 9. Checking the line

Image 10. Checking the vinyl tape top binding

THE CHALLENGE SYSTEM – ITS FIRST USE IN SERBIA

In our country, the challenge system was first used at the World Championship Games in 2014 when our national team played against the Russian national team on May 30 and 31, 2014 in the sports hall Čair. The head operators during these matches, with the help of some colleagues from Italy, were the members of the Volleyball Referee Association of Serbia: Đorđe Stevanović, Uroš Milinković and the author, Stanko Jelisić.

The Italian delegation included Fabrizio Rosini, who in addition of his numerous functions, is the vice president of the Italian league and the head manager of the project of their challenge system, Gabriele Pirusio, one of the main operators and the individual who implemented the entire system, and Emanuele Chiwele, the sales manager of the Data Project company which developed the entire system.

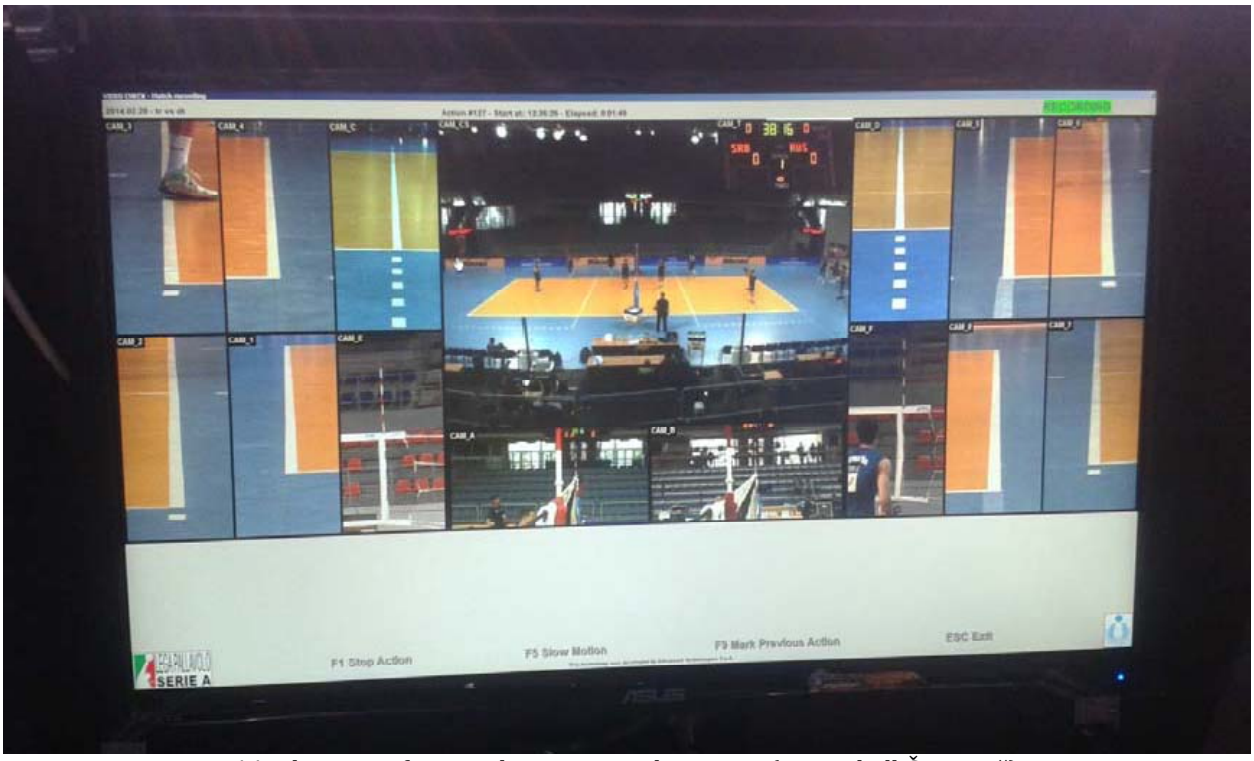

Image 11. The image from each camera on the screen (sports hall Čair - Niš)

"During the first match, after two sets and without any requests for a challenge, it seemed that everything was "clear as day" and that there would be no problematic moments which need to be checked. And then the trainers and players from both sides began to show disapproval of the referee's decisions and soon our team was very busy. It was the Russians who first requested a challenge, after a parallel from Uroš Kovačević, thinking that the ball had not touched the sideline. Another referee was immediately shown the appropriate frame and luckily for us, they were wrong. Later two more requests for challenges were made for contact with the net and both were to our advantage, to the crowd's delight. During one action in the first set, the Russian libero attempted to reach the ball by "sliding" on the floor and thus keep it in play. Our team thought that the ball touched the floor at that time and requested a challenge to check the situation. However, since this situation did not meet the requirements for the use of the challenge system, and considering that the referee had not ruled on the end of the rally and that the game had continued, the result was a reprimand for stalling. After that, Fabrizio explained how such a situation cannot be the subject matter of a challenge, since the high speed cameras follow only a small portion outside the boundary lines and the attack line, and so it is not possible to have a complete view of the entire court. For the second match, the challenge awarded the initial point. At a score of 0:0, Lisinac sent the ball straight to the sideline, but the referees still ruled it was an out. At the request of the Serbian team, the action was replayed up until the moment of contact between the ball and the floor, and the referees changed their decision to our advantage. After the first game, the trainers were better informed about the possibilities which our system offers, and were less hesitant, asking for challenges more often" (Milinković, 2014).

CONCLUSION

The challenge system in volleyball is still in the phase where it is expected to work toward better and more sophisticated solutions, since the experiences of trainers and players have so far been very positive. The reaction of the audience to a challenge is always good, which we have learned from other sports as well. It is clear that people like to see a problematic situation played out in slow motion. Future research should focus on a unique software solution which would be used at competitions the world over, since for now various software solutions are being used (Italian, Polish, Russian…). The experience of referees has also been

positive and they stated that the challenge system to a great extent decreases the tension among the team players and any protests against referee decisions. Future plans for the development of this system are touch control of the ball and developing the connection between this system and other DataProject software solutions, primarily the electronic ledger. This would enable automatic actions (the system "presses the F1 key itself"), as well as the more sensible name of the actions (the result, instead of the automatically assigned number).

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THE METRIC CHARACTERISTICS OF THE TESTS FOR SERVE RECEIVE PRECISION IN VOLLEYBALL

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SUMMARY

With the aim of determining the metric characteristics of the tests for the evaluation of precision in serve receive drills in volleyball, a pilot study was carried out on a sample of 25 volleyball players, all active competitors in the Second League of Serbia and 25 volleyball players, active competitors of the First League of Serbia, in the 2012/2013 competitive season. Four tests were validated: to evaluate the volleyball serve receive precision with a hammer and fingertips, from zone VI to position III, while passing the ball from zone VI, from the same side of the court. Three items were measured for each test, so that the test-retest method could be used to evaluate their reliability, and a factor analysis could be used to determine their validity. The data were processed using multivariate analyses (item analysis, factor analysis) from the 'Statistica 6.0 for windows' statistical package. Based on the results of the research and the discussion, we can conclude that the applied tests of serve receive precision do not have any high coefficient of reliability, or factor validity, and that these tests, in order to be used to evaluate serve receive precision in volleyball, must be analyzed further, adjusted and repeated on a larger and more representative sample of participants.

Keywords: metric characteristics, precision, serve receive, volleyball

INTRODUCTION

Deflecting a ball using the forearms is used to receive an opponent's serve, and to defend the team's side of the court and receive of the deflected balls from a block. The arms are joined in the so-called "bump", the forearms arms are parallel and inside part of the forearm region are facing upward. This kind of deflection is usually used for the first contact with a ball during serve receive and for the effective defense of the court and from the opponent's attack. Today, following its introduction, the libero player specializes in this technique, and takes over the main defensive role in the court, both for the serve receive, and defense. The serve receive using the bump should precisely guide the ball to the player who will lift it, so that he could have the optimal conditions to set up a swift and varied attack. The optimum indicator of such a receive is in more than two thirds of all cases stability and the safe serve receive in each game, for achieving a high quality game. The other elements, performed after the serve receive, depend on its precision to a great extent. Lifting in volleyball is directly conditioned by the precision of the serve receive, and in practice it is usually the case that a successful lift to a great extent depends on the precision of the serve receive, while the remaining factors including technical-tactical, psychological and all the other abilities of the player performing the lift.

Even though the existence of a dimension of motor precision was experimentally confirmed on several occasions, and that there is no obstacle for the concept to be intuitively accepted, the concept of precision has not been scientifically confirmed or proven at a satisfactory level, irrespective of its relatively early mention both in the relevant literature as an aspect of coordination, and at the same time, in relation to the neuro-muscular control of movement and motion.

There are studies which correspond to this particular study: (Filin, Kasatkin & Maksimenko, 1997), (Strahonja & Janković, 1975), (Janković, 1976), (Strahonja, 1983,) (Tomaš, 1982), (Strahonja, Janković & Šnajder, 1982), (Milić, 2011).

THE METHOD

The sample of participants

The sample of participants numbered 50 members, divided into two sub-samples. The first subsample consisted of 25 participants – volleyball players who actively competed as members of three first league clubs. The second sub-sample also consisted of 25 participants – volleyball players who actively compete as members of three Second League clubs.

The participants, all volleyball players, voluntarily agreed to take part in the research and were all registered for the 2012/2013 competitive season. Testing in the domain of the situational-motor skills of all the participants was carried out during the preliminary period of the competitive season.

The newly-designed measuring instruments

All of the measuring was organized in sports halls in which the volleyball players trained, and during their training sessions.

Hitting a horizontal target with the tips of the fingers from zone VI to position III, while passing the ball from zone VI, from the same side of the court

The aim: to measure the precision of hitting the target with the bump, a horizontal target in position III.

The equipment: A hoop, with a diameter of 47 cm, was positioned horizontally at a height of 2.43 m, a basketball hoop with 10 balls and a ledger.

The task: The participant assumes the ready position in the volleyball position VI, 2 m behind the attack line. The horizontal target was set in zone III (0.5 m from the net). The player who passes the ball is in zone III, next to the hoop, on the same side of the court. The player passes 5 balls each in a high arc in the direction of the participant who tries to use the bump to hit the target in position III.

The evaluation:

- successful - 1 point – the ball passes through the hoop and
- unsuccessful - 0 points – the ball does not pass through the hoop.

The final grade: the overall number of points out of 5 tries is added together.

The comments: One practice attempt is allowed. The following pass by the player passing the ball begins when the participant touches the ball with his fingers, and it either hits the target or not.

The notes: One individual is needed to do the measuring and at least two who will collect the balls. The attempt is repeated is the players passing the ball is not precise, if the participant strikes the ball with only one hand, or if the participant makes a ball handling error a held ball).

Hitting a horizontal target with joined forearms (the bump) from zone VI to position III, while passing the ball from zone VI, from the same side of the court

The aim: to measure the precision of hitting the target with the bump, a horizontal target in position III.

The equipment: A hoop, with a diameter of 47 cm, was positioned horizontally at a height of 2.43 m, a basketball hoop with 10 balls and a ledger.

The task: The participant assumes the ready position in the volleyball position VI, 2 m behind the attack line. The horizontal target was set in zone III (0.5 m from the net). The player who passes the ball is in zone III, next to the hoop, on the same side of the court. The player passes 5 balls each in a low arc (at knee-level) in the direction of the participant who tries to use the bump to hit the target in position III.

The evaluation:

- successful - 1 point – the ball passes through the hoop and
- unsuccessful - 0 points – the ball does not pass through the hoop.

The final grade: the overall number of points out of 5 tries is added together.

The following pass by the player passing the ball begins when the participant hits the ball with the bump, and it either hits the target or not.

The notes: One individual is needed to do the measuring and at least two who will collect the balls. The attempt is repeated is the players passing the ball is not precise, if the participant strikes the ball with only one hand.

Hitting a vertical target with the fingers from zone VI in position III, while passing the ball from zone VI, from the same side of the court

The aim: to measure the precision of hitting the target with the bump, a horizontal target in position III.

The equipment: A hoop, with a diameter of 47 cm, was positioned horizontally at a height of 2.70 m, a basketball hoop with 10 balls and a ledger.

The task: The participant assumes the ready position in the volleyball position VI, 2 m behind the attack line. The horizontal target was set in zone III (0.5 m from the net). The player who passes the ball is in zone III, next to the hoop, on the same side of the court. The player passes 5 balls each in a high arc in the direction of the participant who tries to use the bump to hit the target in position III.

The evaluation:

- successful - 1 point – the ball passes through the hoop and
- unsuccessful - 0 points – the ball does not pass through the hoop.

The final grade: the overall number of points out of 5 tries is added together.

The following pass by the player passing the ball begins when the participant hits the ball with the fingers, and it either hits the target or not.

The notes: One individual is needed to do the measuring and at least two who will collect the balls. The attempt is repeated is the players passing the ball is not precise, if the participant strikes the ball with only one hand, or if the participant makes a ball handling error (a held ball).

Hitting a vertical target with the bump from zone VI in position III, while passing the ball from zone VI, from the same side of the court

The aim: to measure the precision of hitting the target with the bump, a horizontal target in position III.

The equipment: A hoop, with a diameter of 47 cm, was positioned horizontally at a height of 2.70 m, a basketball hoop with 10 balls and a ledger.

The task*: The participant assumes the ready position in the volleyball position VI, 2 m behind the attack line. The horizontal target was set in zone III (0.5 m from the net). The player who passes the ball is in zone III, next to the hoop, on the same side of the court. The player passes 5 balls each in a low arc (at knee-level) in the direction of the participant who tries to use the bump to hit the target in position III.*

The evaluation:

- successful - 1 point – the ball passes through the hoop and
- unsuccessful - 0 points – the ball does not pass through the hoop.

The final grade: the overall number of points out of 5 tries is added together.

The following pass by the player passing the ball begins when the participant hits the ball with the bump, and it either hits the target or not.

The notes: One individual is needed to do the measuring and at least two who will collect the balls. The attempt is repeated is the players passing the ball is not precise, if the participant strikes the ball with only one hand, or if the participant makes a ball handling error.

The data analysis

In order to determine the factor validity of the tests, a factor analysis was used, the method of main components, which was used to give the projections of all the items on the first main component, and which were used as the basis of validity of each test. The reliability of the test was determined using an item analysis via the Crombach and Standardized alpha coefficient, as well as the means of the coefficients of the inter-item correlation. The 'Statistica for windows 6.0' package was used for these analyses.

THE RESULTS AND DISCUSSION

Table 1. The factor validity and predictability of the test of Hitting a horizontal target using the fingers from zone VI in position III, while passing the ball from zone VI, from the same side of the court

Item	Mean	Std.Dev.	Factor loading	Eigenvalue	% Total	Cronbach alpha	Standardized alpha	Average inter item corr.
I	1,86	1,11	-0,66	1,71	57%	0.610	0.617	0.352
II	1,53	0,96	-0,82					
III	1,73	1,08	-0,77					

Table 1. shows the coefficients of the factor validity and test reliability of Hitting a horizontal target using the fingers from zone VI in position III, while passing the ball from zone VI, from the same side of the court and their statistical significance. It is clear that the projections of the items on the first main component (Factor loading) is low and ranges from -0,66 to -0,82, which cannot be used to determine the validity of the test for the precision of the serve receive using the fingers. The overall valid variance of this test is 1,71, and the percentage of the explained variance is low and has a value of 57%. We can also determine that the Chronbach (0.610) and the standardized test (0.617) are quite low, as are the means of the inter-item correlation (0.352), which indicates the poor reliability of this test.

Table 2. The factor validity and predictability of the test Hitting a horizontal target with joined forearms (the bump) from zone VI to position III, while passing the ball from zone VI, from the same side of the court

Item	Mean	Std.Dev.	Factor loading	Eigenvalue	% Total	Cronbach alpha	Standardized alpha	Average inter item corr.
I	1,72	1,18	-0,80	2,09	70%	0.776	0.780	0.544
II	1,53	1,02	-0,86					
III	1,89	1,18	-0,84					

Table 2. shows the coefficients of the factor validity and reliability of the test Hitting a horizontal target with the joined forearms (the bump) from zone VI to position III, while passing the ball from zone VI, from the same side of the court and their statistical significance. It is clear that the projections of the item on the first main component (Factor loading) are low and range from d -0,80 to -0,86, which can be used to determine the validity of the test for serve receive using the bump. The overall validity of this test is 2,09, and the percentage of the explained variance is low and has a value of 70%. We can also note that both the Cronbach (0.776) and the standardized test (0.780) are quite low, as are the means of the inter-item correlation (0.544), which indicates the poor reliability of this test.

Table 3. The factor validity and predictability of the test of Hitting a vertical target with the fingers from zone VI to position III, while passing the ball from zone VI, from the same side of the court

Item	Mean	Std.Dev.	Factor loading	Eigenvalue	% Total	Cronbach alpha	Standardized alpha	Average inter item corr.
I	1,60	1,21	-0,82	2,03	68%	0.758	0.760	0.514
II	1,40	1,07	-0,83					
III	1,79	1,09	-0,82					

Table 3. shows the coefficients of the factor validity and reliability of the test for Hitting a vertical target using the fingers from zone VI to position III, while passing the ball from zone VI, from the same side of the court and their statistical significance. It is clear that the projections of the items on the first main component (Factor loading) are low and range from -0,82 to -0,83, which can be

used to determine the validity of this test for the precision of the serve receive with the fingers. The overall valid variance of this test has a value of 2,03, while the percentage of the explained variance is low and has a value of 68%. We can also notice that both the Cronbach and (1.758) the standardized test (0.760) are quite low, as are the means of the inter-item correlation (0.514), which indicates the low reliability of this test.

Table 4. The factor validity and predictability of the test for Hitting the vertical target with the bump from zone VI to position III, while passing the ball from zone VI, from the same side of the court

Item	Mean	Std.Dev.	Factor loading	Eigenvalue	% Total	Cronbach alpha	Standardized alpha	Average inter item corr.
I	1,46	1,09	-0,82	1,94	65%	0.725	0.726	0.469
II	1,30	0,98	-0,80					
III	1,41	0,94	-0,79					

Table 4. shows the coefficients of the factor of validity and reliability of the test for Hitting the vertical target with the bump from zone VI to position III, while passing the ball from zone VI, from the same side of the court and its statistical significance. It is clear that the projections of the items on the first main component (Factor loading) are low and range from -0,79 to -0,82, which can be used to confirm the reliability of this test for the precision of the serve receive with the bump. The overall variance of this test is 1,94, while the percentage of the explained variance is low and has a value of 65%. We can also note that both the Cronbach (0.725) and the standardized test (0.726) are quite low, as are the means of the inter-item correlation (0.469), which also indicates the low reliability of this test.

THE CONCLUSION

The practical application of this paper lies in the fact that its aim is to modernize the programming process of training of the most high quality volleyball players in our environment, and the function of its intensification and improved effectiveness in relation to the individual needs and tendencies of the players lifting, receiving, serving, spiking and the libero players.

The results of this research can probably relatively easily be applied in practice, since they enable insight into the scientifically verified exercise program with the aim of the development and improvement of the situational-motor skills in volleyball, especially precision. In addition, they could have a positive influence on the motivation of senior athletes for the improvement of precision, considering that precision, as well as the other situational-motor abilities, are of great importance for achieving better results, both of each volleyball player individually as well as the volleyball team as a whole. In addition, this research can be used by other researchers as a foundation and source of ideas for the further direction their research should move in. The authors of this research should use these tests of precision of the serve receive in volleyball to further analyze, adjust, and retest them on a larger and more representative sample. The research has provided the authors with some answers, and has clarified certain problematic issues related to precision, which was constructed, and which was used to measure the precision of the serve receive with the bump and fingers.

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DETERMINE THE BEST WAY OF FORMING THE FINAL RESULTS IN A COMPOSITE COORDINATION TESTS

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SUMMARY

Introduction: The research problem is related to the determination of the most appropriate procedure for registration of the final results in a composite test coordination. It is assumed that the method of calculating factor scores intercorrelation matrix, and the method which involves recognition item in the largest correlated with the main object of measurement, represent the best method for registration of the final results in a composite test coordination.

Methods: The sample for this study consisted of 112 boys aged 7 years, where is applied 17 composite coordination tests. In order to determine the most appropriate procedure for registration of the final results in a composite test was applied factor analysis.

Results: Smallest number of factors with the highest percentage of common variance matrix of correlations, as well as the highest correlation coefficients with a subject of major measurements obtained in the case of application of methods that take into account the information of all the item.

Conclusion: Based on these results it is recommended that when using the results of testing for scientific research purposes, certain priority should be given condensation process by summing or mean the original results. The above-mentioned procedures are simple and economical to use, and the other, provide the most information about the structure of the analyzed area.

Keywords: condensation results, factor analysis, the first subject to measurement

INTRODUCTION

Motor testing on a sample of respondents includes the use of more motor measuring instruments. This is necessary because any of the motor ability cannot be measured, or estimate, by the use of only one motor test. Likewise, it is very problematic to evaluate one motor ability only on the basis of one reaction to a stimulus that is caused by the motor task in the corresponding motor test. Therefore, during design of Kinesiology research must construct appropriate samples (battery) of motor composite tests, i.e. tests whose performance is repeated two or more times (Bala & Madić, 2002).

When using composite motor test raises the question: which measurement result, and that particle must be taken into consideration. In other words, you should choose the method of condensation measurement results with more results (particles) on the one most representative information. In practice is using several modes of condensation results in one composite test and that (Bala & Krneta, 2007; Pedišić & Dizdar, 2010):

1. Condensation of original results with first particle;
2. Condensation of original results with maximum result (best particle);
3. Condensation of original results with mean;
4. Condensation of original results by summing the results;
5. Condensation of standardized results of mean;

6. Condensation of particle with first main component;
7. Condensation of results with particle that is in the greatest correlation with the main object of measurement.

Thomas and associates (Thomas, Nelson & Silverman, 2010) consider that is the most and the best information obtained when taking into account all of the particles, and the result of his subjects is his factor score of the first main component of matrix variance results in all embodiments of the appropriate test. This way takes into account information of all the particles, but also on their mutual relations, i.e. their common case of measurement (Pedišić & Dizdar, 2010).

Obtained research results on the whole area of motor skills how to preschool children as well as with the student population (Bala & Madić, 2002) indicate that some priority should be given procedure of summation results of each execution of the same test, or on the basis of calculating the scores of the main components based on the results of performing the same test. Furthermore it's stated that it is worth to take into account the best result of all performances of the same test.

The practice and science confirms every day that the coordination is one of the most important psychomotor skills (Mijanović & Vojvodić, 2010). Just because of that fact, the coordination is in all formulas and equations specifications of success in sport (Kostić, Đurašković, Pantelić, Živković, Uzunović, & Živković, 2009).

Difficulties in trying to define the notion of coordination, especially the difficulty in trying to determine its latent structure, mainly are consequence of disagreement in determining the operational areas of motor skills (Hošek, 1976; Pavlović, 2008). Coordination significantly correlate with a number of other motor abilities which often limit it. Coordination is not only determined by one factor. It consists of a number of "manifestations" (Sekulić & Metikoš, 2007). Having in mind multidimensionality of coordination, authors Yan & Xu (1999) point out the necessity of applying the battery of tests in the evaluation of this ability, and not just one measuring instrument.

The big problem is that the area of coordination is in many cases tested with measuring instruments whose reliability has not been checked (Veličković & Petković, 2005). As a result of the measuring instrument is often taken just one shot and one motor task (one systemically tests). Only in the selection process of gymnastic, for measuring of coordination have been identified even 19 tests of one item character (Veličković, 1999). This way of motoric testing emits little information on the measured motor skill and can lead to wrong conclusions. With this constructed, one item tests it is impossible to reduce the specificity or measurement error, and it is often impossible, especially in terms of specificities, accurately identify its size (Thomas, Nelson & Silverman, 2010). Improving the reliability of existing tests can be obtained only if it is conducted restandardization and reconstruction in composite measuring instruments type. The simplest and the most economical procedure that allows to evaluate and reduce measurement error is a multiple repetition of certain motoric task (Bala, 2001).

The aim of the research is to determine the most appropriate procedure for registration of the final results when measuring coordination. Guess is that the factor score of matrix intercorrelation particles and particles which is mostly correlated with the main object of measurement, will represent the best way of registration of final results in the coordination test.

METHODS

Sample of subjects

The study was conducted on a total sample of 112 boys, the age of 7 years (± 6 months), participants of the first grade at six elementary schools in the town of Nis. Criteria based on which is defined sample for this study are the initial selection criteria for men's gymnastics, prescribed by the Gymnastics Association of Serbia. The subjects had to meet the following criteria:

Age of subjects was determined by the chronological age of 7 years (± 6 months);

The subjects must be clinically healthy and without the presence of any deformities, primarily foot (flat foot), knee (bowlegged) and elbow (hyperextension) joint, the spinal column (lordosis, kyphosis and scoliosis);

The subjects must have a weight-height index (BW/BH) below 0.190 kg/cm.

Consideration of the criteria set allowed the selection of suitable for gymnastics, namely, the formation of the sample for this study. From a total of 288 first-grade schoolboys from six elementary

schools (100%) underwent to the initial selection, the established criteria were met by 112 schoolboys, or approximately 40% of total.

All subjects included in this study had the approval of the parents to participate in research. The study was approved by the ethical committee of the Faculty of Sports and Physical Education in Nis.

Testing procedure

Measuring of coordination skills was conducted in each school separately. Since the school classes of the first grade conducts differently by individual schools, measurements were performed according to the classes time, or between 8h and 10h, or between 13h and 15h. All measurements were performed indoors at the temperature between 16 and 20°C.

Considering the size of the sample at schools (between 13 and 23 students) and the number of tests (17), for the treatment of each school, three days was necessary (first day six tests, the second day six tests and five tests on the third day). The order of implementation of coordination tests was the same in all schools and for all subjects. In the organization of measurements, it was respected the rule that the tests that requires higher energy consumption was performed last.

Sample of measuring instruments

The sample of variables was obtained on the basis of motor testing using a set of 17 composite motoric tests, with three particles (three repetitions of the same motor task), which were hypothetically evaluating the following factors:

Tests for the evaluation of the realization speed of complex motor tasks

- Rolling forward, sideways and backwards (RFSB)
- Skills polygon, easier version (POLE)
- Skills polygon, harder version (POLH)
- Backwards polygon (POLB)

Tests for evaluating the accuracy realization of complex motor tasks

- Rolling and walking on the line with asymmetrical hand movements (RWAH)
- Exercise in movement with asymmetrical movements of the hands (EMAH)
- The combination of asymmetric movements with arms and legs in one place (AALP)
- The combination of symmetrical extremity movements in a sitting position (SMES)
- The combination of asymmetric hand movements and jumps in one place (AHJP)
- Jumping in one place with symmetrical movements of the extremities (JPSE)
- Jumping in one place with asymmetrical movements of the extremities (JPAE)

Tests for agility evaluating

- 10x lying, squat, jump (LSJ)
- Running 2x15m from a lying position (R2X15)
- Envelope test (ENVT)

Tests for evaluation of coordination in rhythm

- Un-rhythmic drumming with hands (UDRU)
- Rhythmic drumming with hands and legs (RDHL)
- Drumming on the horizontal plates (DHOP)

For all of these measuring instruments it was concluded the measured results provide a distribution that's not significantly deviated from the normal (Veličković & Petković, 2005), that have a high objectivity (Veličković & Petković, 2005) and reliability (Veličković, Aleksić-Veljković, & Herodek, 2013). Veličković et al. (2013) gave a detailed description and standardization of all measuring instruments for coordination used in this research.

Statistical data analysis

Analyses were conducted on the basis of the following methods of forming the final results of the measurements:

1. Condensation of original results with first particle;
2. Condensation of original results with maximum result (best particle);
3. Condensation of original results with mean;
4. Condensation of original result with summarizing results;
5. Condensation of standardized results with mean;

6. Condensation of particle with first main component;
7. Condensation of results with particle that is in the greatest correlation with the main object of measurement.

Determining the most appropriate method of condensation of results in composite tests of coordination performance was conducted in two ways.

The first method included the determination of the structure of space of coordination respecting all seven ways of registration of the final results of measurements in each composite test. Way that gave structure space with a smaller number of factors, and higher percentage of common variance was considered to be a better method for registration of the final results in a composite test. In these analyzes were applied Direct Oblimin transformation of the main components of the corresponding intercorrelation matrix of adequately formed variables. Number of statistically significant main components was determined based on the Guttmann-Kaiser criteria. To illustrate the analyzed were only displayed matrix of isolated components of motor factors and the percentage of common variance.

The second method included determination of correlation of each way of registering the final results in a composite test with the main subject of measuring of the same test. For this method, it was used a factor analysis, method of the main components. Procedure which had a higher correlation with the main object of measurement was considered better.

It should be noted that in well-constructed motor tests, with strict compliance to its standardization, practically it's all the same on which way is calculated the test result, because the difference in the accuracy of the difference is so small that practically it can be ignored. However, the problem is with motoric coordination tests, which are not, or cannot be completely well constructed (due to the complexity of the main subject of measurement), because of non compliance with the requirements in standardization of appropriate composite motoric tests by the measurer.

Statistical analysis was conducted with program SPSS v 18.

RESULTS

Table 1. Matrix assembly - The best results (A), the arithmetic mean of all three measurements (B), the sum of results of all three measurements (C)

VARIABLE	1A	2A	3A	4A	1B	2B	3B	4B	1C	2C	3C	4C
RWAH	0,43	0,29	**-0,60**	-0,01	0,44	0,32	**-0,63**	-0,01	0,42	0,33	**-0,62**	0,01
EMAH	**0,74**	-0,04	-0,23	0,22	**0,77**	-0,01	-0,28	0,15	**0,77**	0,01	-0,27	0,15
AALP	**0,61**	0,03	-0,53	-0,09	**0,61**	0,11	-0,55	-0,15	**0,59**	0,11	-0,54	-0,13
SMES	**0,63**	-0,01	-0,41	0,07	**0,62**	0,06	-0,43	0,08	**0,62**	0,03	-0,46	0,11
AHJP	**0,55**	-0,07	-0,27	0,29	**0,62**	0,02	-0,27	0,16	**0,61**	-0,02	-0,24	0,16
POLB	-0,11	0,11	-0,43	**0,68**	0,01	0,11	-0,39	**0,78**	0,01	0,10	-0,36	**0,78**
JPSE	**-0,78**	-0,05	0,30	0,05	**-0,79**	-0,12	0,33	0,12	**-0,78**	-0,10	0,36	0,13
JPAE	**-0,80**	-0,19	0,26	-0,03	**-0,78**	-0,25	0,24	-0,02	**-0,77**	-0,27	0,26	-0,01
RFSB	0,29	0,16	-0,09	**0,78**	0,46	0,15	-0,09	**0,75**	0,46	0,14	-0,08	**0,74**
POLE	0,15	0,45	-0,06	**0,59**	0,08	0,49	-0,13	**0,62**	0,07	0,47	-0,10	**0,63**
POLH	-0,04	0,65	-0,29	**0,66**	0,11	0,64	-0,34	**0,63**	0,09	0,62	-0,33	**0,65**
R2X15	-0,04	**0,90**	0,04	0,24	-0,01	**0,89**	0,01	0,13	-0,03	**0,89**	0,01	0,15
LSJ	0,11	**0,51**	-0,18	0,34	0,11	**0,55**	-0,17	0,30	0,11	**0,54**	-0,16	0,32
ENVT	0,00	**0,78**	-0,05	-0,03	0,13	**0,77**	-0,05	0,01	0,11	**0,78**	-0,06	0,01
UDRU	-0,24	-0,26	**0,74**	-0,26	-0,29	-0,26	**0,76**	-0,27	-0,28	-0,22	**0,77**	-0,28
RDHL	-0,34	0,03	**0,75**	0,00	-0,39	-0,03	**0,76**	0,00	-0,37	-0,05	**0,78**	0,01
DHOP	-0,33	0,07	**0,75**	-0,14	-0,24	0,11	**0,73**	-0,24	-0,26	0,11	**0,75**	-0,22
% Variance	***58,16%***				***59,96%***				***59,97%***			

Table 2. Matrix assembly - with factor scores the first main intercorrelation matrix component of all three performances in the composite test (d) and the arithmetic mean of standardized particles (E)

VARIABLE	1D	2D	3D	4D	1E	2E	3E	4E
RWAH	0,43	0,34	**-0,61**	0,02	0,44	0,34	**-0,61**	0,02
EMAH	**0,77**	0,00	-0,26	0,15	**0,77**	0,00	-0,26	0,16
AALP	**0,60**	0,12	-0,52	-0,13	**0,61**	0,12	-0,52	-0,12
SMES	**0,62**	0,03	-0,44	0,11	**0,62**	0,03	-0,44	0,11
AHJP	**0,61**	-0,02	-0,23	0,16	**0,61**	-0,02	-0,23	0,17
POLB	-0,01	0,10	-0,37	**0,77**	0,00	0,10	-0,37	**0,77**
JPSE	**-0,78**	-0,11	0,34	0,12	**-0,78**	-0,11	0,33	0,12
JPAE	**-0,77**	-0,27	0,24	-0,02	**-0,77**	-0,27	0,24	-0,02
RFSB	0,45	0,13	-0,08	**0,75**	0,44	0,14	-0,08	**0,75**
POLE	0,08	0,47	-0,09	**0,63**	0,08	0,47	-0,10	**0,62**
POLH	0,09	0,62	-0,33	**0,66**	0,09	0,62	-0,33	**0,66**
R2X15	-0,03	**0,89**	0,02	0,16	-0,03	**0,89**	0,02	0,16
LSJ	0,11	**0,54**	-0,16	0,32	0,11	**0,54**	-0,16	0,32
ENVT	0,11	**0,78**	-0,06	0,02	0,11	**0,78**	-0,06	0,02
UDRU	-0,28	-0,22	**0,77**	-0,28	-0,28	-0,22	**0,77**	-0,28
RDHL	-0,38	-0,06	**0,78**	0,02	-0,38	-0,07	**0,79**	0,02
DHOP	-0,24	0,12	**0,75**	-0,20	-0,24	0,12	**0,75**	-0,19
% Variance	***59,86%***				***59,83%***			

Table 3. Matrix assembly - of the first result in each test (F) and particle which is in the highest correlation with the main-first subject of measurement (G)

VARIABLE	1F	2F	3F	4F	5F	1G	2G	3G	4G	5G
RWAH	**0,57**	0,03	0,15	-0,25	-0,22	**0,62**	0,31	-0,51	-0,05	0,19
EMAH	0,42	-0,04	-0,09	-0,08	**0,55**	**0,58**	-0,01	-0,29	0,50	-0,28
AALP	**0,57**	0,05	-0,08	-0,12	0,16	**0,66**	0,16	-0,40	-0,07	-0,21
SMES	**0,40**	-0,06	0,05	-0,17	0,31	**0,67**	-0,09	-0,35	0,17	0,10
AHJP	0,04	0,03	0,01	-0,06	**0,73**	0,38	0,12	-0,27	0,34	**-0,55**
POLB	-0,12	-0,22	**0,74**	-0,17	0,20	0,03	0,04	-0,33	0,37	**0,68**
JPSE	**-0,77**	-0,02	0,16	-0,03	-0,03	**-0,71**	-0,06	0,31	-0,16	0,42
JPAE	**-0,79**	0,01	-0,15	-0,14	-0,02	**-0,82**	-0,09	0,15	-0,23	0,03
RFSB	0,15	-0,04	**0,57**	0,23	0,49	0,25	-0,02	-0,17	**0,84**	0,07
POLE	0,01	0,16	**0,77**	0,04	-0,26	-0,02	0,47	-0,08	**0,63**	0,12
POLH	0,12	0,41	**0,58**	-0,16	-0,10	0,22	**0,54**	-0,35	0,44	0,48
R2X15	0,00	**0,83**	-0,01	0,02	-0,18	-0,05	**0,85**	0,00	0,19	0,13
LSJ	-0,21	**0,69**	0,05	-0,12	0,36	0,30	**0,44**	-0,11	0,10	0,51
ENVT	0,17	**0,70**	-0,01	0,13	-0,03	0,15	**0,76**	-0,12	-0,05	0,01
UDRU	-0,02	-0,13	-0,04	**0,75**	-0,16	-0,19	-0,25	**0,78**	-0,19	-0,10
RDHL	-0,24	-0,11	-0,01	**0,66**	0,02	-0,35	-0,03	**0,79**	-0,01	0,10
DHOP	0,09	0,23	-0,01	**0,70**	0,07	-0,26	0,07	**0,74**	-0,13	-0,12
% Variance	***59,18%***					***62,35%***				

Table 4. Correlation coefficients of all seven ways of registration of the final results with the main object of measurement for each composite test

VARIABLE	*I1*	*SUM*	*AS*	*MAX*	*F score*	*RF*	*Z*
RWAH	0,931	0,999	0,999	0,972	0,999	0,958	0,999
EMAH	0,931	0,998	0,998	0,979	0,998	0,959	0,998
AALP	0,941	0,999	0,999	0,981	0,999	0,963	0,999
SMES	0,927	0,998	0,998	0,979	0,999	0,975	0,999
AHJP	0,899	0,998	0,998	0,966	0,998	0,936	0,998
POLB	0,868	0,999	0,999	0,922	0,998	0,928	0,998
JPSE	0,901	0,998	0,998	0,952	0,999	0,943	0,999
JPAE	0,968	1,000	1,000	0,980	1,000	0,981	1,000
RFSB	0,929	0,996	0,996	0,893	0,992	0,929	0,991
POLE	0,887	0,998	0,998	0,914	0,998	0,913	0,998
POLH	0,916	0,999	0,999	0,956	0,999	0,938	0,998
R2X15	0,906	0,996	0,996	0,964	0,997	0,924	0,997
LSJ	0,905	0,998	0,998	0,969	0,997	0,933	0,998
ENVT	0,859	0,996	0,996	0,939	0,997	0,899	0,996
UDRU	0,807	0,995	0,995	0,943	0,997	0,914	0,996
RDHL	0,860	0,996	0,996	0,960	0,996	0,942	0,996
DHOP	0,827	0,998	0,998	0,942	0,999	0,931	0,999
MEAN	0,898	0,998	0,998	0,954	0,998	0,939	0,998

Legend (Ways of registration result) - I1 (the first result), SUM (sum of original results of all three measurements), AS (arithmetic mean of original results of all three measurements), MAX (best result in the composite test), F score (all three performances presented with main component and factor scores), RF (measurement which is highly correlated with main subject of measurement), Z (arithmetic mean of standardized results of composite test).

On treated sample of respondents by factorization of each intercorrelation matrix variables, which represented appropriate number of repetitions of performing motoric tests, was obtained four factors in case of condensation of measurement results with maximum score, arithmetic mean of original and standardized results, the sum of the original results and factor scores the of first main component (Tables 1 and 2). Four-factor models are interpreted practically in the same way: 1) realization accuracy of complex motoric tasks, 2) Agility, 3) coordination in rhythm 4) speed of realization of complex motor tasks. Thereby, percentages of common variance of extracted significant main components of the matrix intercorrelation obtained on the basis of five different registration procedures of measurement results ranged from 58.16% to 59.97%. The lowest was in registering the best performance (Table 1), then at the arithmetic mean of standardized results and when all registered performing was presented as their main component (factor scores - Table 2), and highest was at the sum and arithmetic mean of original results (Table 1).

In two cases were obtained five factors (Table 3), in the case of condensation of information with first measurement and with the measurement which is in highest correlation with the main object of measurement. In obtained five-factor structure of the area, first four factors can be interpreted in a similar way as in the previous case, with the proviso that the fifth factor cannot be logically defined. Percentage of common variance has similar values as with four-factor model.

Reviewing Table 4 it can be seen that on average, the highest correlation coefficients with the main object of measurement have ways of registration of the final results that take into account information's which give all three particles (sum and arithmetic mean of the original results, the mean of standardized result and factor scores the first main intercorrelation matrix component result in all three performances of a test), and not by selecting one of the three measurement (first measurement, the

maximum score). Slightly lower correlations were obtained in average with way of registration where the best result is respected, so the result which is in highest correlation with the main subject of measurement for each composite test. The lowest correlation was recorded in the case of use of the first result.

DISCUSSION

Review of all the tables we can see that the advantage should be given to procedures that take into account information of all three measurement results, and not only by choosing one of three results in a composite test. Similar results were obtained during research of the structure of motoric dimensions based on the way of registration measurement results (Bala & Madić, 2002). This way (when taken into account all three particles) gives a lower number of factors, which are better and more precisely defined, and which, of course, gives more information about performing of the entire coordination test, and therefore more information about the main object of measurement in these tests. Also these methods of registration the final results of measurement have on average higher correlation with the main object of measurement (Table 4).

The previous findings are confirmed (Bala & Krneta, 2007) that taking into account only one measurement (first measurement, the measurement that is mostly correlated with the main object of measurement, and the best result), get lost most of the information about the real potential of respondents. So it is recommended that this method of registration measurement results of appropriate motor skills should be avoided. When it comes to individual results, the only noteworthy is the procedure of taking into account only qualitatively best results of all repetitions of motoric task (particles) in the appropriate motoric test. Of course, this means observance of conditions of measurement, which are prescribed by the appropriate standardization of each coordination test, as well as training the measurer.

CONCLUSION

By analyzing and comparisons of the results obtained in all four cases of forming motoric variables in both samples of respondents, it was concluded that condensation of particles with first main component (calculating factor scores on the main components based on the results of performing same test), much favored in previous researches, however, in this study there were no advantage of this method compared to the previously mentioned two ways of forming final variables. On the other hand, this way is not so economical process, since it requires several steps, application of statistical programs and previous education of researchers. This method, and the method of condensation of standardized results with arithmetic mean, obtained higher utility value when it comes to composite tests where each particle represents a different motor task, and ten way of results registration are not the same measurement units.

Accepting the results which is mostly correlated with an isolated factor (the main subject of measurement), as final results of the composite test, proved to be quite inaccurate procedure.

When using the results of testing for scientific research purposes, strictly theoretical point of view, and to some extent on the basis of information obtained in this study, some priority should be given to procedure of condensation of original results by summing or by arithmetic mean, because this is the most economical and most accurate methods. This way allows simplest method of calculating results, using the original value, and it is available and clear to all researchers.

Of the procedures that take into account only one result in a composite test, noteworthy is the procedure of taking into account only best qualitatively result of all repetitions of motoric task (particles) in the appropriate motoric test. Of course, this means observance of conditions of measurement, which are prescribed by the appropriate standardization of each motoric test, as well as the training of the measurer.

If it is not possible to apply a test with multiple execution of the same test, it is necessary to subjects, especially young children, to enable them to try the performance of a particular test before registering results of performance. In this way we can obtain a more adequate and more reliable results. Of course, this kind of performing tests is recommended to check the condition in work with children from a teacher or coach, but it should be avoided for using it in scientific research practice of quantitative and qualitative characteristics of motoric abilities.

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RELATIONS BETWEEN CONTRACTILE ABILITIES OF LOWER BODY DURING LOADED SQUAT JUMP AND START PERFORMANCE IN SUB-ELITE SWIMMERS

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SUMMARY

The aim of this study was to determine the relations between contractile abilities of the leg extensor muscles with starting performance, as well as whether the level of average power, peak power and maximal force measure with Loaded Squat Jump (SJ) are related to the efficiency of start performance (t10m). Twenty seven sub-elite male swimmers, all members of the swimming club „Sveti Nikola" and „Nis2005" from Nis, Serbia (height = 182.2±5.7 cm, weight = 73.5±7.3 kg, age = 20.1±3.4 yrs) performed one trial of SJ test and two swimming start trials corresponding to 10m distance. The results of inter-correlation matrix showed a statistically significant association between the start efficiency (t10m) and the variables of average power (r = -0.65), peak power (r = -0.63), maximal force (r = -0.52). Results of regression analysis indicate a statistically significant influence of the whole system of SJ predictor variables on the start performance (p = 0.04). This is confirmed by high coefficient of multiple correlation (R = 0.67), where the common variance is explained with 45% (R2 = 0.45). Individually, no variable has statistically significant influence on t10m. This indicates that all power and force variables listed above which were the part of predictor variable set should be developed. Additionally, the results of this study suggest that swimmers, with higher values of power and force variables, should be able to be faster on 10m-mark then the swimmers with lower values of power and force variables.

Keywords: swimming start, muscle potential, vertical jump

INTRODUCTION

The swimming start, if performed effectively might decide the swimmer's classification and is accepted as an important part of sprint swimming events (de Jesus et al. 2011). The starting performance is usually defined by the period between the starting signal and the moment a swimmer reaches 10 m (Blanksby et al., 2002), and it is consisted of several phases: block, flight, entry, underwater and swimming phases (Vantorre et al. 2010). Cossor and Mason (2001) have shown that in competitive swimming, the start has been strongly linked to overall performance. The study of Lyttle and Benjanuvatra (2005) proved that swimming start can contribute between 0.8 – 26.1 percent of total race time depending on the distance. With the percentage contribution increasing as the distance of the race becomes shorter (Hay, 1986). The on-block, flight and underwater phases are three typical start's phases. Slawson et al. (2013) research indicates that the percentage start time contribution of each sub-phase is approximately 11%, 5% and 84% respectively.

The stroke length, stroke index, start dive length and start dive velocity are different technical characteristics which determine the differences between more and less successful swimmers in sprint event (Djurović et al., 2012). As Schnabel and Kucheler (1998) have shown in their study, a swimmer must have a fast reaction time, significant jumping power, a high take-off velocity and a decrease in drag force to provide efficient starting performance.

Benjanuvatra et al. (2007); West et al. (2011); Breed & Young, (2003) examined the relationship between starting performance and land tests using a different kind of methods with lower body land tests in number of studies. Arellano et al. (2005) paper shows that there are strong positive correlations between the maximal forces found during the dry land tests and the maximal forces measured on wedge plates of the starting block, according that dry land tests can be used as an alternative to pool based tests for measure maximal force. Like in any other sport, the optimal level of power is required in swimming too (Newton, Jones, Kraemer & Wardle, 2002). Some specific requirements in terms of swimmers power, conditioned by the character and duration of dynamic effort in the process of competitive activity, are set up by swimming (Madić, Okičić, Rašović and Okičić, 2011). It cannot be denied that leg extensors muscles have great influence on the efficient start performance. Several studies, using a variety of methods, have already tried to examine the connections between strength and power characteristics of leg extensors muscles with swimming start (Lee et al. 2001; Breed & Young, 2003; Arellano et al. 2005; Croin & Hansen, 2005; Mason et al., 2007; West et al., 2011; Beretić et al. 2013). The authors point that the relationship between starting performance and lower body muscle potential during loaded squat jump hasn't been studied enough.

Therefore, the purpose of this paper was to determine the relations between contractile abilities of the leg extensor muscles during loaded squat jump with starting performance, and to determine whether the level of power and force variables measure with loaded SJ are related to the efficiency of start performance. We hypothesized that the muscle contractile abilities of leg extensors produced during loaded SJ is connected to starting performance. The results obtained in this study show that contractile abilities obtained by performing the simple muscle tests measured on land do relate to swimming start performance and can be used by coaches and swimmers to improve the start performance.

THE METHOD

Study involved 27 sub-elite male swimmers (height = 182.2±5.7 cm, weight = 73.5±7.3 kg, age = 20.1±3.4 yrs), all members of the swimming club „Sveti Nikola" and „Nis2005" from Nis, Serbia. Tested swimmers have experience on national level competitions. The swimmers and parents of swimmers under 18 years gave informed written consent for participation in the study. All methods and procedures of this study were approved by both clubs and Central Serbia Swimming Federation Expert Advising Committee and by the ethical committee of the University of Nis Faculty of Sport and Physical Education, Serbia, and confirmed with the Code of Ethics of the World Medical Association (Declaration of Helsinki). All tests were performed on the same day at fitness center of the SRC ''Čair'' from city of Nis. The tests for contractile abilities were performed in the morning, while the tests for start performance were performed in the afternoon session. Before the battery of tests, the participants performed a standardized warm-up for each test. In the warm-up for SJ test, the athletes preformed 5 minutes of cycling and then completed 2 to 3 series with 6 – 8 repetitions of light squats. Before the swimming start tests participants completed a warm up, based around their competition warm up, which consisted of easy swim, some sprint and dive drills to ensure the athletes were ready to perform at their maximal effort. Swimmers were instructed not to be involved in strenuous exercise for at least 48 hours before the testing and consume their normal pre-training diet before the testing. The testing of contractile abilities was measured with a Myotest performance measuring system, Switzerland (Myotest SA, Sion, Switzerland). The Myotest is instrument with high reliability in testing strength and power, demonstrated by the Comstock et al. 2011. The evaluation of leg extensors was made by the following manual Myotest procedure for SJ. Myotest instrument was placed on the barbell and set to measure 5 attempts of jumps. The athlete place the barbell on shoulders and stand still. At the long beep, bend the knees to 90 degrees, stabilize the barbell and stand still. At short beep, jump up as high as possible without any countermovement while firmly keeping the load on the shoulders. The landing should be as soft and smooth as possible. Return to the standing position, and wait for the next long beep before bending the knees and for the short beep before jumping. After 5 repetitions, the double beep signals the end of the test. After the test, results are automatically displayed on the screen of Myotest instrument. The contractile abilities of knee extensors were represented by predictor variables: average power (Pavg) of three best repetitions in 5 jumps, in watts (W); peak power (Pmax) which

provides information on athletes ability to generate mechanical energy over time in watts (W) and maximal force (Fmax) in newtons (N) which provides information on athletes ability to produce the highest dynamics possible against the system moved during the impulse.

After warm-up in the swimming pool the participants performed two swimming starts. There was a 5 min rest between start attempts. The fastest trial (time on 10m) was analyzed. Normal competitive starting procedures were used for both trials. The participants were instructed to perform a maximal effort dive and maximal swim to the 10 meter mark (t10). Time at 10m is the time span from the starting signal to the moment when the swimmer touches the touchpads at 10m in seconds (0.01 s). The starting block height from the surface of the water was 0.70m. The starting platform was 0.5m × 0.5m, with a 10º slope. The touchpads (Alge Timing - Austria) was set on the 10m mark attached on one side on the lane line and on the other side to the swimming pool lateral edge. The kinematic characteristic of start performance was represented as: (t10) Time at 10m. Basic descriptive parameters were calculated for all the variables: A-Mean, R-range, MAX-maximum score, Min-minimum score, SD-standard deviation. Results distribution symmetry was evaluated based on the values of Skewness (Skew) and results distribution uniformity based on the values of kurtosis (Kurt). For determining the influence of the whole predictor system onto the criteria variables the regression analysis was used and following statistical parameters obtained: multiple correlation coefficient (R), determination coefficient, (R2), F-test result (F), statistical significance (p). For determining the influence of each individual variable in regression analysis we calculated: partial correlation coefficients (Part-R). Correlation coefficients (R), standardized coefficients of partial regression (Beta), t-test results (t) and statistical significance (p). All the statistical operations were performed using software Statistica 6.0 and level of significance was set at $p \leq 0.05$.

RESULTS

Table 1. Results of descriptive statistics

	Mean	Min	Max	Range	Std.Dev.	Skew	Kurt
P_{avg}	2900.37	1500	4250	2750	637.56	0.27	0.13
P_{max}	3067.41	1590	4390	2800	676.07	0.32	0.21
F_{max}	1697.41	1110	2130	1020	228.01	-0.15	0.36
t10	4.23	3.7	4.83	1.13	0.29	0.25	-0.23

Table 2. Inter-correlation matrix of applied variables

	P_{avg}	P_{max}	F_{max}	t10
P_{avg}	1			
P_{max}	**0.99**	1		
F_{max}	**0.90**	**0.89**	1	
t10	**-0.65**	**-0.63**	**-0.52**	1

Table 3. Regression analysis of predictor variables and start performance

R=0.67, **R^2=** 0.45, **F**(6,20)=2.72, **p<0.04**						
	Beta	Std.Err. of Beta	Part-R	R	t(20)	p-level
P_{avg}	1.92	11.48	0.04	-0.64	0.17	0.87
P_{max}	-4.09	11.09	-0.08	-0.63	-0.37	0.72
F_{max}	1.10	2.20	0.11	-0.52	0.50	0.62

Tables 1. show the values of basic parameters of descriptive statistics, then the value of Skewness´s, Kurtosis´s. Table 2. presents the results of inter-correlation matrix of applied variables, and all statistically relevant variables were marked with bold. There is statistically relevant and high correlation among all 3 variables for contractile abilities. The results of inter-correlation matrix showed a statistically significant association between the start efficiency (t10m) and the variables of average power (r = -0.65), peak power (r = -0.63), maximal force (r = -0.52). The negative sign in this case represents a positive correlation considering the fact that these two variables are inversely scaled.

Results of regression analysis in table 3. indicate there is statistically significant influence of the whole system of SJ predictor variables on the start performance (p = 0.04). This is confirmed by high coefficient of multiple correlation (R = 0.67), where the common variance is explained with 45% (R2 = 0.45). If we examine any variable on its own, we can conclude that any of them has no statistically significant influence on t10m. It suggests the need of developing all these force and power variables that are the part of predictor variable set.

DISCUSSION AND CONCLUSION

The results of the research show that explored contractile abilities of the leg extensor muscles during loaded squat jump have statistically significant influence on the swimming start in the time at 10m, for sub-elite swimmers. Any parameter, if excluded from the group, has no statistically significant impact. It just shows how complex and mutual is the impact of lower body's power and force on start performance. According to all this, while working with swimmers, optimal conditions for development of contractile abilities, that may affect start performance in sub-elite swimmers, should be made.

The results are partially consistent with the results of (Benjanuvatra et al., 2007; Beretić et al., 2013; Breed and Young, 2003; Mason et al., 2007; Miyashita et al., 1992; West et al., 2011) which also determine relationship between contractile abilities in relation to different muscle force and power characteristics and start variables. Statistically significant relationship between start time and leg extension peak power was found (r = -0.67, p = 0.01) in study of Miyashita et al. (1992). West et al. (2011) the study aim was to examine the key force and power predictors of start performance on international level British sprint swimmers. The results of that study were significantly connected with lower body peak power (r = - 0.85) and average power values showed relation to 10m start times (r = -0.40, p = 0.04) also. In the study of West et al. (2011), authors proved positive correlation between average power of leg extensor muscles and start performance (r = -0.62). Mason et al. (2007) found that peak power, average power and maximum horizontal propulsive force were the features most closely noticeable in excellent starting ability and those three are linked to efficient start performance.

By doing this study we conclude that coaches and swimmers can use contractile abilities, related to swimming, obtained by performing the simple muscle tests measured on land to improve the start performance. The reason is that it do relate to swimming start performance. What showed significant bound to swimming start times on 10 m were contractile abilities indicators of the leg extensors muscles included in consideration (Pavg, Pmax and Fmax). Swimmers with lower peak and average values were slower than swimmers with higher peak and average power values. According to all this, while working with swimmers, optimal conditions for development of contractile abilities, that may affect start performance in sub-elite swimmers, should be made.

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DIFFERENCES IN EXPLOSIVE POWER IN YOUNG SOCCER PLAYERS OF DIFFERENT RANK

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SUMMARY

Introduction: The purpose of this study is to determine the difference in explosive power between players from the federal level and regional-level, aged 14-16. A general hypothesis H_1 has been defined - there are statistically significant differences in the explosive power between the federal level players and regional-level players aged 14 to 16, and three partial: $H_{1.1}$ - there are statistically significant differences in explosive force such as jumping ability between the players of federal and the regional-level players aged 14 to 16; $H_{1.2}$ - there are statistically significant differences in explosive force such as throwing, between the federal and regional-level players aged 14 to 16; $H_{1.3}$ - there are statistically significant differences in explosive sprint power between the federal and regional-level players aged 14 to 16.

Methods: The sample of examinees consisted of 20 players from the football club "Radnički" from Niš, which compete in the federal range, and 20 players from the football club "Železničar" from Niš, who compete in the Serbian regional rank. The sample of variables consisted of the following patterns of motor variables: long jump - MSDM, triple jump - MTRS, five times jump - MPTS, 10 times jump - MDTS, medicine balls throw while lying - MBML, medicine ball sit-up throw - MBMS, medicine ball chest throw - MBMNG, sprint 20 meters - M20L. Data were analyzed by statistical methods to determine the central and dispersion parameters, variables, whereas t-test for small independent samples was applied in order to determine the differences between players.

Results: There is a statistically significant difference between young soccer players in the following variables: MSDM - jump out of spot, MBML - throwing medicine balls while lying, MBMS - throwing a medicine from gray, MBMNG - throwing a medicine ball above your chest.

Conclusion: It is possible to assume that the attention hasn't been paid enough to the development of the explosive power in athletes of regional rank. After processing the obtained data it can be concluded that the federal level coaches pay more attention to developing explosive power than coaches in regional ranking. Based on these results it is necessary to create special programs that will influence on the further development of explosive strength in football players.

Keywords: football, explosive power, federal league, regional rank

INTRODUCTION

Football is an anaerobic-aerobic sport with alternating phases of high loads such as sprints, quick change of direction, jumping, sudden stops. Football is characterized by a continuous course of activities with intermittent intensity of a game and a very low success ratio (the number of achieved goals) according to a possession of a ball (Reilly, Clarys, & Stibbe, 1993). Explosive power is defined as the ability of maximum rate of force development in one move for as short as possible period of time. This factor is reflected in all movements in which the whole body, its parts, or loads extend their movement due to the received impulse or initial acceleration (Malacko, 1991). Explosive power is manifested in the activities such as: throwing, jumps, kicks and sprint. Sprint, being a form of movement, is regarded by some authors as associated with the factor of speed power. Soccer is one of the most widely played and complex sports in the world, where players need technical, tactical, and physical skills to succeed (Joksimović, Stanković, Ilić, Joksimović, & Jerkan, 2009). Today's top soccer requires strong endurance players with good motor skills and sense of improvisation and collective performance. Creating top football players is a long-term process which includes identification,

development and selection of the talents (Reilly, Williams, Nevill, & Franks, 2000). Because of that, the identification and development of young football players have become very important for the majority of the top-level teams (Williams & Reilly, 2000). Researches in the field of explosive power of football players are numerous both in the world and in our country (Gil, S., Gil, J., Irazusta, Ruiz, & Irazusta, 2005; Joksimović, 2005; Kymahugotis, Dulgeridis, & Panajotis, 2005; Krsmanović & Krulanović, 2007).

METHODS

Sample of examinees

The sample of examinees consisted of 20 players from the football club "Radnički" from Niš, which compete in the federal range, and 20 players from the football club "Železničar" from Niš, who compete in the Serbian regional rank. During testing, all players were in the training process with three sessions per week. All players have undergone a health examination, after which those who could not be included in the experimental program were eliminated.

Sample of measuring instruments

The sample of variables consisted of the following patterns of motor variables: long jump - MSDM, triple jump - MTRS, five times jump - MPTS, 10 times jump - MDTS, medicine balls throw while lying - MBML, medicine ball sit-up throw - MBMS, medicine ball chest throw - MBMNG, sprint 20 meters - M20L. Sample of measuring means were: leather mat two meter long and 7-10 cm thick, thin rubber mat with rough surface whose length is 25 meters, steel tape measurement with an accuracy of 0.1 cm, a medicine ball weighing three kilograms, a chair with a backrest and electronic stopwatch JUNSD JS- 320 with an accuracy of 0.01 seconds.

Statistical procedures

All results have been analyzed in the statistical program Statistica 19.0. For all variables basic parameters of descriptive statistics were calculated: Range (R), the minimum score (MIN), maximum score (MAX), mean (M), standard error (Er), standard deviation (SD), skewness (Skew) and kurtosis (Kurt). To determine a statistically significant differences between the groups for each variable, *t*-test was used, and significance was set up to 0.05 ($p \leq 0.05$).

RESULTS

Table 1. Descriptive statistics of the regional ranking players aged 14 to 16

	R	MIN	MAX	AS	Er	SD	Skew	Kurt
MSDM	0.75	1.70	2.45	2.025	1.015	0.179	0.659	0.632
MTRS	1.90	5.30	7.20	6.035	0.213	0.412	0.861	1.580
MPTS	3.50	9.10	12.60	10.565	0.173	0.774	0.650	1.539
MDTS	5.60	19.40	25.00	21.940	0.336	1.506	0.500	-0.214
MBML	3.00	4.10	7.10	5.635	0.188	0.840	0.053	-0.173
MBMS	2.00	3.50	5.50	4.685	0.112	0.500	-0.508	0.127
MBMNG	2.60	5.00	7.60	6.172	0.157	0.702	0.057	-0.390
M20S	0.50	3.40	3.90	3.655	0.118	0.139	0.145	-0.648

Table 2. Descriptive statistics of the federal level players aged 14 to 16

	R	MIN	MAX	AS	Er	SD	Skew	Kurt
MSDM	0.66	1.84	2.50	2.158	0.116	0.184	-0.132	-0.467
MTRS	2.05	5.10	7.15	6.089	0.122	0.546	-0.019	-0.114
MPTS	2.90	9.70	12.60	11.011	0.164	0.734	0.460	0.314
MDTS	5.00	20.40	25.40	22.747	0.312	1.398	0.701	-0.165
MBML	3.52	4.60	8.12	6.306	0.196	0.877	0.478	0.333
MBMS	1.60	4.20	5.80	5.210	0.116	0.407	-0.665	0.476
MBMNG	3.00	5.50	8.50	7.030	0.166	0.744	-0.083	-0.198
M20S	0.50	3.40	3.90	3.695	0.945	0.131	-0.667	-0.289

In Tables 1 and 2 are given descriptive parameters for regional players and the federal players. Viewing of the results presented in both tables can be ascertain that the value of basic, central and dispersion parameters at intervals of minimum and maximum results, do not contain five or more standard deviations none of the variables, based on which it can ascertain their sensitivity.

Table 3. Significance of differences between groups in explosive force - type vertical jump

Var	Group	AS	SD	t	p
MSDM	REG.	2.025	0.179	-2.32	0.026
	FED.	2.158	0.184		
MTRS	REG.	6.035	0.412	-0.356	0.724
	FED.	6.089	0.546		
MPTS	REG.	10.565	0.774	-1.873	0.069
	FED.	11.011	0.734		
MDTS	REG.	21.940	1.506	-1.757	0.087
	FED.	22.747	1.398		

Table 4. Significance of differences between groups in explosive force - the type throws and sprint

Var	Group	AS	SD	t	p
MBML	REG.	5.635	0.840	-2.469	0.018
	FED.	6.306	0.877		
MBMS	REG.	4.685	0.500	-3.636	0.001
	FED.	5.210	0.407		
MBMNG	REG.	6.172	0.702	-3.748	0.001
	FED.	7.030	0.744		
M20S	REG.	3.655	0.139	-0.933	0.357
	FED.	3.695	0.131		

The results of *t*-test in Tables 3 and 4 showed that there is a statistically significant difference between the players of regional and federal rank aged 14 to 16 in the following variables: long jump-MSDM (.026), medicine ball throw while lying-MBML (.018), medicine ball sit-up throw- MBMS (.001), and medicine ball chest throw- MBMNG (.001).

DISCUSION

Present study was conducted in order to analyze the explosive power of young football players of different rank. After the data, concerning the significance of differences in explosive force, being processed and analyzed, we may conclude that there is a statistical significance between the player's of federal compared to regional rank players in the following variables: MSDM – long jump, MBMS - medicine ball sit-up throw, MBML – medicine ball throw while lying, and MBMNG - medicine ball chest throw, in favor of the senior players. For other motor area variables of explosive power, there aren't any statistically significant differences. Based on the obtained parameters it can be determined that football players of regional competition rank are weaker in some types of explosive force, mainly in the types that are not highly genetically determined, compared to their peers from the federal rank. Furthermore, it leads us to a conclusion that federal rank coaches work more with the players so as to develop explosive throwing strength type, i.e. they pay more attention to the development of the upper extremity compared to coaches of regional rank competitions. The very same conclusions were obtained by Gill et al. (2005), Joksimović (2005), Kymahugotis et al. (2005), Strudwick, Reilly, & Doran (2002). It seems that it doesn't matter that the subjects are in a period of intense growth and development, however what seems to matter is harder training, as analyzed variables show. In other words, players who have undergone a harder training have better explosive force results.

CONCLUSION

Results obtained by descriptive analysis of the motor area have shown that there is a statistically significant difference between the players of federal rank compared to players of regional rank competition aged 14 to 16. This difference is defined by much better results in motor tests in favor of the players from the federal rank competitions. On this basis hypothesis H_1 is partially confirmed, which states: There is statistically significant difference in explosive power between the federal and regional-level players aged 14 to 16. Results of explosive power-type vertical jump are statistically significant for variable MSDM- long jump, whereas the following variables don't show any statistical significance: MTRS- triple jump, MPTS- five times jump, MDTS- ten times jump. This partly confirms the hypothesis $H_{1.1}$ which states: There are statistically significant differences in explosive force-type vertical jump between the federal and regional-level players aged 14 to 16. Results of explosive power such as throwing are statistically significant for all variables of the motor area, which therefore fully confirms the hypothesis $H_{1.2}$ which states: there are statistically significant differences in the type of explosive throwing force between the federal and regional-level players aged 14 to 16. Results of explosive sprint power don't show any statistically significant difference in variable M20S - sprint 20 meters, which completely rejects the hypothesis $H_{1.3}$ which states: there are statistically significant differences in the type of explosive sprint power between the federal and regional-level players aged 14 to 16. The obtained results should represent the important information for the coaches when it comes to the selection of players, but not as the only one determining factor. In general, this research suggests the need for further investigations of this issue given, its importance to the development and promotion of sport practice which has repeatedly confirmed.

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INTER-POSITIONAL DIFFERENCES IN SOMATOTYPE AMONG YOUNG SOCCER PLAYERS

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SUMMARY

Introduction: The aim of this study was to determine if there were significant differences in somatotype components among young soccer players according to player position.

Methods: The study was carried out on a sample of 147 young Croatian soccer players, of mean chronological age of 14.25 years, mean body height of 167.92 cm and body mass of 56.65 kg.

The participants were divided into 4 groups according to player position: *goalkeepers*, *defenders*, *midfielders* and *forwards*. According to age category, young soccer players were divided into 3 groups: *young pioneers (U-13)*, *pioneers (U-15)* and *cadets (U-17).*

Ten measures of anthropometric characteristics were used based on which the *Body Mass Index* and *Somatotype* according to the Heath-Carter method were then calculated. By univariate analysis of variance (ANOVA) the differences between somatotypes, morphological characteristics and Body mass indices according to player positions in different age categories of young soccer players were calculated.Data analysis was done by *Somatotype 1.2.5.* and *Statistica Ver.11.00*. computer programmes.

Results: The obtained results show that in these age categories there were no significant differences in somatotype according to the criterion of player role. Also, there were significant differences in *body height* and *body mass* variables between the *goalkeeper* position and other positions, as well as in the *elbow diameter* variable.

Conclusion: The set hypothesis about the lack of significant differences in somatotype between player positions among young soccer players is fully accepted.

In future studies it would be desirable to expand the sample by including soccer players from other Croatian regions and to divide young players according to the criterion of efficacy. In this way correlation between body build and situational efficacy of young soccer players at competitions could be determined.

Keywords: anthropometry, body build, BMI, soccer, ANOVA.

INTRODUCTION

Today, soccer is considered one of the most developed, most visited and most popular sports games in the world. From a simple and attractive game soccer has become “the most important secondary thing in the world” in a very short time period. Soccer is played on almost every court surface (grass, clay, asphalt, concrete, parquet, sand), open or closed (Dujmović, 2000).

To achieve top results in sport, one must be familiar with scientific knowledge about the characteristics of the sport and the influence of certain factors on success in that sport. Scientific approach includes systematic and successive monitoring and testing of athlete’s overall anthropological status through all stages of his sports career. The most frequently tested components of anthropological status are athlete’s motor-functional abilities and morphological characteristics. This is due to the fact that measuring instruments for assessing those characteristics have satisfactory metric characteristics, so the obtained results are exact and interpretable, and are of great importance for success in almost every sport (Krstulović, 2006).

Somatotype is a convenient shorthand descriptor of overall physique in terms of body shape and composition independent of body size. Somatotyping is one of the most frequently used techniques for analysing body build. Because of its uniqueness, somatotyping has been used to study many aspects

of exercise, sports sciences and human biology, which may be important in identifying talented young athletes for particular sports (Carter, Ackland, Kerr and Stapff, 2005).

The application of new Somatotype Ver.1.2.5. software package according to Carter & Goulding (2010) has caused investigations on somatotype of different athletes and populations to evoke greater interest and become more attractive to many scientists because the programme uses certain age and gender coefficients in addition to basic morphological measures necessary for somatotype calculation (Milić, Grgantov and Katić, 2012).

Results of previous studies (Janssens, Renterghem and Vrijens, 2002; Matković et al. 2003; Gil, J. Gil, Ruiz, Irazusta, and Irazusta, 2010; Lago-Penas, Casais, Dellal, Rey, and Dominguez, 2011; Polat et al., 2011; Russell and Tooley, 2011) show that goalkeepers are generally the tallest and have the highest body mass value, skinfold values and body fat percentage. Wide midfielders were the shortest and had the lowest body mass. In soccer players mostly the mesomorphic type of somatotype has been established, and in relation to the general population, the soccer players are taller and have greater body mass. The basic problem of investigating inter-positional differences is including a larger number of participants because of the division into 3-5 smaller subsamples according to player positions, which would represent a homogenous sample.

The main aim of this study was to determine if there were significant differences in somatotype components among young soccer players according to player position.

METHODS

Sample of examinees

The study was carried out on a sample of 147 young Croatian soccer players of mean chronological age (MCA) of 14.25 years, mean body height of 167.92 cm and body mass of 56.65 kg.

The participants were divided into 4 groups according to player position: goalkeepers (N=14), defenders (N=46), midfielders (N=44) and forwards (N=43).

According to age category, young soccer players were divided into 3 groups: U-13 - young pioneers (N=51, MCA=12,32 years), U-15 - pioneers (N=52, MCA=14,30 years) and U-17 - cadets (N=44, MCA=16,30 years).

Sample of measuring instruments

Ten anthropometric characteristics were measured: body height, body mass, triceps skinfold, back skinfold, abdominal skinfold, calf skinfold, upper arm circumference flexed, calf circumference, elbow diameter and knee diameter. From these characteristics, the following values were then calculated: *Body mass index* (BMI) by dividing body mass (kg) and body height squared (m^2), and *somatotype* according to the Heath-Carter method (Carter & Goulding, 2010). The measurements were made according to the ISAK protocol (Stewart, 2011) on the dominant side of the body, as was originally suggested by the original description of using the Heath-Carter method of somatotype calculation (Heath and Carter, 1967; Carter and Heath, 1990).

The measurements were taken twice, and mean value was taken as the final result.

The exception was made in case of possible great variability in skinfolds and the necessity of taking a third measurement.

Statistical procedures

Methods of data analysis included calculation of descriptive statistical indicators of ten morphological measures: mean (M) and standard deviation (SD).

By univariate analysis of variance (ANOVA) it was determined if there were significant differences between somatotypes, morphological characteristics and Body mass index according to player position in different age categories among young soccer players.

Data analysis was done by *Somatotype 1.2.5.* and *Statistica Ver.11.00.* computer programmes.

RESULTS

The results of one-way analysis of variance (ANOVA) of morphological characteristics, *Body mass indices* and *somatotype components* (*endomorphic*, *mesomorphic* and *ectomorphic*

component) according to player position among young pioneers (N=51) are presented in Table 1.

Table 1 Differences of morphological characteristics, *Body mass indices* and *somatotypes* according to player position among U-13 (N=51)

	Goalkeepers (N=4)		Defenders (N=17)		Midfielder (N=19)		Forwards (N=11)		
Variables	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**	**F**
Body height	165.80	5.32	154.14	7.95	150.87	7.02	151.40	6.38	5.17*
Body mass	50.88	5.02	45.72	7.43	41.00	6.68	40.70	5.44	3.83*
Upper arm circumference flexed	25.25	1.29	24.07	2.82	22.75	2.28	22.80	1.17	2.19
Calf circumference	27.66	10.83	32.15	3.06	29.88	4.03	30.84	2.09	1.60
Elbow diameter	6.14	0.21	5.91	0.50	5.82	0.43	5.90	0.35	0.61
Knee diameter	9.53	0.17	9.13	0.46	8.96	0.57	8.82	0.38	2.43
Triceps skinfold	10.68	4.47	10.97	4.67	9.71	3.61	8.86	1.85	0.78
Back skinfold	7.90	4.04	8.00	3.38	7.73	3.69	6.00	0.84	0.99
Abdominal skinfold	9.85	5.80	8.06	3.78	6.44	3.38	5.69	1.62	2.11
Calf skinfold	12.75	3.91	12.77	4.65	10.88	4.54	9.40	2.43	1.68
Body mass index	18.43	2.06	19.09	2.07	17.94	2.04	17.64	1.30	1.63
Endomorphic component	2.90	1.54	2.95	1.22	2.66	1.19	2.26	0.44	0.91
Mesomorphic component	3.53	0.81	4.16	1.16	3.94	0.88	3.96	0.49	0.55
Ectomorphic component	4.23	1.30	3.08	1.18	3.54	1.01	3.69	0.81	1.64

LEGEND: mean (**M**), standard deviation (**SD**), coefficient of F-test (**F**), significant difference at the level of p≤0.05 (*****)

By analysing the results from Table 1 it can be noticed that the goalkeepers in the U-13 category had significantly the highest values of body height and body mass, and the midfielders were the shortest, whereas the forwards had the lowest body mass. The defenders had the highest and the forwards had the lowest values of BMI.

Mean values of somatotype components showed no significant differences between player positions among U-13 and indicate that the goalkeepers fit the mesomorphic ectomorph somatotype category, whereas all other player positions displayed mean somatotype of ectomorphic mesomorph.

The results of one-way analysis of variance (ANOVA) of morphological characteristics, *Body mass indices* and *somatotype components* (*endomorphic, mesomorphic* and *ectomorphic component*) according to player position among U-15 (N=52) are presented in Table 2.

By analysing the results from Table 2 it can be seen that the goalkeepers in the U-15 category had significantly the highest values of body height and body mass, whereas the forwards were the shortest and had the lowest body mass. The forwards also had the lowest values of BMI, whereas the goalkeepers and the defenders had the highest values of BMI.

Mean values of somatotype components showed no significant differences between player positions in the U-15 category and indicate that the goalkeepers fit the ectomorphic mesomorph somatotype category, the midfielders fit the ectomorph-mesomorph category, whereas the defenders and the forwards displayed mean somatotype of mesomorph-ectomorph.

The results of one-way analysis of variance (ANOVA) of morphological characteristics, *Body mass indices* and *somatotype components* (*endomorphic*, *mesomorphic* and *ectomorphic component*) according to player position among cadets (N=44) are presented in Table 3.

Table 2 Differences of morphological characteristics, Body mass indices and somatotypes according to player position among U-15 (N=52)

	Goalkeepers (N=4)		Defenders (N=16)		Midfielders (N=11)		Forwards (N=21)		
Variables	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**	**F**
Body height	176.47	8.01	169.43	8.80	169.21	7.08	168.65	9.91	2.67*
Body mass	64.03	8.66	59.13	11.48	56.09	7.33	55.82	10.53	2.27*
Upper arm circumference flexed	27.08	2.06	27.75	3.50	26.29	2.03	26.39	2.58	0.92
Calf circumference	34.78	3.08	35.83	3.01	34.74	2.20	33.93	2.69	1.46
Elbow diameter	6.46	0.38	6.74	0.57	6.58	0.33	6.52	0.47	0.79
Knee diameter	9.74	0.44	9.81	0.56	9.52	0.29	9.54	0.51	1.24
Triceps skinfold	10.49	4.74	10.09	4.57	9.01	1.72	8.73	2.09	0.75
Back skinfold	8.63	3.09	8.45	2.50	7.46	1.36	7.12	1.57	1.69
Abdominal skinfold	7.35	1.27	7.85	3.13	6.49	1.66	6.92	2.44	0.75
Calf skinfold	11.45	3.72	11.31	4.40	10.09	3.08	9.98	3.75	0.49
Body mass index	20.43	1.20	20.42	2.73	19.50	2.02	19.43	1.96	0.79
Endomorphic component	2.68	1.04	2.52	1.00	2.29	0.49	2.25	0.51	0.68
Mesomorphic component	4.00	0.51	3.69	1.16	3.91	1.03	3.83	0.82	0.17
Ectomorphic component	3.33	0.33	3.87	1.17	3.85	1.21	3.86	0.83	0.35

LEGEND: mean (**M**), standard deviation (**SD**), coefficient of F-test (**F**), significant difference at the level of p≤0.05 (*****)

Table 3 Differences of morphological characteristics, Body mass indices and somatotypes according to player position among U-17 (N=44)

	Goalkeepers (N=6)		Defenders (N=14)		Midfielders (N=14)		Forwards (N=10)		
Variables	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**	**F**
Body height	185.13	5.69	181.24	5.13	181.07	4.36	176.48	6.61	3.51*
Body mass	75.75	8.99	68.96	5.17	68.13	9.14	67.50	5.12	1.95
Upper arm circumference flexed	31.41	2.86	29.78	1.87	29.33	2.26	29.08	1.02	1.92
Calf circumference	38.41	2.23	36.29	1.03	36.60	1.90	36.51	1.66	2.46
Elbow diameter	7.28	0.37	6.81	0.31	6.94	0.29	6.70	0.19	5.49*
Knee diameter	10.13	0.27	9.79	0.42	9.71	0.54	9.82	0.42	1.21
Triceps skinfold	8.98	2.79	8.76	2.16	9.04	4.97	9.95	3.43	0.22
Back skinfold	8.79	1.83	8.99	1.36	9.08	3.44	9.28	1.57	0.06
Abdominal skinfold	8.21	2.22	6.97	1.94	8.52	6.16	9.08	4.31	0.54
Calf skinfold	10.47	2.69	8.42	2.19	10.02	4.26	9.74	2.93	0.85
Body mass index	22.13	2.53	20.96	1.21	20.70	2.11	21.68	0.87	1.36
Endomorphic component	2.37	0.68	2.31	0.44	2.42	1.28	2.73	0.88	0.45
Mesomorphic component	4.33	1.44	3.62	0.78	3.64	0.76	4.05	0.69	1.39
Ectomorphic component	3.52	1.31	3.79	0.76	3.95	0.90	3.15	0.64	1.81

LEGEND: mean (**M**), standard deviation (**SD**), coefficient of F-test (**F**), significant difference at the level of p≤0.05 (*****).

By analysing the results from Table 3 it can be seen that the goalkeepers in the U-17 category had significantly the highest values of body height and elbow diameter. Values of body mass and knee diameter were also the highest among the goalkeepers, but with no significant inter-positional difference. The forwards were the shortest and had the lowest body mass in this category as well. The midfielders had the lowest values of BMI, whereas the goalkeepers showed the highest values.

Mean values of somatotype components showed no significant differences between player positions

in the U-17 category and indicate that the goalkeepers and the forwards fit the ectomorphic mesomorph somatotype category, whereas players in other positions, the defenders and the midfielders, fit the mesomorph-ectomorph mean somatotype.

Frequencies and relative values of somatotype categories according to age groups are presented in table 4.

Table 4 Frequency and percentage of somatotype categories among young soccer players (N=147)

	U-13 (N=51)		U-15 (N=52)		U-17 (N=44)	
Somatotype category	N	%	N	%	N	%
Endomorph- ectomorph	3	5.88	-	-	1	2.27
Balanced endomorph	1	1.96	-	-	-	-
Mesomorphic endomorph	8	15.69	4	7.69	3	6.82
Mesomorph - endomorph	5	9.80	5	9.62	3	6.82
Endomorphic mesomorph	5	9.80	5	9.62	9	20.45
Balanced mesomorph	3	5.88	4	7.69	6	13.64
Ectomorphic mesomorph	11	21.57	15	28.85	11	25.00
Mesomorphic ectomorph	10	19.61	16	30.77	6	13.64
Balanced ectomorph	-	-	1	1.92	1	2.27
Central	5	9.80	2	3.85	4	9.09

LEGEND: frequency of participants (**N**), relative values (**%**).

In the U-13 category, out of the 13 somatotype categories, 9 categories were recorded. The majority of young soccer players in this age group fit the ectomorphic mesomorph and mesomorphic ectomorph somatotype category with the overall percentage of 42%. At the same time, 16% of U-13 fit the mesomorphic endomorph category.

In the U-15 category, there were 8 different somatotype categories, only two of which, the mesomorphic ectomorph and the ectomorphic mesomorph, exceeded 59% or the total of 31 participants.

U-17 also defined 9 somatotype categories. The ectomorphic mesomorph had the highest percentage as it included 11 participants or 25%, followed by the endomorphic mesomorph with 20.54% or 9 young soccer players. The balanced mesomorph and the mesomorphic ectomorph categories fit around 27% of the total percentage in the age group of cadets.

The somatoplot of the overall sample of young soccer players (N=147) is presented in Figure 1.

DISCUSSION

The main aim of the study was to determine if there were significant differences in somatotype components among young soccer players according to player position. The study showed that there were no significant differences between young soccer players at different player positions, which is congruent with previous findings (Janssens et al.,2002; Sporiš, Čanaki and Barišić, 2007; Russell and Tooley, 2011; Salgado et al.,2009; Rogan, Hilfiker, Clarys, Clijsen and Taeymansa, 2011; Cossio-Bollanoso, Portella, Hespanhol, Fraserr and de Arruda, 2012; Orahn, Sagir and Zorba, 2013).

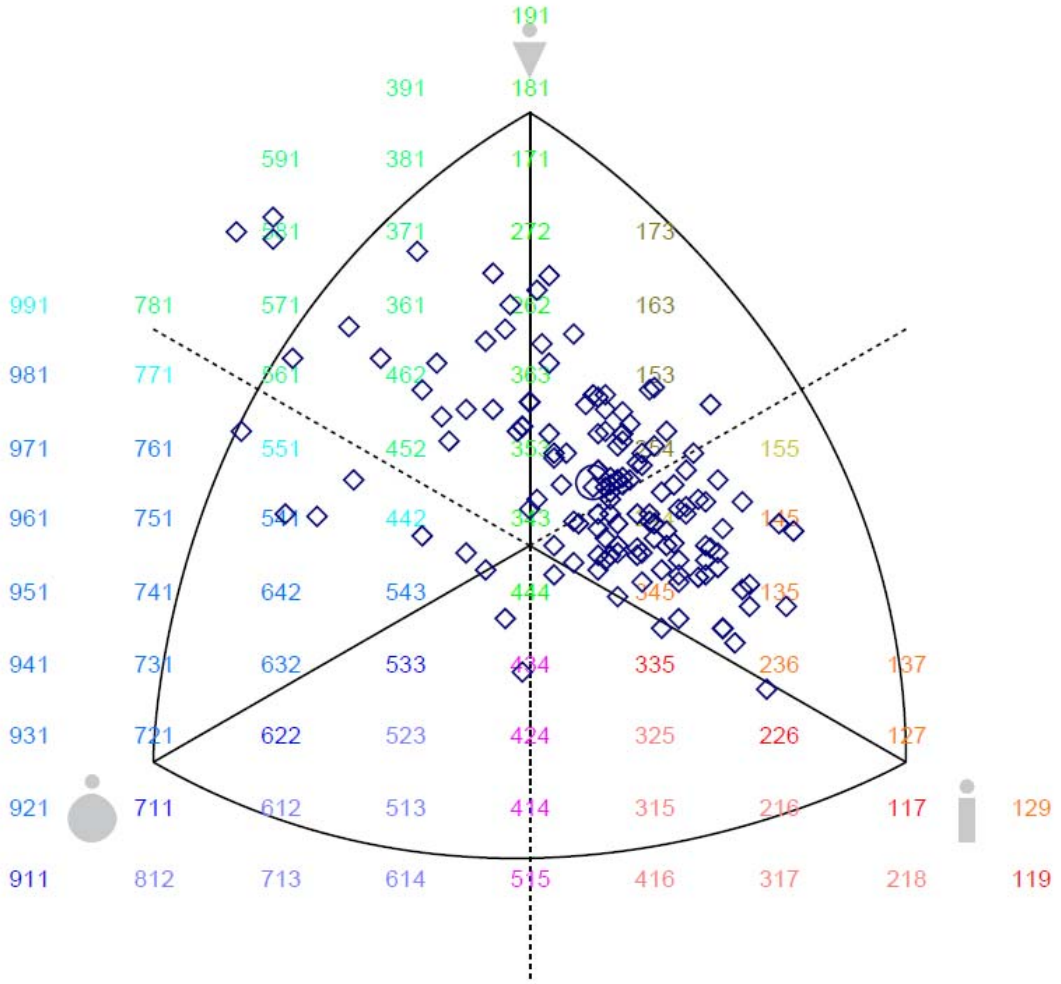

Figure 1 Somatoplot of the overall sample of young soccer players (N=147)

The soccer players that were measured were averagely 3 cm shorter and had 6.5 kg lower body mass than the participants in a study carried out by Russel and Tooley (2011) in which 43 young soccer players of mean age of 15±2 years were tested. Given that the participants in the current study were somewhat chronologically younger, these differences were expected. The same conclusion can be drawn by comparing the current study with a study carried out by Polat et al. (2011) in which soccer player at the age of 16 had mean body height of 174.38 cm and body mass of 57 kg. The mean values of somatotype components indicate that all age groups fit the ectomorph-mesomorph somatotype category (U-13 2.69-3.99-3.47; U-15 2.37-3.82-3.82; U-17 2.45-3.82-3.66), whereas in a study carried out by Gil et al. (2010) on soccer players of mean age of 16.48±2.63 years, the mesomorph component was prevalent in all age groups, with the exception of fourteen-year-olds who were mostly ectomorphic.

Dominance of two somatotype categories, balanced mesomorph and ectomorphic type, was determined in a study carried out by Martirovsov, Skomorokhov, Farmochi and Varga (1987) on 254 young soccer players. In a study carried out by Salgada et al. (2009), dominance of the mesomorphic component was also determined among young soccer players aged 17 to 18 years.

In studies among senior soccer players (Janssens et al., 2002; Castanhede, Filho and Dantas, 2003; Hazir, 2010; Orahn et al., 2013), the results indicated dominance of the mesomorphic component, with the emphasised somatotype component of balanced mesomorph.

All the aforementioned studies that were carried out on young soccer players and senior soccer

players indicated the prevalence of the mesomorphic component, whereas in the current study, besides the mesomorphic component, the ectomorphic component stood out as well. It can be assumed that the reason for this was the participants' younger chronological age in the current study. Namely, a study carried out by Nikolaidis and Vassilios Karydis (2011), investigating body composition of young soccer players through adolescence (from 12.01 to 20.98 years), showed that somatotype components change during adolescence so that the endomorphic and ectomorphic component are decreased, while the mesomorphic component is increased.

Significant differences in morphological characteristics, body mass index and somatotype according to player position among U-13 and U-15 were found only in morphological variables of body height (p=0.00; p=0.05) and body mass (p=0.02; p=0.05). Among U-17, significant difference was found only in the body height variable (p=0.02) and the elbow diameter variable (p=0.00). Among U-13 and U-15, the goalkeepers were significantly different from the other three positions by being taller and having higher body mass. Among U-17, the goalkeepers were also taller and significantly different from the other three positions in the elbow diameter variable. The results of previous studies on young soccer players (Gil, S. M., Gil, J., Ruiz, Irazusta, A. and Irazusta, J., 2007; Lago-Penas et al., 2011) are congruent with those results. In studies carried out among senior soccer players, it was also determined that goalkeepers were significantly taller and had higher body mass than their teammates playing other positions (Bloomfield, Polman, Butterly and O'Donoghue, 2005; Hazir, 2010).

Therefore, it can be concluded that many young soccer players were selected for the goalkeeper position at the very beginning of their training because of their dominant height in comparison to their teammates.

CONCLUSION

The set hypothesis about the lack of significant differences in somatotype between player positions among young soccer players is fully accepted. In future studies it would be desirable to expand the sample by including soccer players from other Croatian regions and to divide young players according to the criterion of efficacy. In this way correlation between body build and situational efficacy of young soccer players at competitions could be determined.

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DIFFERENCES BETWEEN SUCCESSFUL AND UNSUCCESSFUL TEAMS IN INDICATORS OF SITUATIONAL EFFICIENCY IN BASKETBALL - CASE OF ELITE CLUBS

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SUMMARY

Introduction: The aim of this study was to analyze differences in the parameters of situational efficiency of two clubs that were by results most successful in the Croatian basketball league at the end of the season 2012/2013. The hypothesis of this research is to identify variables that discriminate winning matches from the defeated ones.

Methods: The sample consisted of 8 matches between basketball clubs „Zadar“ and Cibona“ played in the regional ABA league, the Krešimir Ćosić cup, Croatian championship and playoff. Used variables are 13 standard indicators of situational efficiency in basketball. Parameters of descriptive statistics were calculated for an overall sample, and also for groups of winner teams and hence the defeated teams. By using T-test for independent samples, for each of the 13 parameters of situational efficiency, the existence of significant differences between winning and defeated teams has been examined.

Results: Results indicate that variables *Points made, Offensive rebounds, Three point shots total, Free throws total* and *Fouls made* statistically significant differ winning teams from defeated ones ($p<0,05$)

Conclusion: Obtained results show that, from the viewpoint of basketball expertise, indicators of situational efficiency are only a partial indicator of efficiency of an individual or a team that emphasizes further importance of an expert basketball experience, knowledge and understanding in their interpretation, with the aim of acquiring relevant information of overall efficiency of all participants of the game. Surely, the research is limited due to a relatively small number of matches. In future researches dealing with similar issues, the sample should certainly be increased, and nonstandard indicators of situational efficiency should be used.

Key words: team efficiency, situational efficiency, basketball expertise

INTRODUCTION

Outstanding achievements in basketball in general are a result of continuous scientific research and mostly thorough professional work those cognitions have been integrated. Therefore, the research of the effect of standard indicators of situational efficiency on a total result in a basketball game no longer belongs only to the scientific area, but to a professional area too, and furthermore, it is a practical link between the two areas (Trninić, 2006). Detailed analysis of obtained data along with the results of conducted researches, surely provide coaches with information that can direct and form the preparation, as well as the training process. It is important to point out that a large amount of works has been published, based on the analysis of standard indicators of situational efficiency conducted with different statistical methods and with different research goals.

Structure of a basketball game is not easily described with one or more sentences. For direct participants, the game goes beyond the mere kinesiological definition, and seen from their point of view, it takes on a different or, that is to say, more concrete dimension. For a coach, the game consists of a number of tasks that players of different positions must execute in order to create defensive

and offensive advantage (Trninić, 2006). Coach, besides the knowledge how to use skills, qualities and knowledge of a player in a tactical part of the game and how to consolidate them within a team, must also know how to compensate the deficiencies, concerning both the team and an individual. On the other hand, for players, the game is consisted of a number of defensive and offensive situations in which their own set of skills can be demonstrated with the aim of outplaying the opponent with the tendency of a rational energy consumption (Trninić, Dizdar & Dežman, 2002). The above mentioned skills, qualities and knowledge raise the question of the equation of specification in basketball. Equation of specification is an often subject of discussion and it is relative in a complex motorical activity that is realized within the dynamic conditions of the game (Trninić, Jelaska & Papić 2009). Quality game performance is highly related to almost every dimension of an anthropological status. Besides an optimal health state and appropriate morphological features, the game demands a high level of functional and certain motor skills. Some experts emphasized conative traits (strong character, motivation,...) are very desirable, also some cognitive abilities (perception, anticipation,...) make a difference between the players and it is an additional quality for players of similar characteristics and skills. The ratio of importance of mentioned dimensions within the equation specification opens up space for further scientifically based discussions (Bartlett, 2006; Jelaska, 2011). Certainly, the structure of a basketball game with its demands opens up a enough large space for participants of various anthropological statuses, which is probably one of the reasons for the attractiveness of this sport.

Of great significance is also the research, that was conducted on a sample of 870 matches during 6 LEB1 seasons (Spanish basketball league) with the aim of establishing which statistical indicators differ seasonally successful and unsuccessful teams (Ibanez, Sampaio et al., 2008). Using the discriminant analysis, the obtained results indicate on a great number of differences between statistical indicators of the best and the worst teams on the end of the season, with an emphasis on the passings, rebounds and blocks. The mentioned example of the research is a part of a great amount of related works that offer a different view on a basketball game, aswell as open up new spaces for further researches.

Previous studies, along with the future ones, do not prove but rather educate, direct and undertake the additional step to the improvement of basketball and a basketball game. methods

Sample of examinees

In accordance with the resarch goal, 8 games played between basketball clubs „Zadar“ and „Cibona“ in the season of 2012/13 were used. The games were played according to the seqeunce: two in the regional ABA league, one in the Krešimir Ćosić cup semifinale, two in the Champions League of the Croatian championship and three in the Croatian championship playoff finale. Games were observed from the aspect winner – defeated. Both teams had result oscillations during the season and weren't the best ranked Croatian club in the end of the regional league, but the two have played the most matches among themselves, accomplished the best position for the Champions League and played the finals of the championship. The matches were observed in terms of differentiating the winners from the defeated.

Sample of variables

The variables used in this resarch are 13 standard indicators of situational efficiency in basketball: 2PT SUC – two point shots successful; 2PT TOT – two point shots total; 3PT SUC – three point shots successful; 3PT TOT – three point shots total; FT SUC – free throws made; FT TOT – free throws total; DEF REB – defensive rebounds; OF REB – offensive rebounds; ASSIS – assists; STL – steals; TO – turnovers; BL – shot blocks; and FTS – fouls made. The PM – points made variable was also used. Data was taken from the official ABA league site (www.abaliga.com) and the official Croatian basketball association site (www.hks-cbf.hr). Results presented in the tables, aswell as the discussion we written on behalf of this insight in the indicators of situational efficiency, and without any further visual analysis of the matches.

Data processing methods

For both teams, regardless of the match results, parameters of descriptive statistics were calculated: artithmetic mean, median, minimum score, maximum score, standard deviation, coefficient of skewness, coefficient of kurtosis and significance

while testing the normality using Kolmorgov-Smirnov test. Same parameters of descriptive statistics were calculated for groups of both winners and defeated teams as well. T-test for independent samples, for each of 13 parameters of situational efficiency, existence of statistically significant differences for the winners and defeated teams were examined.

RESULTS

In table 1, results of descriptive statistics for all observed matches are found. Indicators of descriptive statistics were calculated: arithmetic mean, median, minimum score, maximum score, standard deviation, coefficient of skewness, coefficient of kurtosis and significance while testing the normality by using Kolmorgov-Smirnov test

Table 1: Results of descriptive statisctic for all matches (AS – arithmetic mean, MED – median, MIN – minimal score, MAX – maximal score, σ – standard deviation, α_3–coefficient of skewness, α_4 – coefficient of kurtosis, KS-p – and significance while testing the normality by using Kolmorgov-Smirnov test).

	AS	MED	MIN	MAX	σ	α_3	α_4	KS-p
PM	82,9	82,5	67	101	9,75	0,29	-0,16	p > 0,20
2PT SUC	23,1	22,0	18	33	4,02	0,86	1,08	p > 0,20
2PT TOT	44,2	44,0	34	53	6,05	-0,26	-0,82	p > 0,20
3PT SUC	6,8	7,0	4	10	1,87	0,24	-0,60	p > 0,20
3PT TOT	21,3	22,0	16	27	2,89	-0,00	-0,20	p > 0,20
FT SUC	16,4	15,0	10	28	5,14	1,50	1,89	p > 0,20
FT TOT	22,4	21,0	16	35	5,92	0,72	-0,23	p > 0,20
DEF REB	24,6	25,0	20	30	2,99	0,25	-0,12	p > 0,20
OF REB	10,4	9,0	5	20	4,60	1,13	0,15	p > 0,20
ASSIS	13,0	11,0	9	21	3,60	1,11	0,23	p < 0,20
STL	7,5	7,0	4	15	2,66	1,52	3,27	p < 0,20
TO	13,4	13,0	9	22	3,10	1,36	2,99	p > 0,20
BL	1,9	1,5	0	5	1,65	0,72	-0,46	p > 0,20
FTS	23,6	23,5	17	32	3,67	0,50	0,65	p > 0,20

Legend: PM – points made, 2PT SUC – two point shots successful; 2PT TOT – two point shots total; 3PT SUC – three point shots successful; 3PT TOT – three point shots total; FT SUC – free throws made; FT TOT – free throws total; DEF REB – defensive rebounds; OF REB – offensive rebounds; ASSIS – assists; STL – steals; TO – turnovers; BL – shot blocks; FTS – fouls made

From the table of basic statistic indicators (Table 1), it is visible that all of the variables are normally distributed. Although there's a slight range of values in the variable *Points made* (67-101), the arithmetic mean (AS=82,9) indicates a standard value of the final result with a standard deviation of 9,75. The range of results of other variables, for example *Offensive rebounds* (5-20), or *Turnovers* (9-22), is also wide, but the arithmetic mean of the two has a standard value, also with no bigger oscilations (σ=4,60; σ=3,10). Arithmetic mean of all variables, with the hypothetical replacement of values between the variables STL (AS=7,5) and TO (AS=13,4), observed from a basketball aspect, is a good final match statistic.

In Table 2, results of descriptive statistics of the winning teams are found. The basic statistic parameters are calculated: arithmetic mean, median, minimum score, maximum score, standard deviation, coefficient of skewness and coefficient of kurtosis.

Table 2: Results of descriptive statistics - winners (AS – arithmetic mean, MED – median, MIN – minimal result, MAX – maximum result, σ – standard deviation, α_3 – coefficient of skewness, α_4 – coefficient of kurtosis).

	AS	MED	MIN	MAX	σ	α_3	α_4
PM	89,25	88,50	78	101	8,22	0,32	-1,00
2PT SUC	24,75	25,50	18	33	4,74	0,29	0,11
2PT TOT	43,88	43,00	34	53	7,68	0,09	-1,85
3PT SUC	7,25	7,00	4	10	2,25	-0,01	-1,39
3PT TOT	19,38	18,50	16	23	2,50	0,60	-0,66
FT SUC	18,00	16,00	10	28	6,63	0,85	-0,49
FT TOT	25,25	24,50	16	35	6,30	0,21	-0,67
DEF REB	26,38	26,00	23	30	2,56	0,47	-0,82
OF REB	9,00	8,50	5	17	3,63	1,68	3,90
ASSIS	14,38	12,50	10	21	4,34	0,55	-1,70
STL	8,00	7,00	4	15	3,42	1,23	1,99
TO	12,63	13,00	9	15	1,77	-1,10	2,42
BL	1,00	1,00	0	2	0,76	0,00	-0,70
FTS	21,00	21,00	17	24,	2,14	-0,58	0,94

Legend: PM – points made, 2PT SUC – two point shots successful; 2PT TOT – two point shots total; 3PT SUC – three point shots successful; 3PT TOT – three point shots total; FT SUC – free throws made; FT TOT – free throws total; DEF REB – defensive rebounds; OF REB – offensive rebounds; ASSIS – assists; STL – steals; TO – turnovers; BL – shot blocks; FTS – fouls made

From the table of basic statistic indicators (Table 2), it is visible that the variable *Points made* indicates that the winning team, from a basketball point of view, have accomplished a high value in the parameter arithmetic mean (AS=89,25), extremely high in parameter maximum (MAX=101). Moreover, bearing in mind the minimum number of *Points made* (MIN=78), resonating from an aspect of Croatian league basketball practice, we can notice that a relatively high value of *Points made* had been accomplished at the match. Furthermore, from the more exceptional results of other statistical parameters, the high values of S*uccessful two point shots* (AS=24,75) and assist variables (AS=14,38) are worth of emphasizing. It should be mentioned that the winning team had a more significant oscillations in values of minimum (MIN) and maximum (MAX) *Offensive rebounds* (5-17), *Steals* (4-15) and *Free throws made* (10-28).

Table 3: Results of descriptive statistics – defeated (AS – arithmetic mean, MED – median, MIN – minimal result, MAX – maximum result, σ – standard deviation, α_3 – coefficient of skewness, α_4 – coefficient of kurtosis).

	AS	MED	MIN	MAX	σ	α_3	α_4
PM	76,63	76,00	67	86	6,72	-0,23	-0,88
2PT SUC	21,38	22,00	18	25	2,39	-0,34	-0,26
2PT TOT	44,50	45,50	35	48	4,38	-1,66	3,16
3PT SUC	6,38	6,50	4	8	1,41	-0,48	-0,56
3PT TOT	23,13	22,00	22	27	1,89	1,64	1,77
FT SUC	14,75	14,00	12	19	2,55	0,85	-0,65
FT TOT	19,50	18,50	16	26	4,07	0,84	-0,92
DEF REB	22,75	23,00	20	25	2,25	-0,19	-2,19
OF REB	11,88	10,00	7	20	5,25	0,78	-1,12
ASSIS	11,63	11,00	9	15	2,13	0,53	-1,15
STL	7,00	6,50	5	10	1,69	0,95	-0,03
TO	14,25	13,50	10	22	3,99	1,03	0,81
BL	2,88	3,00	0	5	1,81	-0,34	-0,93
FTS	26,25	26,00	23	32	2,92	1,05	1,12

Legend: PM – points made, 2PT SUC – two point shots successful; 2PT TOT – two point shots total; 3PT SUC – three point shots successful; 3PT TOT – three point shots total; FT SUC – free throws made; FT TOT – free throws total; DEF REB – defensive rebounds; OF REB – offensive rebounds; ASSIS – assists; STL – steals; TO – turnovers; BL – shot blocks; FTS – fouls made

In Table 3 are the results of descriptive statistics of defeated teams. The basic statistic parameters are calculated: arithmetic mean, median, minimum score, maximum score, standard deviation, coefficient of skewness and coefficient of kurtosis.

From the table of basic statistic indicators for the defeated teams (Table 3), it is evident that the maximum value (MAX) indicates that the defeated teams have not accomplished an exceptionally high value of *Points made* (MAX=86), but have accomplished a high value in *Turnovers* variable (MAX=22), aswell as the *fouls made* variable (MAX=32). On the other hand, in the same statistical indicator of variables of *Offensive rebounds*, the defeated teams mark a high value (MAX=20), but not in the arithmetic mean as well (AS=11,88). Furthermore, by examining the arithmetic mean (AS), it can be noticed that, from a league basketball practice, there is a relatively bad ratio of values in *Steals* (AS=7,00) and *Rebounds* (AS=14,25) variables. There is also an interesting information that the defeated teams in variables of *Two points shots total* (AS=44,50) and *Three points shots total* (AS=23,13), mark higher values than those of the winner teams. On the other hand, the values of *Two point shots successful* (AS=21,38) and *Three point shots successful* (AS=6,38) variables are lower.

In Table 4 results of t-test for independent samples are presented. Previously calculated arithmetic values are shown and a testing value while testing the statistical significance of differences between the arithmetic means, level of significance while testing the statistical significance of differences between the two observed groups in the arithmetic means, test value while testing the statistical significance of differences between two observed groups in variances and level of significance while testing the statistical significance of differences in variances were calculated.

Table 4: Results of t-test for independent samples (AS-1- arithmetic mean of winners, AS-0- arithmetic mean for defeated, t – testing value while testing the statistical significance of differences between the arithmetic means, p – level of significance while testing the statistical significance of differences between the two observed groups in the arithmetic means, F-Var - test value while testing the statistical significance of differences between two observed groups in variances, p-Var - level of significance while testing the statistical significance of differences in variances).

	AS - 1	AS - 0	t	p	F-Var	p-Var
PM	89,25	76,63	3,36	0,005	1,50	0,61
2PT SUC	24,75	21,38	1,80	0,094	3,95	0,09
2PT TOT	43,88	44,50	-0,20	0,844	3,08	0,16
3PT SUC	7,25	6,38	0,93	0,367	2,56	0,24
3PT TOT	19,38	23,13	-3,38	0,004	1,76	0,47
FT SUC	18,00	14,75	1,29	0,217	6,77	0,02
FT TOT	25,25	19,50	2,17	0,048	2,39	0,27
DEF REB	26,37	22,75	3,01	0,009	1,29	0,74
OF REB	9,00	11,88	-1,27	0,223	2,10	0,35
ASSIS	14,38	11,63	1,61	0,130	4,14	0,08
STL	8,00	7,00	0,74	0,471	4,10	0,08
TO	12,63	14,25	-1,05	0,310	5,10	0,05
BL	1,00	2,88	-2,71	0,017	5,72	0,03
FTS	21,00	26,25	-4,11	0,001	1,86	0,43

Legend: PM – points made, 2PT SUC – two point shots successful; 2PT TOT – two point shots total; 3PT SUC – three point shots successful; 3PT TOT – three point shots total; FT SUC – free throws made; FT TOT – free throws total; DEF REB – defensive rebounds; OF REB – offensive rebounds; ASSIS – assists; STL – steals; TO – turnovers; BL – shot blocks; FTS – fouls made

From the Table 4 it is visible that variables *Points made*, *Defensive rebounds*, *Three point shots total*, *Free throws total* and *Fouls made* statistically differentiate the winning teams from the defeated teams.

DISCUSSION

From Table 4 it is evident that high value of points made (PM=89,25), or in other words, an

efficient offense statistically significantly contributes to victory. In modern basketball, where defense is a very important segment of team strategy, a value of almost 90 points is usually classified as a high value of points made. On the other hand, from the same amount of value, it could be concluded that poor quality defense is the one that takes away the victory. Therefore a pointed question is asked: „Does the winning team have a quality offense or does the defeated team have poor quality defense?“ As it can be seen from tables 2 and 3, a high number of total shots from the game, shown in variables *Two point shots total* and *Three point shots total*, of the winning teams (2PT TOT =43,88; 3PT TOT =19,38) but also the defeated teams (2 PT TOT=44,50; 3PT TOT=23,13) marks a basketball match with a high number of offenses. Furthermore, considering the variable *Offensive rebounds* in winning teams (OF REB= 9,00), and defeated teams (OF REB=11,88) doesn't mark any slight deviation from the usual statistical values of a basketball match, it can be assumed that there weren't many chances for a second or a third attack (Ibanez, Garcia et al., 2008). So it is necessary to mention that, in a basketball match, team in the attack phase, after a missed jump shot in the offense, gets a chance for at least another attack while a big number of total shots is a result of a high game tempo. High game tempo in offense is characterised by shorter time of attacks, in which an attempt to score is realized in 10 or more seconds before the expiration of an allowed time of offense phase, and a large number of counterattacks. Unlike short attacks in which the attacking team, using a „quick shot“, decreases the chance of a successful realization because of the more quality defensive formation of the defending team and higher level of fatigue as a consequence of an inadequate physical recovery from previous defensive and offensive actions, the counterattacking team increases the chance of a successful realization because of the numerical superiority realized with a fast transition (conversion) from defense to offense. The prerequisite of every counterattack, primary (2:1) or secondary (5:4), is a defensive rebound in which the defending team in the defensive phase gains possession of the ball. Statistically significant difference between the winner and the defeated in the variable *Defensive rebounds* (p=0.009) indicates that the winning team (DEFREB=26,37) had significantly more overtaken balls than the defeated ones (DEF REB=22,75), and therefore more chances for counterattack and easier realization. The *Two point shots successful* (p=0,094), although statistically not differentiating the winning team from the defeated team, indicates that the winning team (2 PT SUC=24,75) had a more successful realization than the defeated team (2 PT SUC=21,38 in that segment of the game which can be accomplished with a quality counterattack and a good selection of offence and shots in the set offence, respectively (Gomez, Lorenzo, Sampaio et al., 2008).

A team surely has a good shot selection when it, with various offensive maneuvers which do not allow the defense to adapt (good offense selection), finds a player who is, according to his own capability, in the best position for realization in relation to defense and the basket. It is partially visible from the *Three point shots total variable* (p=0,004) which statistically differentiates the winning team (3 PT TOT=19,38) from the defeated (3 PT TOT=23,13). The defeated teams had a higher number of *Three point shot total*, but lower number of *Three point shots successful* (3 PT SUC=6,38) than the winning team (3 PT SUC=7,25), which also indicates the posibility of worse three point shot selections emerging from the unilateral offensive maneuveres to which the defense has adapted (bad attack selection that lowered the efficiency of realization). In the other hand, it is possible that the winning teams were more „hot“, or that the defeated team was less „hot“ so the winning team took the conceptional risk and allowed more open shots. Shooting outside of the three point line is part of the basketball game and it is also the offensive strategy of many teams, so it can not and shouldn't be *a priori* characterised as a bad shot selection. Precisely speaking, bad shot selection is not a missed shot, rather it is a bad shot timing and poorly chosen shooting position, as well as a wrong choice of player for shooting (bad offense selection).

Because of the higher realization percentage, lots of different ways for realization and the nearness of the basket, and also the chance of extortion of a higher number of fouls, the two points shot is a more safer way to score than the three point shot. However, the following two variables which statistically differentiate the winner from the defeated, *Free throws total* (p=0,048) and *Fouls made* (p=0,001), indicate and almost prove a better shot selection of the winning team. The winners have a higher number of *Free throws total* (FT TOT=25,25) than the defeated (FT TOT=19,50), and the defeated - as expected but not necessary, have a higher number of *Fouls made* (FTS=26,26) than the winners

(FTS=21,00). The highest number of fouls is made or extorted inside the three point line when the attacker has obtained advantage (in position, in penetration, on the shot,...) in relation to the defense and is in a likely position for realization. Stopped by a foul, the attacker gains the ball on the side and a new attack or free throws or even both (in unsportsmanlike or intentional fouls).

The defeated teams had a higher number of *Two point shots total* (2 PT TOT=44,50) than the winners (2PT TOT=43,88) but as is already mentioned, also a lower number of *Two point shots successful* as well as *Free throw total*, while the winners had higher number of *Two point shots successful* and *Free throws total* with a lower number of *Two point shots total*. That probably indicates that the winners had more good opportunites from where with good shooting (and attack) selection have scored or extorted a higher number of fouls made from the defeated and, from the same reason, made more free throws (Gomez, Lorenzo, Barakat et al., 2008). As the significantly lower number of fouls is made on the three point shot than in the two point shot zone, it is probably that the winners were loooking for a safer mean of scoring. Furthermore, a higher number of defensive rebounds in the winning team has opened more opportunities for counterattacks from which they have either scored or extorted a foul right after a missed shot, by which „easy points“ are prevented (tactical foul if the team isn't in bonus); or extorted a free throw foul. The block variable also statistically differentiates the winners from the defeated (p=0,017), but, although having a negative value (t=-2,77) because of the aforementioned, it goes in favor of the winning team because most of the shots are blocked below or in proximity of the basked which even further confirms that the winning team was constantly looking for a safer way of realization, which finally means, closer to the basket.

CONCLUSION

Basketball is an extremely complex sports game in which a continuous, nonlinear, hardly predictable and at moments even chaotic interactions within a team along with confrontations between two teams, takes place. Researches show that the structure of a basketball game is similar to the systems that describe dynamic systems and models of deterministic chaos (Jelaska, 2011). Analysis of the differences of situational efficiency indicators of the selected clubs, in this case Cibona and Zadar, can surely only partially present all the relevant elements that affect the result efficiency in basketball games. In this research, relatively small number of indicators used (although used by standards) surely has a limited reach. A pointed question is asked: „To which extent is it even possible to present and explain the issues and course of events that take place in the match, based only on the statistical indicators, even if they are greatly numbered?“. Indicators of situational efficiency give thorough information, draw coaches' and players' attention and even educate, but they surely cannot present all of the elements that are to a greater or a lesser extent important for the ultimate outcome. This is not only because of the complexity of basketball as a sports game, but because of a series of other external and internal factors that are in reality extremely difficult, or even impossible, to accurately measure.

Thus, for example, the pure issues of the sports form, which defines itself as an optimal psychophysical condition of a athlete or a team, is of great importance in basketball as for a single match so for an entire season, which in real situations cannot be exactly measured or presented. The influence or pressure from the audience, positive or negative, has an impact on individuals and teams to such an extent that it makes them look like other persons or teams. From great significance is also the referee criterion, or in other words the possible subjective impact of the referee, which isn't exactly measureable but is an integral part of a basketball match. In basketball games there were situations in which one particular decision of a referee changed the outcome of the entire match. The sole basketball match tracked by educated statisticians consists of a series of situations which cannot be recorded on paper. As an example, a team with a great offensive player, who is also already renowned and has its „significance“ in the field, can be specified. Because the strategy of the defending team is focused on him, the attacking team will have different indicators of situational efficiency (for example more shots 'in the paint', more offensive rebounds etc.) than against a team with no such defensive strategy. Or, for instance, a team who has few attempts and a low percentage of two shot realizations, and only because the defending team has a tall player or an exceptional blocker who had "closed" access towards the basket. The presence of such a player on the floor can be recorded in minutes, the efficiency with recorded blocks and rebounds, but the deviation

from the shot execution or loss of confidence by the opposing team cannot be measured. These situations which in various factors have effect on the score and lots of unmentioned situations proved that the situational efficiency indicators aren't and shouldn't be the only measure in player and team efficiency. So, for instance: "How to record the pressure level in the defense?", or how to quantify a player who is, from a statistical point of view, among the worse players, but who has during the defensive phase "shut down" an opponent from all actions and minimized his effect?

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SPORTS METAPHORS SHOOTING HIGH OTHER DISCOURSES

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SUMMARY

Introduction: Generally understood as the linguistic/semantic structures represented in the written and spoken medium, discourses represent the sociolinguistic phenomena, whose analysis merits scientific importance; they are closely linked to the means by which a society is governed and managed. Other life discourses, in this particular case, political one, cannot do without sports language. This cohabitance of linguistics units is the scope and aim of this paper.

Methods: The identification of metaphor clusters or bursts requires the analyst to decide which increases in use are sufficiently sudden or distinct from the immediately previous discourse to warrant labelling as clusters. By plotting the cumulative frequencies on a graph, increases in use appear as sudden rises in the curve, i.e., they become visually identifiable. However, reliability and validity in visual identification are affected by the unit chosen to divide the discourse.

Results: The visual displays created using the VisDis software proved to be as accurate as the statistical method in identifying metaphor clusters, and for many research purposes will be 'reliable enough'. The extra information about Vehicle domains available in the visual display showed cluster boundaries more clearly than in a cumulative frequency graph**.**

Conclusion: Media commentators have long bemoaned a style of campaign coverage known as "horse-race journalism," in which the contest becomes everything. Strategies and tactics subsume policies and ideas. Soon this interminably long race will be over - it is a marathon not a sprint - and there will follow another of the great rituals of campaign coverage. Correspondents will identify the single moment the election was won or lost, or the strategy or move that led to defeat. Needless to say, the Americans have a name for this kind of post-match analysis: Monday morning quarterbacking. In a word, it seems no sphere of life can do without sports language, so the sooner we realize the better for us all. The sooner we educate our students to use the wealth of sports language in other domain discourses the better life rank awaits them.

Keywords: discourse, power, politics, language, communication

INTRODUCTION

The focus of research shifts from the structure of language on its functions and specific practices related to the particular context. Based on these shifts, poststructuralist and constructionalist comprehensions of a discourse go a step further in the direction of functionalism with the process of identifying discourse signification, the creation of meaning. The concept of discourse gains thus specific meanings, irreducible to the existing linguistic and vocabulary definitions. The discourse is seen as a kind of a linguistic structure, which social use represents a specific exertion of power. By linking the notion of discourse with the concept of power in his research, Michel Foucault gave the main impetus to these studies. Foucault sees a discourse as a power that should be won. Thus, the power is a discursive category, the vacant position that can be occupied by individuals and institutions.

Metaphor, whether conceptual or linguistic, from the discourse dynamics perspective becomes processual, emergent, and open to change. Rather than seeing metaphor as a 'tool' or some other kind

of object that is put to use, a processual view attends to metaphor activity. Through self-organization and emergence, metaphors and systems of metaphors can stabilize out of use. That stability too though is dynamic, open to further change, and accompanied by flexibility. The flexibility or variability around stabilized phenomena allows the possibility of further change in the continuing flow of discourse. Linguistic metaphors, or rather 'metaphoremes' (Cameron & Deignan, 2006), stabilize as idiomatic or preferred forms and associated pragmatic and semantic features that emerge from interaction. Depending on communicative activity, they may continue to change or they may remain in the stabilized form for a long period of time.

METHODS

Corpus sample

The topic of a linguistic metaphor is the real world referent of the vehicle word or phrase. In spoken interaction, there is often no explicit topic verbalized. The extra information is itself not very specific: there is no evidence to warrant a more specific interpretation. Given also that we were dealing with more than 1000 linguistic metaphors in each transcript, it became impractical to work out and agree specific topics for each vehicle. Our solution was to streamline topic coding by constructing and using a limited set of key discourse topics relevant to our research topic and research questions. Thus, "system" was allocated to the key topic: responses to terrorism (coded as 3) and one of its two sub-topics, responses to terrorism by the authorities (coded as 3a) (the other being, responses to terrorism that affect Minorities (3m)). The three other key discourse topics were: politics (elections) and terrorism (including acts of, risk of, causes of, perpetrators (coded 1)); communication about politics and terrorism (coded 2) (with sub-topics: communication about politics and terrorism by the media (2n) and communication about terrorism and the politics by the authorities (2a)); society and social groups (coded 4) (with a sub-topic: Minorities in society (4m).

Political language segmenting and sports metaphors

The language of politics is abundant in sports metaphors. When analyzing the current political situation one often hears: True, we have not quite reached the bottom of the ninth (the final, often dramatic, inning of a baseball game). In the election period we could also encounter the following: It is probably too early for the front-runner (Barrack Obama) to start running down the clock (cautious tactics used by the team ahead in the final minutes of a basketball match designed to protect its lead). When talking about the running candidates as the opponents the newspapers report something like this: Three presidential debates still lie ahead, where Mitt Romney will doubtless be looking for a knock-out punch (one of the few analogies that requires no translation outside the US). Even after the debates, there may still be time to hurl a Hail Mary pass (a desperate long pass thrown by the quarterback in the dying minutes of an American football game in the hope of getting a touchdown). Certainly, he needs a game-changer (some dramatic "play" that will upend the contest).

Across the political Anglo-sphere, the language of sport often doubles as the language of politics. At Westminster, cricketing metaphors are not uncommon. The sticky wicket, the straight bat, the hit-for-six. When the former Conservative Chancellor Geoffrey Howe delivered his dramatic resignation speech attacking Margaret Thatcher, he likened her handling of negotiations with Europe to "sending your opening batsmen to the crease only for them to find the moment the first balls are bowled, their bats have been broken before the game by the team captain." In Australia, the preferred national metaphor is a sporting one: the country punches above it weight. In the daily rough and tumble of Canberra life, politicians also often accuse each other of playing the man not the ball. In Canada, ice hockey naturally provides the analogies. Politicians are sometimes described as pylons (hopeless defenders that attackers can skate round at will). Occasionally they have to stickhandle an issue (which means to retain possession of the puck with some artful individual stick play).

Still, it is in US presidential politics that sports-speak is most prevalent. During the convention season, the test of a speech is whether it is hit out of

the park or remains within the confines of the auditorium - which, fittingly, now tends to be a sports arena. At the Democratic convention in Charlotte, for instance, Bill Clinton was deemed to have hit a home run for Obama. The previous night, the First Lady Michelle Obama had also swung for the fences and connected. It is often more than necessary to introduce the lay public into the language of sports metaphors. Here are some of these metaphors:

Front-runner: An athlete or horse that leads the race, Punching above one's weight: When a boxer fights someone in a heavier weight category, To hit a home run: To hit the baseball far enough to give time to circuit bases and score a run, Swing for the fences: Swing the bat as hard as possible, aiming for the stadium perimeter, Step up to the plate: Take your turn at the batting plate in baseball, Knock-out punch: A hard punch that floors the opponent.

In the coming days, as we approach the televised debates, boxing will supply the metaphors. The talk will be of knock-out punches, even though relatively few debates have finished with much blood on the canvas. In the classic Kennedy-Nixon debates in 1960, the first in US political history, it was not the then Vice-president's glass jaw that was the problem but rather his sweaty upper lip. Go back and study the tapes: from Kennedy, you will not find a smack-down blow. Success in the debates often bestows upon the winning candidate the Big Mo (unstoppable momentum); a phrase that has become such an integral part of the political vocabulary that it is easy to forget that it comes from 1960s gridiron football. Earlier this month, as the college football season got under way, Mitt Romney urged voters to hire a new coach because "it's time for America to see a winning season again." Obama responded in kind with a string of sporting analogies: with an economic play-book so badly flawed, he said, Romney would produce a losing season. Rick Perry optimistically compared himself to quarterback Tim Tebow.

Statisticial data processing

The identification of metaphor clusters or bursts requires the analyst to decide which increases in use are sufficiently sudden or distinct from the immediately previous discourse to warrant labelling as clusters. By plotting the cumulative frequencies on a graph, increases in use appear as sudden rises in the curve, i.e., they become visually identifiable. However, reliability and validity in visual identification are affected by the unit chosen to divide the discourse.

The visual displays created using the VisDis software proved to be as accurate as the statistical method in identifying metaphor clusters, and for many research purposes will be ‘reliable enough’. The extra information about Vehicle domains available in the visual display showed cluster boundaries more clearly than in a cumulative frequency graph**.**

RESULTS

BASEBALL METAPHORS

1. (throw) a curve (ball) - “unexpected, surprising, even deceptive event”

As the Oscars roll towards us, the Berlin film festival has thrown the world a curveball by picking as best film the most thoroughly anti-Hollywood offering you can imagine. [The Guardian (London), Feb 20, 2009]

2. step up to the plate - “take on or accept a challenge or responsibility”

Some of our senators and representatives say the Iraqis should step up to the plate and reconcile their differences; others say we made the mess and we should stay in Iraq until there is a return to stability. [New York Times (USA), Apr 10, 2008]

3. be off base - “be completely wrong”

But, unfortunately, the party's assessment of its own strength is way off base. [Hindustan Times (India), Feb 8, 2009]

4. out P left field - within: “a state or position far from the mainstream”; “not knowing what’s happening”; with of/from: “a source of the unexpected or illogical”

Kerry Keady, a solicitor representing three leaseholders, said the revoking of leases "came completely out of left field". [Sydney Morning Herald (Australia), Feb 15, 2008]

5. have two/three strikes against - “condition or situation that makes it extremely difficult to be successful”

When Jesus Montero, 28, immigrated from Peru six years ago to join his mother and begin a new life in New York, he had three strikes against him. Mr. Montero is deaf, he cannot speak, and he reads only ''a little Spanish and less English,'' he said last month through a sign-language interpreter. [New York Times (USA), July 8, 2007]

CRICKET METAPHORS

1. a sticky wicket - “difficult or tricky situation”

The Assam Government is on a sticky wicket by not holding Panchayat elections within five years of its constitution as provided under Article 243(E)(3) of the Constitution of India. [Hindustan Times (India), Mar 17, 2007]

2. (just) not cricket - “unfair or unjust”

Gentlemen's agreements ought to be sacrosanct and the behavior of the Russian leader was just not cricket. [The Observer (UK), July 22, 2007]

3. V a straight bat - “offer a noncommittal or evasive answer to a question”

On immigration, Ms Smith has played a very straight bat - acknowledging concerns about east European migration but stressing the benefits it has brought. [The Guardian (UK), June 29, 2007]

4. have a good innings - “having spent a long time doing smth., having had a long, successful life”

None of my immediate family has died early and my grandparents all had reasonably good innings, except for my paternal grandfather who died of a heart attack in his 60s. [The Guardian (UK), Dec 9, 2008]

5. hit for six - “score a big success”, “being astonished or amazed by smth.”, “being devastated”

The corporate regulator has had its landmark lawsuit against the world's biggest bank hit for six after it failed to prove the very basis of its case. [Sydney Morning Herald (Australia), June 29, 2007]

FOOTBALL/SOCCER METAPHORS

1. play it safe - “act carefully, avoid risks”

Michael Davison, super policy adviser at CPA Australia, says that in the past advisers would tell their clients to play it safe by limiting their investment to equity warrants and installments. [Sydney Morning Herald (Australia), Dec 12, 2007]

2. V an own goal - “creating a problem by achieving the opposite effect from what was intended” . The Liberal Democrat's home affairs spokesman, Chris Huhne, said: "It beggars belief that the government could have scored such a devastating own goal on the very day that it was pushing draconian counter-terrorism laws through parliament.". [The Guardian (UK), June 12, 2008]

3. V the back of the net - “be successful”. As Lev's Irish landlord Christy says, with some prescience: 'Life's a feckin' football match to the Brits now. They didn't used to be like this, but now they are. If you can't get your ball in the back of the net, you're no one.' [The Observer, (UK), June 10th, 2007]

4. V the ball rolling - “start smth. happening”

In 2001, King Jigme Singhye Wangchuck set the ball rolling for Bhutan's transformation from an absolute monarchy to a parliamentary democracy, which led to a new draft constitution. [Hindustan Times (India), Jan 1, 2008]

5. V the goalposts – “change the rules, limits etc for something while someone is trying to do something, making it more difficult for them”. As they try to play the game in a situation of constantly shifting goal posts, South Africa's mining companies are about to take some tough strategic decisions. [Sunday Times (South Africa), Feb 03, 2008]

DISCUSSION

Use of metaphorical expressions across sport types

a) American Michael Phelps got the ball rolling, smashing Ian Thorpe's 200m freestyle record to claim gold. (Sydney Morning Herald, Mar 28, 2007)

b) Yet, it wasn't all William’s work. Safina scored some own goals, starting with three double faults in her first service game. (Sun Herald, Feb 1, 2009)

c) In order to advance from a heat, many surfers take what waves they can catch and play it safe for sure points. (NYT, Nov 27, 2007)

d) After the week Craig Pickering has had - winning his second major 100metres senior international meet in Ostrava following victory at the European Cup last weekend - the 20-year-old Bath sprinter says the goalposts keep changing as he prepares for his next race, the IAAF Grand Prix in Athens, tomorrow evening. (The Observer, July 1, 2007)

e) Understandably, McClaren played a straight bat, and would only repeat that he had picked a team to beat Estonia in next week's qualifier. (The Guardian, May 28, 2007)

f) Football: Championship: Wolves' promotion hopes hit for six but omens may provide comfort (The Guardian, Apr 2, 2007)

g) The sport's leaders will be hoping that Jamaica's Asafa Powell or America's Tyson Gay can step up to the plate in the 100m to help bring these championships alive. (The Observer, Aug 26, 2007)

h) The first was the decision, made not in haste before the Wellington Test but in the immediate aftermath of New Zealand's first-innings 470 in Hamilton, to drop not just Steve Harmison but, straight out of left field, Matthew Hoggard as well. (The Guardian, Mar 27, 2008)

CONCLUSION

Linguistically speaking, one question is always posed: should sport and politics mix? Media commentators have long bemoaned a style of campaign coverage known as "horse-race journalism," in which the contest becomes everything - although a better description might be "play-by-play journalism. "Strategies and tactics subsume policies and ideas. Politicians tend to be judged as players in the political game, rather than as potential leaders. Soon this interminably long race will be over - it is a marathon, remember, not a sprint - and there will follow another of the great rituals of campaign coverage. Correspondents will identify the single moment the election was won or lost, or the strategy or move that led to defeat - which will seem obvious now, even if it wasn't at the time. Needless to say, the Americans have a name for this kind of post-match analysis: Monday morning quarterbacking. To conclude: it seems no sphere of life can do without sports language, so the sooner we realize this fact the better for us all.

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EFFECTS OF GAME-BASED TRAINING ON EXPLOSIVE STRENGTH IN ADOLESCENT VOLLEYBALL PLAYERS

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SUMMARY

Introduction: The aim of our research is to determine the effects of game-based training on explosive strength in adolescent volleyball players. The authors hypothesized that this program might significantly improve explosive strength in adolescent volleyball players.

Methods: Fifty six adolescent volleyball players participated in this study (16,26±1,01). Players were randomly allocated into a game-based conditioning group (n = 30) or a control group (n = 26). Each player participated in a 8-week training program that included 3 organized court training sessions per week. Training effects were analyzed using a one-way univariate analysis of variance (ANOVA).

Results: Game-based conditioning training induced a significant improvement ($p < 0.05$) in SJ, CMJ, MEDS and MEDST, whereas traditional volleyball activities did not significantly improved any of the tested variables. In SJ and CMJ results revealed a statistically significant difference between groups pre- to post-training ($p < 0.05$). After 8 weeks of training, there were increases in two medicine ball tests (MEDS and MEDST) for training group ($p<0.05$). There were no significant changes for lying medicine ball throw in both groups ($p> 0.05$).

Conclusion: Game-based training appears to be an effective way of improving explosive strength in adolescent volleyball players. The results of this study indicate that game-based training method was more effective for explosive strength performance than traditional instructional programme.

Keywords: skill, conditioning, impact, power

INTRODUCTION

In recent years, an approach called game-based training has been developed in order to combine the skill and conditioning elements in a coordinated approach (Gabbett, 2002; Gabbet, 2003; Gamble, 2004; Nurmekivi et al., 2002; Sassi, R., Reilly, T. and Impellizzeri, 2004). It is an important consideration to optimize skill development in volleyball while still obtaining appropriate conditioning levels. Simply put, according to Magill, (2001) transfer of practice to the game environment depends on the extent to which practice or training resembles the game. In order to expose players to the intensity, decision making, speed and skill execution required in the competition setting, practice sessions need to replicate actual game events and phases of play. The use of game-based conditioning games as training drills allows the simulation of movement patterns of team sports, while maintaining a competitive environment in which athletes must perform under pressure and fatigue (Gabbett, 2002). Game-based training offers an additional challenge to team-sport athletes not normally present in non-skill related conditioning activities (Farrow, Pyne, Gabbett, 2008).

Studies have assessed the specificity of game-based conditioning games in a limited number of team sports (e.g., volleyball, soccer, rugby league, and rugby union). Gabbet (2008) showed that skill-based conditioning games that simulate the physiological demands of competition in junior elite volleyball players offer a specific training stimulus. Gabbett, Georgieff, Anderson, Cotton, Savovic, and Nicholson (2006) have concluded that skill-based volleyball training improves speed and agility performance, spiking, setting, passing accuracy, spiking and passing technique, but has little effect on

the physiological and anthropometric characteristics of players. They also stated that skill-based training programs should be supplemented with an appropriate amount of energy system training to enhance the physiological and anthropometric characteristics of talented junior volleyball players. Trajković, Milanović, Sporis, Milić and Stanković (2012) examined the effects of pre-season skill based conditioning training in semi- professional volleyball players. The authors stated that selected program does not offer a sufficient stimulus for semi- professional volleyball players due to the fact that there were no significant differences between pretraining and posttraining for lower-body muscular power (vertical-jump height, spike-jump height, and Standing broad jump) and agility.

According to author's findings, game-based training could be a part of training programs in younger volleyball players where the intensity of training is not as high as in professional and elite volleyball players. Therefore, more research is needed in order to confirm this theory. The aim of our research is to determine the effects of game-based training on explosive strength in adolescent volleyball players. The authors hypothesized that this program might significantly improve explosive strength in adolescent volleyball players.

METHODS

Subjects

Fifty six adolescent volleyball players participated in this study. Four of the participants in control group didn't complete the program. All players were members of the teams that finished in best eight youth and junior teams in Serbia for the past few years. Two participants were in the under-16 National team which finished first in the world youth championship in Italy, and two of them were candidates for National junior squad. Descriptive characteristics are presented in Table 1. Players were randomly allocated into a game-based conditioning group (n = 30) or a control group (n = 26). All subjects received a clear explanation of the study, including the risks and benefits of participation, and written parental or guardian consent was obtained before players were permitted to participate. The protocol of the study was approved by the Ethical Committee of the Faculty of sport and physical education, University of Nis, and according to the revised Declaration of Helsinki. The mean ± *SD* sporting experience of all subjects was 5 ± 1 year (range: 2–9 years), corresponding to 2-hour training sessions, and at least 1 competition per week.

Table 1. Descriptive characteristics of the subjects

	Mean±SD (n=56)	Mean±SD Experimental (n=30)	Mean±SD Control (n=26)
Age (years)	16,26±1,01	16,36±1,03	16,16±0,98
BH (cm)	182,15±7,44	184,18±8,62	180,13±5,46
BW (kg)	68,99±10,79	70,84±10,45	67,14±10,97

Procedures

Beside the results, basic anthropometric parameters (body height and body weight) were registered in the study protocol. The initial testing took place before the beginning of the pre-season period while the final testing was performed after 8 weeks of intervention with the game-based training method. All study procedures took place at a school athletic facility. All participants took part in one introductory session during which time proper form and technique on each fitness test were reviewed and practiced. During this session research assistants demonstrated proper testing procedures and participants practiced each test. Participants were asked not to perform any vigorous physical activity the day before or the day of any study procedure. The same researchers tested and trained the same participants and the fitness tests were performed in the same order with identical equipment, positioning, and technique. Before each testing, the participants performed a standard 20-minute warm-up. Standard warm up protocol consisted of 10 min of warm up running and 10 min of dynamic stretching and 5 x 30m of running exercises.

Countermovement and Squat Jump Performance

For the purpose of the explosive strength assessing, a device "Myotest" was used. Subjects performed two vertical jumps, Countermovement Jump (CMJ) and Squat jump (SJ). The sample of the variables, processed and mistreated by the device "Myotest" consisted of the: Height (expressed in cm); Power (expressed in W/kg); Force (expressed in N/kg) and Velocity (expressed in cm/s). Subjects carried a belt around their lower trunk, on which was positioned a wireless device "Myotest" (safely attached to a belt). All subjects performed three vertical jumps (CMJ), in the following way: from the initial position, i.e., normal standing position and the hands placed on the hips, through the flexion in the articulations of the knee up to 90º, after the audio signal of the device, the subjects performed the maximum vertical take-off, and landed with affable flexion (up to 110º) in the articulations of the knee and finally, went back into a starting standing position, while waiting for the new sound signal, when the specified jump technique was repeated. In the case, when the CMJ was not well performed, double audio signal, informed the subject, to repeat properly specified jumping technique. At the end of the protocol, software of the device "Myotest", automatically processed and mistreated the mean values of analyzed variables.

The squat jump (SJ) allows measurement of "non-pliometric" displacement and the ability to develop a great deal of strength within a very short space of time (explosiveness). This test consisted of the person jumping as high as possible with their hands on their hips from a half-squat position (i.e. 90° bending of the knees). This position was maintained for about 1s. The subjects were then instructed to extend the lower limbs as explosively as possible with the aim of performing a squat jump. Three attempts were made at this exercise. The best result was retained for analysis.

Spike and block jump performances

For the standing reach, while wearing their normal volleyball footwear, players were requested to stand with their feet flat on the ground, extend their arm and hand, and mark the standing reach height while standing 90° to a wall. Players were encouraged to fully extend their dominant arm to displace the highest vane possible to determine their maximum standing reach height. The measurement of the standing reach height allowed for a calculation of the relative jump heights on each of the jumping tasks (absolute jump height (cm) – standing reach height (cm) = relative jump height) (Sheppard et al, 2009).

Spike (SJ) and block (BLJ) jump performances for volleyball players depend heavily on the height at which these skills are performed above the net and are determined by not only the capacity of the athlete to raise vertically his center of gravity, but also his stature and standing reach. In this particular case, specific tests would provide a further understanding of the training-induced adaptation. For the SJ, the standing reach was determined as the maximal distance between the fingertip of the attack hand and the ground, while standing 90° to a wall. The SJ was measured from a running lead (2- or 3-step approach) by using a basketball backboard marked with lines 1 cm apart with a 1-minute rest interval between them (Hasegawa, Dziados, Newton, Fry, Kraemer, and Hakkinen, 2002). For the BLJ, the standing reach was determined as the maximal distance between fingertips of the block hands and the ground, while facing the wall. The BLJ jumps started from a standing position with the hands at shoulder level and arms raised from the start position without extra swing. All tests used the same observer who was situated on a volleyball referee stand placed 2 m from the backboard. Both jumps were recorded as the best of the 3 attempts (Stanganelli, Dourado, Oncken, Mançan, da Costa, 2008).

Upper-Body explosive strength

Medicine Ball Testing

Upper-body explosive strength was estimated using an overhead medicine ball throw, seated medicine ball throw and lying medicine ball throw. Medicine ball throws were performed using the 21.5-cm diameter and 3-kg rubber medicine balls (Tigar, Pirot, Serbia). All subjects were introduced to the testing on familiarization session. The skin of the medicine ball was lightly dampened (magnesium carbonate) to leave an imprint on the floor where first contact was made and to ensure precise measurement of the throwing distance. Distance was measured from the base of the bench to the closest edge of the medicine ball imprint.

Overhead medicine ball throw (MEDST)

The test was conducted with players standing one step behind a line marked on the ground facing the throwing direction, with a 3-kg medicine ball

held in both hands behind the head. Players were instructed to plant the front foot with the toe behind the line and to throw the medicine ball overhead as far forward as possible. Each throw was measured from inside the line, to the nearest mark made by the fall of the medicine ball. Throwing distance was measured to the nearest 1 cm, with the greatest value obtained from 3 trials used as the overhead throw score (Gabbett & Georgieff, *2007*).

Medicine Ball Put (MEDS)

The medicine ball put approximated a basketball chest put, completed from a sitting position. Each subject was seated on an adjustable chair with back oriented vertically against a back support, thighs horizontal, knees flexed at 90°, and ankles fixed behind swivel pads at the base of the chair. Subjects were secured to the bench with elastic strapping placed around the trunk and the backrest at midchest level under the axillae. This position and mode of stabilization minimized trunk movements during the put. Subjects were instructed to hold the medicine ball in their laps with both hands, bring the ball up quickly to touch their chest at about nipple level, and then explosively perform a chest type pass, pushing the ball outward and upward at an angle approximately 30° above horizontal. The same instructions and demonstrations were given to each subject before each test (Vossen, Kramer, Burke, & Vossen, 2000).

Lying medicine ball throw (MEDL)

The subjects were instruct to lay down on their backs and held a 3-kg medicine ball on the floor above their head with the arms fully extended. The shoulders were on the zero-line. The throwing action was similar to that used for a soccer throw-in. The ball was thrown forward as vigorously as possible, while the head was kept on the floor. The best of the consecutive trials was recorded as the final result (to the nearest 1 cm). (Tomljanovic, Spasic, Gabrilo, Uljevic & Foretic, 2011).

Statistical Analysis

Statistical analysis included descriptive analyses (means and standard deviations for the sample as a whole, and separately for the EG and CG) for the pre- and post-training status. The normality of the distribution was tested using Shapiro–Wilk test.

Training program

One cycle of eight weeks was analyzed in preseason (2013/14). The schedule of the performed preseason conditioning is shown in Table 2. The goals of the preseason conditioning were to increase the intensity of sport-specific training, and attention was given to volleyball drills and skills. Two weeks before the training program players performed the general conditioning in order to level the conditioning of players after the break during off season. None of the players was performing any additional resistance or aerobic training outside of the 3 game-based sessions. The duration of training sessions was recorded, with sessions typically lasting 90 min. During the 8-week follow-up, the team played 4 friendly preseason matches. For this purpose game-based conditioning exercise were selected based on previous experience and pilot studies in which mean exercise intensity responses of traditional drills is suggested by previous authors (Gabbett, 2008; Gabbett, et al., 2006). In the first part of sessions players were involved in technical drills and after that more complex, game-based conditioning exercises were used (2 vs. 2, 3 vs. 3, 4 vs. 4 and competition drills 6 vs. 6). Although the duration of each individual rally in this drills was not controlled by the coach, total duration of the drill can be recorded to assist in inter and intra-session planning. The total repetitions can be easily quantified by summing the total points played in the rally, then multiplying by the number of rallies per point (Sheppard and Borgeaud, 2009). The coach create an emotionally intense environment by implementing a scoring system (e.g., team that wins 2 out of the 3 rallies scores one big point, 5 seconds rest) and by encouraging the players.

Changes in the physical characteristics, lower-body and upper-body muscular power of players over the training period were compared using one-way univariate analysis of variance (ANOVA). All coefficients were considered significant at a level of 95% ($p<.05$).

Table 2. Training program used between weeks 1 and 8.

Goal: game-based conditioning	
Sessions 1–24 (Monday-Wednesday-Friday)	
Exercises	
Warm up	General activity + specific warm up games with the ball (25 min)
Instructional drills for technique	20 min of drills that include low intensity movement and combine volleyball technique . Two drills were performed with 2 minute break between.
3 vs. 3, 4 vs. 4 and 6 vs. 6 drills	Small-sided (e.g., 3 vs. 3, 4 vs.4) games where the volleyball court was separated in two smaller (9 x 4.5 m) courts. Competition drills (6 vs. 6) with the majority of free balls to each side thrown by the coach. Both teams rotate depending of the scoring. After each rotation players take one minute break (40 min).
Stretching	5 minutes of stretching for the muscle groups mainly involved in sessions

RESULTS

The Shapiro–Wilk test has shown that data was normally distributed. There were no significant differences ($p > 0.05$) between the groups for vertical jump and medicine ball throw tests before training program. Game-based conditioning training induced a significant improvement ($p < 0.05$) in SJ, CMJ, MEDS and MEDST, whereas traditional volleyball activities did not significantly improved any of the tested variables. Moreover, one way ANOVA revealed a statistically significant decrease in control group pre- to post-training ($p < 0.05$) in MEDS. Significant differences ($p < 0.05$) were detected between traditional volleyball activities and game-based conditioning groups for changes in block jump, SJ, CMJ, MEDL, MEDS and MEDST. There were no statistically significant differences between the groups for Spike jump prior to the training (Table 3).

Table 3. Differences between experimental and control group

	Experimental group (*n*=30)		**Control group** (*n*=26)	
	Initial (Mean ± SD)	**Final** (Mean ± SD)	**Initial** (Mean ± SD)	**Final** (Mean ± SD)
Block jump	44,10± 7,48	45,33± 5,67 †	41,02± 6,33	40,42± 6,68
Spike jump	56,63± 8,70	58,63± 8,72	53,73± 7,30	57,26± 8,66
SJ	30,29± 4,65	32,21± 3,91*†	31,59± 4,19	31,30± 4,74
CMJ	36,16± 6,59	40,87± 5,62*†	36,04± 4,86	36,66± 4,84
MEDL	6,82± 1,23	7,31± 1,09 †	6,24± 1,05	6,28± 1,01
MEDS	5,07±0,65	5,39± 0,68* †	4,70±0,64	4,32± 0,60*
MEDST	8,03± 1,46	8,84 ± 1,42* †	7,34±1,36	7,52± 1,41

***** Significant difference $p < 0.05$ between initial and final testing

† Significant difference between experimental and control group ($p < 0.05$)

Table 3 shows the means for distance of medicine ball throw tests for two groups at pre and post measurement. After 8 weeks of game based training, there were increases in two medicine ball tests (MEDS and MEDST). Significant differences were found between the experimental and control group at improving all medicine ball tests.

DISCUSION

The present study investigated the effect of a game-based training program on explosive strength in male volleyball players. Due to the different responses inherent with specific game-based volleyball training and instructional training, we hypothesized that the game-based volleyball training would be more efficient at enhancing jumping performance. Our results show that game-based volleyball training was more effective than instructional training at increasing most performance parameters in young elite players, and suggest that game-based volleyball training should be used preferentially due to their higher quantity of game-based specificity. Significant improvement was observed in squat and countermovement jump tests for training group. However, game based conditioning group showed significant improvement compared to control group in Block jump, SJ and CMJ. In similar studies with young male subjects Gabbett (2008) stated that skill-based conditioning games have induced improvements in speed, vertical jump, spike jump, agility, upper-body muscular power, and estimated maximal aerobic power. In addition, Gabbett et al. (2006) have concluded that skill-based volleyball training improves speed and agility performance, spiking, setting, passing accuracy, spiking and passing technique, but has little effect on the physiological and anthropometric characteristics of players. Moreover, our results are in opposition to another longitudinal 6-week study conducted in senior semi professional volleyball players that showed no impact of skill-based conditioning training on jumping performance (Trajković, Milanović , Sporis, Milić & Stanković, 2012) . It is possible that training backgrounds of the players, training modality and exercise intensity prescription might explain discrepancies in these results.

Both groups showed no significant improvement in Block and Spike jump. Two possible reasons could be involved with this results. This is not surprising, since both training programs use the same technique to improve volleyball skills and conditioning. Based on previous research, it was suggested that the training-induced adaptations in this types of specific tests (Block jump and Spike jump test) could occurred due to the characteristics of the loads applied. Moreover, the drills (i.e., service, attack, and block) and matches during training programs can contribute significantly to the improvement of the performance in such a specific type of test (Stanganelli, Dourado, Oncken, Mancan, and da Costa, 2008). Applied loads in our research were probably insufficient for the improvement in specific volleyball tests. Another reason could be that the subjects were familiar with this specific volleyball tests and already have high level of jumping abilities. Moreover, the prolonged season with beach volley could also contribute to high level of jumping abilities. Therefore, it is unclear if the improvements would have been better if the stimulus was different or more similar to a competitive environment.

The most number of recent studies in volleyball concerning the effects on squat jump and countermovement jump included plyometric training showing that it should be included in volleyball training (Ziv and Lidor 2010). In our study, results for SJ and CMJ test showed a statistically significant difference between groups pre- to post-training ($p < 0.05$). In volleyball, a squat and countermovement jump are usually performed in a fast spike and in a static block jump (BJ). Volleyball players use two different BJ techniques, starting from an upright position or starting from a squat position, with a countermovement being performed in both cases (Amasay, 2008). Therefore, improvement in SJ and CMJ following game-based training was logical.

After 8 weeks of game based training, there were increases in two medicine ball tests, overhead medicine-ball throw and medicine ball put (Table 3). The improved upper-body power in response to training may reflect the highly repetitive nature of selected explosive volleyball skills (e.g., blocking, spiking, serving). However, it is unclear why these skills failed to improve lying medicine ball throw ability. Gabbett et al, (2006) also failed to improve upper-body muscular power (overhead medicine-ball throw) following a skill-based training program. However, Gabbett (2008) founded in male junior volleyball players that skill-based conditioning games induce improvements in vertical jump, spike jump, speed, agility, upper-body muscular power (Medicine ball throw), and estimated maximal aerobic power.

Studies of the effect of volleyball and physical conditioning training on the physiological characteristics of players could not show clear conclusions, with reports of increased (Fardy, Hritz, and Hellerstein, 1976; Franks and Moore, 1969; Hascelik, Basgoze, Turker, Narman, and Ozker, 1989), decreased (Hakkinen, 1993.), or unchanged

fitness (Gabbett and Georgieff, 2004; Trajkovic et al., 2012) in response to training. Therefore, more research is necessary in order to further examine the effects of different training programs in volleyball, especially game-based conditioning and its effects in volleyball.

CONCLUSION

To conclude, game-based training appears to be an effective way of improving explosive strength in adolescent volleyball players. The results of this study indicate that game-based training method was more effective for explosive strength performance than traditional instructional programme. From a practical viewpoint, these findings demonstrate that instructional-based training programs should be supplemented with an game-based conditioning training or with appropriate amount of energy system training to enhance the physiological characteristics of adolescent volleyball players. Volleyball coaches could use this information in the process of planning the pre and in-season training. For proper volleyball conditioning, coaches could make training more specific in such a way that the transfer of training effects to game efficiency will be faster. Many coaches do not use the approach described in this article to the training process because they fear of insufficient stimulus that game-based training could have in volleyball or that the level of skills could decrease in adolescent volleyball players.

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DIFFERENCES OF GYMNASTIC CONTENTS IN THE TRANSFORMATION BALANCE AND STRENGTH

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SUMMARY

Introduction: The aim of subject was 172 karate players 11 years old from region of Raska. his research presents the results of the respondents involved in the educational process in schools and training process in karate clubs. The experimental treatment was applied upon the completion of the initial check, and included a program that contains the program contents in artistic gymnastics for 48 hours, with two sessions a week for a period of six months. Upon completion of the final measurement was performed and the results applied to the program (Mekić, 2009) on participants involved in karate sections have shown that there is a positive influence and transform of balance and strenght. The aim of subject was focused on balance and strength boy Raska region aged 11 years. The problem of this study is to determine the impact of gymnastics program content of motor skills of balance and strength. Formulated the following hypotheses: $H_{1.}$ - It is expected to identify significant differences in the area of motor skills of balance and strength after the application of experimental treatments between the groups; $H_{1/1.}$ – It is expected significant differences in the area of balance and strength after the application of experimental treatments within the experimental group and $H_{1/2.}$ - It is expected significant differences in the area of balance and strength after the application of experimental treatments within the control group.

Methods: Methods: To determine the difference between the initial and final measurements shall be applied t-test on small independent uzorcimam the univariate level and canonical - discriminant analysis for multivariate level.

Results: Applying the T-test showed statistically significant differences between two groups in two variable power (MSIZ and MSDT) and two variable balance (MRPs and mroku) at a significance level of 100% (p = .00). Statistically significant difference between the control group achieved only one variable balance (mroku), the significance level of 98% (.02). After conducting the Program isolated one canonical factor, with 87% explained by differences expressed tested parameters balance of power in favor of young karate.

Conclusion: Planned study determined the differences of program content in artistic gymnastics at the transformation of the balance and strength of the test samples at a level of significance of 100% (p = .000), so we can conclude that the hypothesis H1 is confirmed. When your existing experimental program conducted within a group of students led to the positive transformation of two variables and two variables balance of power, thus hypothesis H1 / 1 only partially accepted. Within the group karate there was a positive transformation in only one variable balance, thus hypothesis H1 / 2 partially upheld.

Keywords: Gymnastic program content, Artistic Gymnastics, experimental treatment, transformation, motor skills

INTRODUCTION

One of the central points in the science of physical culture are essential physical skills and motor performance man (Petkovic, 2008). This notion of different authors are named (Anthropo ability biomotoričke dimensions, kinesiology skills, crete habits, motor size etc..), But they all talk about the qualities of man expressing his physical fitness for a particular work or activity, as well as the creative expression of their own personality . The most widely accepted and most frequently cited is the division Zaciorskog (1975), which is based on previously ascertained latent motor dimensions, singled out seven (according to Petkovic, 2008): strength, speed, endurance, coordination, balance, accuracy and mobility. As a basic sport, sports gymnastics impact on the development of motor

skills: strength, coordination, flexibility and balance (Arruda & Farinatti, 2007). Balance is an important factor for success in many sports, but in gymnastics it is one of the most important factors of success. The impact of exercise on the psychosomatic status of children can lead to significant positive, but also negative consequences. The reaction of the organism to external influences are not the same in all age periods of muscle development in children aged 11 years is an intense, strength increases, and also the speed of contraction. Many researchers have dealt with the exploration of the anthropological status of children and their transformation under the influence of physical exercise.). Petkovic (1989) investigated the relation of morphological, motor and cognitive skills with success in gymnastics, through the implementation of the "school of gymnastics", a sample of 207 participants (104 girls and 103 boys) aged 7 to 9 years from the territory of Serbia. Doder (2001) determined the differences of motor skills in a sample of 82 karateka aged 10-14 years from clubs from the province of Vojvodina. Kovac (2003) on a sample of 70 karateka aged 11-13 years, who are in the training process 5-7 years investigating the impact of the program karate school on anthropometric dimensions, motor and situational-motor abilities of.

The subject of this research are motor skills and balance power boys Raska region aged 11 years, involved in the training process and regular physical education in elementary schools. The problem of this study was to determine the differences of programs sport of gymnastics as a basic function of the level of motor skills and balance of power among the boys. On the basis of this case and the problem can be formulated the following hypothesis H_1. - It is expected to identify significant differences in the area of motor skills of balance and strength after the application of program content between the groups; $H_{1/1}$ - Expect significant differences in the area of balance and strength after the administration of programs within the experimental group; $H_{1/2}$ - Expect significant differences in the area of balance and strength after the administration of programs within the control group.

METHODS

The sample

Population of sample was young male karate on one side, and elementary school boys, on the other hand, aged 11 years + 6 months, in the cities of Raska region. Subjects were divided into two groups in order to monitor the impact of gymnastics program contents on transformation motor skills of balance and strength. Sample of respondents consists of 172 boys Raska region. Of the total number of respondents experimental group were 132 school boys, a control group of 40 karate players. Experimental research sample consists of fifth grade school boys who attended regular physical education in their schools. The control group consisted of karate the same age, who are in the system of programming training process. Program that includes program content from Sport Gymnastics (Mekić, 2009) was carried out for 48 hours, with two sessions per week for a period of eight months. The experimental group program implemented prior to physical education in their schools, and the control group before their training, according to the present plan (Mekić, 2009). The time interval for the implementation of the eight months, the annual cycle is divided into two periods of four months, so that children can smoothly follow the teaching of physical education in school or training in their chosen club. School curriculum predicts that the program is implemented in groups of 25 to 30 children, who attend a normal physical education in primary schools in the region of Raska and children who are involved in the training process of the karate club (control group). The experimental treatment was introduced programs that provide program content from the sport of gymnastics, consisting of "A" PROGRAM (polygons), "B" PROGRAM (small trampoline) and "C" PROGRAM (gymnastics all-round competition).

Sample of measuring instruments

Applying this program to be implemented as additional content at the beginning of karate training and physical education included the following variables (Kurelić et al., 1975): strength - endurance in an overhand grip pull-ups (MSIZ), lift forces on the Swedish bench (MSDT), Correcting troops (MSIT);

Poise - Transverse standing on one leg (MRPs), Standing on the reverse bench for balance (MOK), Standing on one leg with eyes closed (MRZO).

Statistical analysis

For determining the difference between initial and final measurements will be applied t-test for small independent samples of the univariate level and canonical - discriminant analysis for multivariate level.

RESULTS

Table 1. shows the arithmetic mean of the initial and final measurements in the experimental group using the t-test. Table 2. shows the arithmetic mean of the initial and final measurements in the control group at the univariate level by applying the T-test. Table 3. shows the T-test between the experimental and control groups after the completion of the program, and Table 4. the differences between these two groups after the completion of the Program on the multivariate level, applying Canonical - discriminant analysis.

Table 1. The significance of differences initial and final measurements in the Experimental group

Variables	In/Fi	N	Mean	SD	t-value	p
MSIZ	Inic.	132	15.11	5.82	-5.74	**0.00**
	Fin.	132	19.18	5.66		
MSDT	Inic.	132	10.54	3.49	-2.82	**0.00**
	Fin.	132	11.63	2.72		
MSIT	Inic.	132	39.64	7.04	-1.79	0.07
	Fin.	132	41.13	6.40		
MRPS	Inic.	132	19.97	5.66	-5.72	**0.00**
	Fin.	132	23.82	5.23		
MROK	Inic.	132	17.29	6.01	-7.62	**0.00**
	Fin.	132	22.98	6.12		
MRZO	Inic.	132	32.90	8.56	0.35	0.72
	Fin.	132	32.57	6.50		

Table 2. The significance of differences initial and final measurements in the Control group

Variables	In/Fi	N	Mean	SD	t-value	p
MSIZ	Inic.	40	9.57	5.03	-1.32	0.18
	Fin.	40	10.93	4.13		
MSDT	Inic.	40	8.35	3.58	-0.35	0.72
	Fin.	40	8.62	3.35		
MSIT	Inic.	40	34.05	9.15	-0.41	0.67
	Fin.	40	34.85	7.99		
MRPS	Inic.	40	14.18	4.26	-1.49	0.14
	Fin.	40	15.54	3.89		
MROK	Inic.	40	11.98	3.96	-2.28	**0.02**
	Fin.	40	14.28	4.98		
MRZO	Inic.	40	26.10	10.12	0.62	0.53
	Fin.	40	24.84	7.91		

Table 1. shows that the statistical significance of the difference after the program was conducted in two variables and the strength of two variables, and balance to the significance level of 100% (p = .00). When a group of students in Table 1. shows that all the results numerically better on the final measure unless MRZO but statistical significance only have MSIZ, MSDT, MRPs and MROK.

Table 2. shows the statistical significance of differences after conducting the program was only

one variable balance, and with variable - Vigils reversed bench for balance (MOK), at a significance level of 98% (.024), while the other parameters examined power and the balance was not statistically demonstrated significant differences. In group karate in Table 2. shows that all the results are numerically better on the final measure unless MRZO but statistical significance only have MROK.

Table 3. T-test between the Experimental and Control groups after gymnastic program content

Variables	Ek/Ko	N	Mean	SD	T	p
MSIZ	Experimental	132	19.18	5.66	8.53	**0.00**
	Control	40	10.93	4.13		
MSDT	Experimental	132	11.63	2.72	5.77	**0.00**
	Control	40	8.62	3.35		
MSIT	Experimental	132	41.13	6.40	5.11	**0.00**
	Control	40	34.85	7.99		
MRPS	Experimental	132	23.82	5.23	9.25	**0.00**
	Control	40	15.54	3.89		
MROK	Experimental	132	22.98	6.12	8.19	**0.00**
	Control	40	14.28	4.98		
MRZO	Experimental	132	32.57	6.50	6.25	**0.00**
	Control	40	24.84	7.91		

Table 3. shows a significant difference between the experimental and control groups after the completion of the Program on the univariate level. It is observed that there is a statistically significant difference between the groups after the completion of the Program in all tested parameters of balance and strength, the significance level of 100% (p = .00).

In Table 4. is an isolated canonical factor, which may explain the significant difference after the completion of the Programme at a significance level of p = .00. With 87% was explained the significance of differences in balance and strength among a group of students of the same age and karate.

Table 4. Canonical- discriminal analysis between the Experimental and Control groups at the final measurement

	Eigen-	Canonicl	Wilks'	Chi-Sqr.	df	p-level
0	3.18	**0.87**	0.23	228.50	21	**0.00**

In Table 5. are given centroids of the experimental and control groups after the completion of the gymnastic program contents. The experimental group or a group of students with a positive sign and a control group or a group of karate with a negative sign. How centoidi indicate the homogeneity of the samples, and in our case it is from -0.97 to + 3.22, it can be seen that the homogeneity violated, and to move to the right towards the positive values of groups of students.

Table 5. Centroids

	Root 1
Karate players	-0.97
School boys	3.22

Results of canonical structure factors (Table 6) indicate that the existing separation - discrimination is possible to explain the results of the group with a negative sign, which is a group of karate. Credits for discrimination belong to the karate.

The largest contribution in the hierarchical structure of motor skills belong variables balance -

Cross standing on one leg (MRPS - 0.39), the variable strength - endurance in an overhand grip pull-ups (MSIZ - 0.36), then two variables balance (MOK - 0.35 and MRZO - 0.26) followed by two variable power (MSDT - 0.24 and MSIT - 0.21).

Table 6. Structure of canonical factors

	Root 1	Hierarchy
MSIZ	-0.36	2
MSDT	-0.24	5
MSIT	-0.21	6
MRPS	-0.39	1
MROK	-0.35	3
MRZO	-0.26	4

DISCUSSION

Results of previous studies (Kovacs, 2003 .; Doder, 1998) suggests a positive transformation of motor skills of balance and strength, on the basis of which was followed by the proposal of the Programme with the program of sports of gymnastics and its verification in practice. The proposed program of sports gymnastics at students aged 11 in the region of Raska contributed to the positive transformation of motor skills of balance and strength (Table 4.) upon completion of the Program, which lasted eight months.

Table 1. shows statistical improvement in the examined parameters of strength and static strength in arms and shoulders (MSIZ) and repetitive strength of the abdomen (MSDT), while the repetitive force of the back muscles (MSIT) has not achieved statistical transformation. In the examined parameters balance the proposed program content from the sport of gymnastics are significantly influenced the improvement of static equilibrium (p = .00) for students who have progressed from the initial measurement to the final measurement, except for the variable MRZO that no numerical or statistical significance of the transformation. In Table 2. the sample of respondents are karate practitioners in their chosen clubs. Program content even though they have not contributed to the numerical significance of the positive transformation of the tested parameters of strength and balance, except for standing in the reverse bench for balance - MROK. Parameter balance MROK a statistically significant transformation (p = .00), suggesting that in their training process were not represented exercises that develop balance on a high bench, because it is not of great importance for success in the sport of karate. In Table 3, using the T-test for independent samples was small it was observed that the differences in the parameters of balance and strength of the .00 level of significance. By applying the canonical - discriminant analysis, despite significant differences (p = .00) and percentage explaining it (genre = .87) was found, a large heterogenity by using centroid (Table 5.) within the experimental group (school boys), as might be expected because the control group of selected athletes - karate.

Disruption of homogenity of the sample is explained that experimental group consists of elementary school boys of Raska region and they are heterogeneus sample. In this sample of respondents are school boys who are already focused on some of the sports section and have better motor skills than school boys who do not do any sports. In contrast to the control group consisting of karate, the sample is homogenous because all karate were selected and have an approximately similar motor abilities as they are programmed into the same system of the training process. Looking at the structure of canonical factors credited for the separation of belonging to a group karate, where he established a hierarchical contribution (Table 6). The largest contribution has MPRS and the lowest MSIT.

CONCLUSIONS

Planned study demonstrates the difference between a student and karate after administration programs with gymnastics contents, which have contributed to the transformation of balance and strength using the T-test (Table 3.) and canonical-discriminant analysis (Table 4.) at a significance level of 100% (p = .00), so it can be concluded that the hypothesis $H_1$is fully confirmed. Applying the offered program of gymnastics contents conducted amongschool boys there was a positive

transformation of two variables, and balance the two variables power, thus hypothesis $H_{1/1}$ (Table 1.) can be only partially accepted as hypothesis. After implementation of gymnastics contents in karate there was transformation to positive in only one variable of balance, so only partially can be accepted hypothesis $H_{1/2}$. (Table 2.). Based on results of this program gymnastics contents can be recommended population of the same age who want to prepare for active participation in sports schools in other sports.

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DIFFERENCES IN EXPLOSIVE MUSCLE STRENGHT WITH HANDBALL PLAYERS AGED 14 TO 16 IN RELATION TO THE PLAYING POSITION

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SUMMARY

Throwing activities, such as shots and passes of props (ball) in sport, in handball, mostly depend of explosive strength in muscle region which is doing the throw. Explosive strength (horizontal and vertical), precision, movement speed of players with or without ball and coordination are defining efficiency of handball players. In popular handball game each position has already developed specific motor abilities which contributes to the final team success. Number of subject was consisted of 30 handball players age from 14 to 16 years. Explosive strength data were collected with Myotest device. Results have also shown difference in explosive strength of upper limbs between players at pivot position and players at other positions, while there was no difference in explosive strength of lower limbs between players at different playing positions of this age. One of possible reasons for non existing of statistically significant differences in explosive strength of lower extremities at different playing positions is age of participants, but before everything length of training process in handball where they still did not manage to develop their specificity based on playing positions.

Keywords: handball, training, explosive strentgh, position in the game

INTRODUCTION

Explosive strength is one of determinants of success in all activities which demands readings of maximal muscle force in shortest time unit possible (Newton & Kreamer, 1994). Most of throwing activities such as kicking and passing the props (balls) in sport, and specifically in handball, depends mostly of explosive strength in muscle region which is doing the throw.

Positive strength effect on speed of flying ball was confirmed in a large number of researches (Kotzamanidis, Karahekaglas, Kiparos, Giavroglov, & Tsaarouhas, 1995; Bayios, Anastasopoulou, Sioudris, & Boudolos, 2001; Joris, Edwards van Muyen, van Ingen Schenau, & Kemper, 1985; Muitjens, Jöris, Kemper & Ingen Schenau, 1991).

Explosive strength represents ability which allows one sportsmen acceleration of his body towards other object or teammate. Exhibited explosive strength depends on percentage and composition of motor units of corresponding muscle groups (Bubanj & Branković, 1997).

In handball, explosive strength of legs is closely associated with the height of the jump during jump shot and running speed (Hermassi, Chelly, Tabka, Shephard, & Chamari, 2011; Marques & González-Badillo, 2006).

In modern handball game each playing position has developed specific motor abilities which contribute to the final team performance (Oxyzoglou, Hatzimanouil, Kanioglou, & Papadopoulou (2008). According to Bolek (1982) circle attackers are exercising higher strength of upper limbs comparing to lower, while wing attackers compared to players at other playing positions are exercising highest endurance in muscles of abdominal region and feet.

Main goal in this research is the quantification of variables of exercised arms and legs explosive strength and determination of differences in exercised explosive strength between players based on playing position.

METHODS

Sample of participants

The number of subject was consisted of 30 boys from handball club „ Sloga „, Kraljevo, which are competing in Second league West. Boys are from 14 to 16 years of age. They are divided by the playing positions on the subsample with backs players (n=9), wing players (n=10), goalkeepers (n=5) и pivots (n=6).

Basic criteria for participating in this research was length of practicing handball, which was at least three years, with also any absence for diseases and injuries that could adversely affect the health status of the participants and the results of research.

Variable sample

Anthropometric characteristics were assessed by following variables:

- Body Weight in kg,
- Body Height in cm and
- BMI (Body mass index).

With usage of wireless accelerometer Myotest, the values of following variables for explosive strength in upper limbs were determined:

- Power (power in W),
- Force (forcein N) and
- Velocity (velocityincm/s).

With usage of wireless accelerometer Myotest, the values of following variables for explosive strength in lower limbs were determined:

- Height (height in cm),
- Power (power in W/kg),
- Force (force in N/kg) and
- Velocity (velocity in cm/s).

Organization, instruments and conditions of measuring

Research of transversal character was carried by authors and for this purpose specially trained staff to use the device for the assessment of explosive strength "Myotest."

Determining the strength was preceded by the determination of height using anthropometry by Martin, and weight using digital scales. Research was conducted in accordance with the Helsinki Declaration in the hall of the Sports Center "Ibar" in Kraljevo. All participants were familiar with the tasks of measurement, and their participation, i.e. agreement of participation in the study was confirmed in writing.

Determining the explosive strength of the lower extremities was preceded by a warm-up consisting of jogging 800m, skip ahead 4 x 30 m, lateral movement 4 x 30 m and skip back 4 x 30 m.

Determining the explosive strength of the upper extremities was preceded by a warm-up consisting from protocol of thrust from the bench with 2 x 5 repetitions of low intensity, with a load of 10 kg, 2 x 5 repetitions of moderate intensity, with a load of 10 kg and 2 x 3 reps of high intensity with a load of 20 kg. Between the above series of thrust from the bench, there was a rest for 1 min, and also after conducting a series of warm-up with a period of 3 min.

Measuring procedures

Countermovement Jump - CMJ represents a plyometric exercise for the lower body. The application purpose of the of CMJ jump is to improve the reactivity and explosive strength of the lower body (Brown, Ferrigno, & Santana, 2004). Participants were required that from initial, normal upright position, through rapid flexion of the knee joint to 90 deg, i.e. eccentric phase, enter the concentric phase, i.e. complete and rapid extension in the knee joint and take off in order to reach a maximum height of vertical jump (Gorostiaga, Granados, Ibanez, Gonzalez-Badillo, & Izquierdo, 2005).

In order to determine the explosive power of the lower extremities, just before the vertical jump, special Velcro belt attached with device Myotest was placed around participants waist.

The subjects performed five CMJ jumps with half squat on above described way after the short beeps from Myotest device.

In addition, subjects were instructed to put hands on hips, as they would communicate the additional body momentum during takeoff, and that the take off spot should be identical in landing, as well as contact with the ground should be as short as possible.

Bench press represents basic exercise for strengtheningand testing the strength of the upper body athletes in different sports (Ebben & Blackard, 2001; Ebben, Carroll, & SimEnz, 2004) and involves lifting and lowering of the specific load. Pectoralis major, Deltoideus pars anterior and Triceps brachi are main muscles involved in this exercise conducting (Ojasto & Hakkinen, 2009). The most

critical factor of this exercise, which needs to be predicted by exercise plan, is load (Earle & Baechle, 2004), which can be determined unprofessional i.e. randomly by participant itself, or instructor, after a number of trials and repetitions or professionally determined using certain formulas and calculations which are including properly overcome loads (Wong et al., 2010).

In order to determine the explosive strength of upper limbs thrust from the bench, authors have set Myotest device to the Smith machinebar, whose total weight with weights was 20 kg.

From the initial supine position with arms stretched in elbow joints, subjects performed five- lowering and lifting of the load, after short beeps from Myotest device.

Method of processing data

Explosive strength results were automatically statistically processed by Myotest device after performing the protocol and on-screen display showed the mean value of the studied variables.

In order of statistical processing of the used data package "SPSS version 18" was used, and the results are presented using descriptive statistics (tables).

For determination of statistical significant differences in variable values variance analyses was used i.e. One-way ANOVA (Petković, 2000).

Checking the normality of data distribution was checked with Kolmogorov-Smirnov test.

RESULTS

Descriptive statistic

Table 1. Body height and body weight of players based on positions

position		Weight (Kg)	Height (cm)
back player n=9	Mean	73,78	185,56
	Std. Dev.	9,16	5,70
	Minimum	62,00	175,00
	Maximum	91,00	193,00
wing player n=10	Mean	62,70	184,60
	Std. Dev.	7,17	9,07
	Minimum	54,00	174,00
	Maximum	77,00	198,00
pivot n=6	Mean	86,33	181,00
	Std. Dev.	5,75	5,69
	Minimum	79,00	171,00
	Maximum	92,00	187,00
goalkeeper n=5	Mean	67,60	184,40
	Std. Dev.	1,14	4,39
	Minimum	66,00	178,00
	Maximum	69,00	189,00
Total n=30	Mean	71,57	184,13
	Std. Dev.	11,02	6,75
	Minimum	54,00	171,00
	Maximum	92,00	198,00

Table 2. Explosive strength of upper limbs of players based on positions

position		Power (W)	Force (N)	Velocity (cm/s)
back player n=9	Mean	135,22	260,89	68,11
	Std. Dev.	14,91	24,52	6,90
	Min.	114,00	231,00	58,00
	Max.	159,00	293,00	79,00
wing player n=10	Mean	135,70	242,70	65,10
	Std. Dev.	12,70	52,86	7,26
	Min.	118,00	149,00	54,00
	Max.	161,00	293,00	77,00
pivot n=6	Mean	109,33	233,83	56,17
	Std. Dev.	9,61	10,03	6,74
	Min.	98,00	221,00	49,00
	Max.	123,00	251,00	68,00
goalkeeper n=5	Mean	139,20	255,40	68,40
	Std. Dev.	19,20	12,60	4,22
	Min.	112,00	241,00	62,00
	Max.	163,00	273,00	73,00
Total n=30	Mean	130,87	248,50	64,77
	Std. Dev.	17,32	34,41	7,80
	Min.	98,00	149,00	49,00
	Max.	163,00	293,00	79,00

Table 3. Explosive strength of lower limbs of players based on positions					
position		Height (cm)	Power (W/Kg)	Force (N/kg)	Velocity (c/ms)
back player n=9	Mean	37,56	38,33	24,47	222,11
	Std. Dev.	4,77	10,63	2,61	*38,56*
	Min.	31,00	28,00	21,20	165,00
	Max.	46,00	54,00	28,70	276,00
wing player n=10	Mean	35,60	41,00	24,47	246,30
	Std. Dev.	3,75	7,21	4,43	20,19
	Min.	32,00	30,00	20,20	208,00
	Max.	43,00	52,00	33,40	278,00
pivot n=6	Mean	33,50	39,67	24,83	227,17
	Std. Dev.	3,15	6,68	2,25	30,05
	Min.	28,00	33,00	21,20	192,00
	Max.	37,00	51,00	28,00	279,00
goalkeeper n=5	Mean	39,00	40,40	24,40	216,60
	Std. Dev.	9,46	8,56	2,83	59,20
	Min.	29,00	30,00	21,60	117,00
	Max.	51,00	51,00	27,80	261,00
Total n=30	Mean	36,33	39,83	24,53	230,27
	Std. Dev.	5,31	8,15	3,10	36,32
	Min.	28,00	28,00	20,20	117,00
	Max.	51,00	54,00	33,40	279,00

ANOVA

Table 5. Explosive strength of upper limbs ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Power (W)	Between Groups	3533,68	3	1177,89	5,93	,003*
	Within Groups	5167,79	26	198,76		
	Total	8701,47	29			
Force (N)	Between Groups	3246,48	3	1082,16	,90	,452
	Within Groups	31091,02	26	1195,81		
	Total	34337,50	29			
Velocity (cm/s)	Between Groups	611,54	3	203,85	4,59	,010*
	Within Groups	1153,82	26	44,38		
	Total	1765,37	29			

Table 6. Variance analyses and Post Hoc test (LSD) for explosive strength of upper limbs.

Dependent Variable	(I) position	(J) position	Mean Difference (I-J)	Std. Error	Sig.
Power (W)	back player	wing	-,48	6,48	,94
		pivot	25,88	7,43	,00
		goalkeeper	-3,98	7,86	,62
	wing player	back	,48	6,48	,94
		pivot	26,36	7,28	,00
		goalkeeper	-3,50	7,72	,65
	pivot player	back	-25,88	7,43	,00
		wing	-26,36	7,28	,00
		goalkeeper	-29,86	8,54	,00
	goalkeeper	back	3,98	7,86	,62
		wing	3,50	7,72	,65
		pivot	29,86	8,54	,00
Velocity (cm/s)	back player	wing	3,01	3,06	,33
		pivot	11,94	3,51	,00
		goalkeeper	-,29	3,72	,94
	wing player	back	-3,01	3,06	,33
		pivot	8,93	3,44	,02
		goalkeeper	-3,30	3,65	,37
	pivot player	back	-11,94	3,51	,00
		wing	-8,93	3,44	,02
		goalkeeper	-12,23	4,03	,01
	goalkeeper	back	,29	3,72	,94
		wing	3,30	3,65	,37
		pivot	12,23	4,03	,01

From this table we see that among groups there are statistically significant values for parameters Power (,003) and Velocity (,010).

Based on results of variance analyses and LSD post hoc test we conclude that players at pivot position are statistically significantly different then all players at other different positions in values for variables Power and Velocity. Average values of pivots were less than average values of other players.

Table7. Variance analyses for explosive strength of lower limbs

		Sum of Squares	df	Mean Square	F	Sig.
Height (cm)	Between Groups	102,54	3	34,18	1,24	,315
	Within Groups	716,12	26	27,54		
	Total	818,67	29			
Power (W/Kg)	Between Groups	35,63	3	11,88	,16	,920
	Within Groups	1888,53	26	72,64		
	Total	1924,17	29			
Force (N/kg)	Between Groups	,71	3	,24	,02	,995
	Within Groups	268,97	25	10,76		
	Total	269,68	28			
Velocity (cm/s)	Between Groups	4160,84	3	1386,95	1,06	,384
	Within Groups	34101,02	26	1311,58		
	Total	38261,87	29			

Based on results of variance analyses we conclude that there is no difference in value of variables for explosive strength of lower limbs between players which are playing at different playing positions.

DISCUSSION

Based on analyses of tables in which are shown differences in explosive strength of upper limbs between players at different playing position and variance analyses and LSD pos hoc test, we conclude that players at pivot position are statistically significantly different then all players at other different position in values for variables Power($p \leq ,00$)and Velocity (back player $p \leq ,00$), wing player ($p \leq ,02$), goalkeeper ($p \leq ,01$). Average values of pivots were less than average values of other players.

Looking at the game play of players at pivot position, it is evident that their game is based on the occupation of space, while using largely static muscle strength, especially the muscles of the lower extremities. Goal shots are with very little start-up of the body and arm swing, shots are accurate and surprising for the goalkeeper, and distance between pivot player and goalkeeper are usually short. All of the above gives right to conclude that pivot players are statistically different in the above-mentioned variables, primarily because they need to provide space for themselves by using muscle strength of lower extremities. Nevertheless, close goal distance from position, from pivot player does not explicitly require strong shot, it requires precise and lucid shot on goal.

The analysis results in table which shows the results of the variance of explosive strength of the lower extremities, leads to the conclusion that there are no differences in values of variables for explosive strength of lower extremities between players which are playing at different position.

One of possible reasons for non existing of statistically significant differences in explosive strength of lower extremities at different playing positions is age of participants, but before everything length of training process in handball where they still did not manage to develop their specificity based on playing positions. Experience and practice are telling us that in longer training process players themselves will „run“ in their specificity all because of better usage of their

physical abilities, together with element correlation, technique and tactic of handball game.

CONCLUSION

If we observed this research which is deducted on this sample as isolated whole, we come to conclusion that the selection of tested players satisfactorily carried out, according to their mental and physical abilities and body composition in relation to positions they play. Their previous training process shows us that the more attention was devoted to the general physical preparation, rather than their specific physical preparation based on the positions which they are playing in a team. Team was probably involved too early in competition system so coaches and trainers did not have enough time to devote themselves to specific need of each participants. In next period as many attention should be focused on diet, sport way of life and exercise plan and program for each player in the team, all in favor of achieving better results for each player at his own place in the team, and also for improving the success of the team in general.

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DIFFERENCE IN EXPLOSIVE STRENGTH BETWEEN ATHLETES AND NON-ATHLETES WITH FLAT AND NORMAL FOOT

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SUMMARY

Introduction: The aim of this study was to determine whether there is a difference in the manifested explosive strength of the lower limbs, determined by the implementation of the jump with a half squat, between the athletes and non-athletes of high school population with normal and flat foot.

Methods: The sample of subjects consisted of 240 high-school students, 16,67±4,21 years (Mean±SD), and was divided in two sub-samples: sub-sample of non-athletes (N=120) and sub-sample on athletes (N=119). Among non-athletes, there were 43 subjects of male and 77 subjects of female sex, while among athletes, there were 75 subjects of male and 44 subjects of female sex. Explosive strength of lower extremities, were determined by a wireless device Myotest (Sion, Switzerland), safely attached to a velcro belt of subjects, for the purpose of the vertical jump. All subjects performed five CMJ (countermovement jumps) without the arms' swing. Status of foot were determined by a modern computerized podoscope Podiart (Hungary) along with the appropriate software. Statistical method applied in this research to investigate the difference was t-test.

Results: Based on the t-test it can be concluded that subjects with normal foot and subjects with flat foot do not differ significantly in terms of average values of the explosive strength parameters, nor in the sub-sample of non-athletes, neither in the sub-sample of athletes.Simodiossita volor sitium id moluptiame nobisit et fugia dolor sediatemolo et facium restiaecus.

Conclusion: Although in previous chapter prevail studies, in which it is concluded that flat foot is not a disadvantage for successful sport performance, parents, health and education workers should be committed in prevention of possible future pain syndromes and injuries of the locomotor apparatus, with children in the period of growth and development, and work on strengthening of their muscles, tendons and ligaments of the foot.

Keywords: lower limbs, countermovement jump, status of foot

INTRODUCTION

In complex movements of human, foot represents a lever and surface with which it is possible to achieve a more effective movement. The pressure of the foot on the ground is not evenly distributed. According to footprints on a flat surface, it is obvious that the main areas of support are calcaneus, heads (distal part) of metatarsal bones and base (proximal part) of the fifth metatarsal bone. The major part of the overall pressure is related to the heel bone and the minor part to the forefoot. During the movement as well as, at various positions, that attitude is changing. Forefoot maximum load is not being on heads of the first and fifth metatarsal bones, i.e., on the outer edges of the distal portion of the longitudinal arch, but in the central area, i.e., on heads of the second, third and fourth metatarsal bones. This is supported by the fact that the first and fifth metatarsal bones are more mobile than other metatarsal bones.

These peripheral metatarsal bones move resiliently sideways during increasing pressure, thus performing two useful functions. First, the bearing surface of the frontal plane is increased, and second, by the same moving pressure depreciation becomes more effective. By the mentioned moving most of the pressure is transferred to the secondary metatarsal bone. It is one of the reasons why in case of the increased pressure, for which the mechanism of the

foot is not prepared, the middle metatarsal bones are being often broken. It is necessary to mention that this function of the metatarsal bones, especially of the first and fifth metatarsal bones, is a consequence of the need for a greater bearing surface; this is particularly emphasized when changing the direction of movement or moving in the curved line, when the foot is more reliant on the ground by its side edges, mainly at the front of the feet (Bubanj, 1997).

The function of the foot of a man is to by its firmness provide the locomotor apparatus a solid ground, and by its elasticity to enable amortization of the increased pressures, that is, to participate in resisting (reflection) by its elastic forces, when the mentioned pressures decrease (Bubanj, 1997). In its broadest sense, the foot comprises the two different shape and function arches, longitudinal and transverse ones. According to the mechanical function, the longitudinal arch is formed by two arcs, external and internal ones. The outer arc is formed by the calcaneus, cuboid bone and the fourth and fifth metatarsal bones. The inner arch is formed by ankle bone, navicular bone, three cuneiform bones of the foot and the first three metatarsal bones. The outer arch is stronger and lower, and the inner arch is more flexible and higher. According to such properties one determines also their functions. In the outer arch prevalent is the support function and in the internal arch prevailing function is that of depreciation. Longitudinal arch sustains the entire weight of the body. The most important connections that are part of the arch system are long plantar arch connections (lig. plantare longum) and plantar calcaneus navicular connection (lig. calcaneonaviculare plantare). In maintaining the longitudinal arch participate muscles whose tendons pass under the foot system and the metatarsus. The same muscles by their contractions increase the arch curvature. It is assumed that the long-leaf muscle is one of the main active holders of the longitudinal arch of the foot, because its paralysis causes changes in the foot that are characteristic for the flat feet (pes planus). Flat foot is described as the loss of the medial longitudinal arch of the foot, valgus deformity of the heel and medial talar prominence (Herring, 1990).

Muscular strength and power are important components of fitness essential for the execution of a variety of daily and sporting activities (Beunen & Thomis, 2004). Explosive strength is defined as the ability of the neuromuscular system to produce dynamic force rapidly in an open kinetic-chain movement, such as jumping, in which rate of force development is at or near maximum (Kinser et al., 2008). Countermovement jumps (CMJ) contain an eccentric and concentric phase that constitute a stretch-shortening cycle, and they are associated with many dynamic movements, including running, bounding, and tumbling. CMJ depend both on contractile elements and elastic properties of the muscle and connective tissue (Schmidtbleicher, 1992).

Flat feet, as a postural morphology, have long been associated with pain and disability and thus are often a concern to parents from a preventative perspective of their children's health and mobility (Evans, Nicholson, & Zakaris, 2009). Changes may occur during the embryonic development and may be the result of some rickets disorders that contribute to bone lesions and deformities. Acquired factors contributing to the emergence of flat feet are: excessive obesity in the developmental age of the child (Milenkovic, 2007; Bordin et al., 2001); rickets and rickets phenomena; atonic or flaccid paralysis of certain muscle groups of the lower leg or foot; various mechanical injuries or diseases; physical inactivity; hygienically unsuitable footwear (Milenkovic, 2007).

Studies have shown that the longitudinal arch develops spontaneously during the first decade of life, when it gets higher (Staheli, Chew, & Corbett 1987, Taussig & Pillard, 1987). However, according to Pfeiffer, Koty R, Ledl, T., Hauser, G., & Sluga (2006), children who start walking earlier also bear a risk factor to the occurrence of foot deformities. It is important to note that most people with flat feet confront almost no problems during their lifetime because of the abovementioned deformity. Individuals, however, develop clinical symptoms which can be divided into subjective and objective ones. We are certain to claim that both of them are important, regardless of their origin. There has been a suggested link between muscle strength and type arch of the foot. However, a distinct cause and effect dependence has yet to be established (Lysis, Posadzki, & Smith, 2010).

In this context, the aim of this study was to determine whether there is a difference in the manifested explosive strength of the lower limbs, determined by the implementation of the jump with a half squat, between the athletes and non-athletes of high school population with normal and flat foot.

METHODS

Sample of examinees

The sample of subjects consisted of 240 high-school students, and was divided in two sub-samples: sub-sample of non-athletes (N=120) and sub-sample on athletes (N=119), with body height 172,31±7,46 cm, body mass 65,27±10,58 kg, aged 16,67±4,21 years (Mean±SD). Athletes were engaged in different sport activities. Among non-athletes, there were 43 subjects of male and 77 subjects of female sex, while among athletes, there were 75 subjects of male and 44 subjects of female sex.

Sample of measuring instruments

Explosive strength of lower extremities, were determined by a wireless device Myotest (Sion, Switzerland), safely attached to a velcro belt of subjects, for the purpose of the vertical jump. All subjects performed five CMJ without the arms' swing. The sample of the variables, processed and mistreated by the device Myotest consisted of the: 1) CMJ height (HEIGHT, in cm); 2) power manifested upon occasion of CMJ (POWER, in W/kg); 3) force manifested upon occasion of CMJ (FORCE, in N/kg) and 4) subject velocity effectuated upon occasion of CMJ (VELOCITY, in cm/s).

By using a modern computerized podoscope Podiart (Hungary) along with the appropriate software, the following variables of the foot were determined: 1) normal foot (PESNOR); and 2) flat foot (PESPL).

Statistical analysis

For the statistical analysis and interpretation of the results, the statistical package SPSS version 11.0 was in use. Results were expressed by descriptive statistics, while in aim to calculate statistically significant difference in the explosive strength of lower extremities between subjects in relation to their sport activity and foot status, t-test was used (Pallant, 2007). Statistical significance was set at level $p < 0,05$.

RESULTS

Table 1. Descriptive statistics of explosive strength among non-athletes with normal foot and flat foot.

Non-athletes		Height in cm	Power in W/kg	Force in N/kg	Velocity in cm/s
PESNOR	N	71	71	71	71
	Mean	23,76	41,81	29,34	215,13
	Std. Dev.	5,90	8,33	3,43	26,46
	Min.	15,10	26,30	19,80	172,00
	Max.	42,20	67,40	36,60	289,00
PESPL	N	49	49	49	49
	Mean	23,92	42,98	36,35	214,73
	Std. Dev.	5,98	8,31	41,37	24,38
	Min.	11,50	21,40	21,10	183,00
	Max.	38,00	61,30	319,00	273,00

Table 2. Descriptive statistics of explosive strength among athletes with normal foot and flat foot.

Athletes		Height in cm	Power in W/kg	Force in N/kg	Velocity in cm/s
PESNOR	N	69	69	69	69
	Mean	30,41	46,61	30,58	231,30
	Std. Dev.	22,44	7,89	3,61	26,75
	Min.	14,90	24,80	21,80	171,00
	Max.	207,00	62,10	38,90	302,00
PESPL	N	50	50	50	50
	Mean	27,97	47,41	30,41	232,50
	Std. Dev.	6,51	9,17	4,01	28,28
	Min.	14,30	22,20	19,90	167,00
	Max.	38,70	68,00	37,50	275,00

Table 3. Kolmogorov-Smirnov test (120 non-athletes and 119 athletes).

	Height in cm	Power in W/kg	Force in N/kg	Velocity in cm/s
Non-athletes	,043	,300	,000	,123
Athletes	,000	,889	,977	,741

Table 4. Difference in explosive strength among non-athletes with normal foot and flat foot (t-test).

Non-athletes	PESPL	N	Mean	Std. Deviation	p
Height in cm	PESNOR	71	23,76	5,90	,885
	PESPL	49	23,92	5,98	
Power in W/kg	PESNOR	71	41,81	8,33	,451
	PESPL	49	42,98	8,31	
Force in N/kg	PESNOR	71	29,33	3,43	,157
	PESPL	49	36,35	41,37	
Velocity in cm/s	PESNOR	71	215,13	26,45	,935
	PESPL	49	214,73	24,38	

Table 5. Difference in explosive strength among athletes with normal foot and flat foot (t-test).

Athletes	PESPL	N	Mean	Std. Deviation	p
Height in cm	PESNOR	69	30,41	22,44	,456
	PESPL	50	27,97	6,51	
Power in W/kg	PESNOR	69	46,61	7,89	,611
	PESPL	50	47,41	9,17	
Force in N/kg	PESNOR	69	30,58	3,61	,809
	PESPL	50	30,41	4,01	
Velocity in cm/s	PESNOR	69	231,30	26,75	,815
	PESPL	50	232,50	28,28	

By application of Kolmogorov-Smirnov test, the postulate about normal distribution of data in sub-samples of non-athletes and athletes was tested.

Three measurements of totally 8 do not have normally distributed data, and that should not affect the credibility of the tests.

Based on the t-test it can be concluded that subjects with normal foot and subjects with flat foot do not differ significantly in terms of average values of the explosive strength parameters, nor in the sub-sample of non-athletes, neither in the sub-sample of athletes.

DISCUSSION

It is difficult to make a systematization of previous studies in which difference (or correlation) in exerted explosive strength between subjects with flat foot and those with normal longitudinal foot arch were determined (due to methodological differences, heterogeneity of the sample in relation to gender, age, body mass index, history of sport activities, test conditions, and other characteristics). However, prevail studies, given as follows, in which it is concluded that flat foot is not a disadvantage for successful sport performance:

Because the controversy about the relation of foot morphology and foot function is still present, Tudor, Ruzic, Sestan, Sirola, & Prpić, T. (2009) conducted a study, dealing with motor skills and athletic performance in flat-footed school children. They aimed to determine if there is an association between the foot flatness and several motor skills that are necessary for sport performance. The feet of 218 children aged 11 to 15 years were scanned, and the arch index was determined. The value of the arch index was corrected for the influence of age, and then the entire sample was categorized into four groups according to the flatness of their feet. The children were tested for eccentric-concentric contraction and hopping on a Kistler force platform, speed-coordination polygon (Newtest system), balance (3 tests), toe flexion (textile crunching), tip-

toe standing angle, and repetitive leg movements. Altogether, 17 measures of athletic performance were measured. No significant correlations between the arch height and 17 motor skills were found, i.e., no disadvantages in sport performance originating from flat-footedness were confirmed. Children with flat and children with "normal" feet were equally successful at accomplishing all motor tests. Thus, authors suggested that there is no need for treatment of flexible flat feet with the sole purpose of improving athletic performance, as traditionally advised by many.

Lizis, Posadzki, & Smith (2010) found any association between longitudinal arch of the foot with the explosive power of lower limb muscles among five hundred seventy-four young adults (n = 574) who participated in a study and were divided into three arch height groups and three muscle strength groups, respectively. The purpose of this study was to compare the outcomes from selected explosive strength tests with different medial longitudinal arch heights measured by using a Clarke's angle method.

Petrović, Obradović, Golik-Perić, & Bubanj (2013) conducted a study with a purpose to compare the differences in explosive strength related to foot type (flat feet and normal feet) in three different age groups. The status of the longitudinal foot arch was measured with the computerized digitalized Pedikom System. Explosive strength of the legs was measured by the Kistler force plate expressed in the squat jump, CMJ and continuous jumps with straight legs. Authors hypothesized that foot type therefore may alter the efficiency of such a kinetic chain and subsequently affect explosive strength. Three different populations of subjects were tested: 80 athletes (age 10±1), 60 adolescent athletes (age 15±1), and 164 students of the Faculty of Sport (age 20±1, Mean±Std.Dev.). All three age groups were divided into sub groups according to the measured status of longitudinal arch (Group A with presence of flat feet and Group B with normal feet). There were no statistically significant differences in the explosive strength of the legs between the groups. These findings suggest that flat foot is not a disadvantage in performing sport activities, but can certainly cause other postural deformities.

On the other side, Živković et al. (2014) conducted a study which included 114 elementary school children, all males, aged 11 and 12, divided in two sub-samples: the first consisted of children suffering from varying degrees of deformities of the foot, while the second consisted of children with normal arches of the feet. The purpose of this study was to compare the outcomes from explosive strength tests and speed running tests selected according to Kurelić (1975), with different medial longitudinal arch heights measured by using a Thomson's method. Children with normal arches of the feet achieved statistically significantly better results while performing explosive strength tests, while children suffering from varying degrees of deformities of the foot achieved statistically significantly better results while performing speed running tests. Results of motor tests for the evaluation of the explosiveness confirmed the significance of the muscles of the longitudinal arch of the foot and thus confirmed the lack of explosiveness of the participants suffering from this type of weakness. Never the less, once speed as a cyclical motor activity is analyzed, significantly better results were obtained by children suffering from flat feet, and this in turn led authors to consider the degree of significance of the muscles of the feet, their influence in activities such as running, in relation to the significance and importance of the muscles of the m. quadriceps femoris, m. biceps femoris, m. triceps sure or the flexors and extensors of the upper leg. According to authors, it is evident that afore mentioned muscles take on significant function in running, so that their function in cyclical movements of the lower extremities is more significant than the activity of the muscles of the feet.

CONCLUSION

Although in previous chapter prevail studies, in which it is concluded that flat foot is not a disadvantage for successful sport performance, parents, health and education workers should be committed in prevention of possible future pain syndromes and injuries of the locomotor apparatus, with children in the period of growth and development, and work on strengthening of their muscles, tendons and ligaments of the foot.

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BODY HEIGHT AND ARM SPAN AS ONE OF THE ASPECTS OF SELECTION IN HANDBALL

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SUMMARY

Introduction: The problem with this investigation is to determine the anthropometric characteristics, body height and arm span in the selection of handball.

Methods: The sample included 12 handball players of the senior national team of Montenegro who were on a narrow list of selectors in pre-season play-offs match for the World Championship against the national team of Belarus. The data obtained in this study were analyzed using statistical software v.SPSS 19.0 customized for use on personal computers. Descriptive statistical values are expressed in terms of the mean (AS) for each of the predicted variables, as well as the minimum and maximum values.

Results: When it comes to the national team of Montenegro, arm span by almost 6cm higher than body height and 4 cm higher when it comes to professional handball Serbia. But when it comes to handball Greece, among them the difference in favor of height. Towards this we can add that both Serbia and Montenegro participants last big competition of the European Championships in Denmark, which was held earlier this year, while the team Greece was not a participant in the last big competition.

Conclusion: From this, the conclusion is that the anthropological characteristics of great importance for the selection and successful engagement handball, and one of the main factors in the modality of top handball player who aims at achieving top sports results, is undoubtedly a range of hand and its differences with respect to body height, which was confirmed by our study on a sample of the senior men's national handball team of Montenegro.

Keywords: body height, arm span, handball teams.

INTRODUCTION

Handball is alternately highly intense sport that requires a combination of aerobic and anaerobic endurance to be executed by a sequence of coordinated and complex motor activities (Chelly, Hermassi, Aouadi, Khalifa, Van den Tillaar, Chamari and Shephard, 2011).This study is the determination of anthropometric characteristics on selection in handball. Modern trends in sports, especially premium, impose more than before and the quality of the wider problem of connecting different sports and science. Science is often used sport as an extraordinary "grateful" ground for research that went beyond the framework and needs of sport, and the sport turned to science in more of a current (or most current) needs, but on the basis of long-term programs and system approaches Handball game is characterized by specific requirements that in the foreground leading question about the importance of anthropometric characteristics of handball at the highest level of performance in the situational conditions. At the present stage, the selection is increasingly present in every sphere of human activity as well as in sports. For a successful and efficient selection of sport invaluable scientific research, analysis and study, which is result be directly applied in daily sports activities, and are based on scientific knowledge and experience, which are important in the development of the system of selection and preparation of elite sport and among others in handball.

METHODS

The sample included 12 handball players of the senior national team of Montenegro who were on a narrow list of selectors for the preparatory period barrage match for the World Championship against the national team of Belarus.

Sample measurement instruments: Body height was measured using a portable anthropometry, while arm span measured by centimeter tape.

Statistical analysis

The data obtained in this study were analyzed using statistical software v.SPSS 19.0 adapted for use on personal computers. Descriptive statistical values are expressed in terms of arithmetic mean (AM) for each of the predicted variables, as well as the minimum and maximum values.

RESULTS

Table 1. Basic descriptive statistics that describe the values of the mean body height and arm span as well as the maximum and minimum results of the senior national handball team of Montenegro.

Number of respondents	Variables	Mean	Min	Max
12	Body height	189,3	179	197
12	Arm span	195	182	205

Basic descriptive statistics are shown in Table 1, as the number of subjects, the mean and the maximum and minimum value.

Table 1. shows the basic statistical parameters of the anthropometric characteristics of height and arm span in the senior national handball team of Montenegro. In a paper published (Bjelica, Popovic, Kezunović Petkovic, Jurak, Grasgruber, 2012), the Montenegrin nation's second-order highest nation after the Netherlands in Europe. Average height of the population in Montenegro on a sample of 285 patients was 183.2 cm, while the population of the Netherlands, average height is 183,8cm. When it comes to the range of hands in this population in Montenegro according to (Bjelica, Popovic, Kezunović Petkovic, Jurak, Grasgruber, 2012), the average score was 185, 7 cm. Analyzing the results in Table 1 it can be concluded that there is visible difference between arm span in relation to body height 5,7cm representing bitaan factor in the selection of top-quality handball.

DISCUSSION

The selection is the first link in a qualified professional work and successful selection of promising high sports achievements, more than any other form of investment in working with athletes. Selection for superior results imply the synthesis of high competitive capabilities and stable sports personality, because it achieves the best results in high-level competitions. (Karišik, Goranocic, Valdevit, 2011) on a sample of 120 handball players premier and first division of Bosnia and Herzegovina received an average body height 188,5cm, and the same measurements and the average arm span 191,8cm. It is interesting to note that despite the fact that the latest IHF (International Handball Federation) rankings team of Bosnia and Herzegovina is the only position 75, they managed to vote plasaman the World Cup which will be held next year in Qatar, which confirms that In recent years a very serious approach to work and selection younger ages. (Oxyzogou, Ore, Rizos, 2012) in a sample of 21 th professional handball players in Greece and 20 professional handball Serbia also measured body height and arm span as an important factor anthropological characteristics for successful selection of top handball. When it comes to professional handball Greece, the average height is 186,5cm, and the average range of hand 185,4cm, while body height Serbian handball team 192,5cm, a range of hand 196,5cm. As indicated in Table 1 when it comes to the national team of Montenegro, arm span by almost 6cm higher than body height and 4 cm higher when it comes to professional handball Serbia. But when it comes to handball Greece, among them the difference in favor of height. Towards this we can add that both Serbia and Montenegro participants last big competition of the European Championships in Denmark, which was held earlier this year, while the team Greece was not a participant in the last big competition.

CONCLUSION

The subject of this research are body height and arm span as one of the important aspects of selection in handball. The selection includes many aspects (anthropological, methodological, psychological, educational, social) that exceed the value of competing goals. From the above, our conclusion is

that the anthropological characteristics of great importance for the selection and successful engagement in handball, and one of the key factors in the modality of top handball player who aims at achieving top sports results, is undoubtedly a range of hand and its difference from the body height, which was confirmed by our study on a sample of the senior men's national handball team of Montenegro.

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ADAPTATION RESEARCH OF NEUROMUSCULAR APPARATUS OF ATHLETES SPECIALIZING IN SPEED-STRENGTH SPORTS

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SUMMARY

The paper shows the current research problems in the theory and practice of the training process, functional state of the neuromuscular apparatus of the athletes and the training load in different periods. This relationship was the basis for assessing the degree of adaptation of the neuromuscular apparatus athletes to stress.

Keywords: Adaptation, neuro-muscular system, functional diagnostics

INTRODUCTION

In sports practice attaches great importance to the evaluation of the adaptive state of the athletes in preparation for competition. Typically, this condition is determined by: the diagnosis of muscular activity, assessment of the level of the functional state of physiological systems and functions of the body at rest and in response to the load. According to Ilin (2003) recognition of logical states in athletes should include a comprehensive assessment of the functional state of the organism with the concepts of functional reserve. The purpose of preclinical diagnosis is to identify the border state between normality and pathology, to find quantitative criteria for assessing an individual's health, which differs from the disease. Every norm has its own reserves, and in its preservation of the important role played by individual adaptation. This means that the body is one and the same person under different conditions will behave differently.

The problem of individualization of training process of the qualified athletes is the key to the theory of sports training. The essential component of management is a constant correction of the process of preparation of athletes depending on the dynamics of their individual condition, which is determined on the basis of objective information obtained in the course of teaching complex control (Bashkin & Kabanov, 2013). Dosage muscular load in accordance with the adaptive capacity of the organism, to take corrective action in a timely manner will allow individual loads (Bashkin, 2011).

The aim of the study was to determine the relationship between changes in the functional state of the neuromuscular apparatus athletes performed as a response to the training load.

METHODS

The study was conducted on the educational training sessions with members of the team SAC and St. Petersburg in athletics. In the planned training load included: training load with weights (squats with weights, jumping with weights, slopes with weights, strength training), the number of rejections in jumping exercises (jumps, jumping, jumping from a place and at a run) and running exercises expressed kilometers (acceleration running start for the Springboks in length, short sprints, acceleration to 100 m, accelerating from 100 to 300 m).

To accomplish the task program has been developed with the help of a survey of athletes of integrated control. The tests, which evaluated the functional state of the neuromuscular apparatus (HMA) athletes were compiled based on objective factors which are most fully and fairly reflect the functional state of the NMA (indicator of muscle elasticity, speed of muscle contraction). Index of

elasticity of muscles (the degree of fatigue) was determined using seysmomiotonografii, speed of muscle contraction using the method of selective electromyography.

RESULTS

Investigation of the rapidity of muscle contraction in response to changes of the training load

The method of selective electromyography (Bashkin, 1989) was used to determine the speed of muscle contraction. Electromyography provides information on the work of the muscles directly during exercise. Electromyogram was shot with flat skin electrodes with the gastrocnemius and rectus femoris during the training process immediately after a workout. As the cyclic load was chosen to run 20 meters to move as fast as possible. Interference EMG was shot with two sensors mounted on the investigated muscles. The data obtained from all subjects were summarized in Table 1.

Table 1. The functional condition of the gastrocnemius muscle and the rectus femoris, depending on the on-time T

Number p / n	m. gastrocnemius (ms)	m. rectus femoris (ms)
1 Great	100-110	140-160
2 Good	111-130	161-180
3 Weak fatigue	131-150	181-200
4 Average fatigue	151-180	201-230
5 Severe fatigue	181-210	231-260

The functional state of the muscles, depending on the time of inclusion of the muscles was assessed as excellent for the gastrocnemius muscle at T = 100-110 ms, for the rectus T = 140-160 ms, as good for the calf muscles at T = 111-130 ms, for the rectus femoris at T = 161-180 ms, weak calf muscle fatigue for at T = 131-150 ms, for the rectus femoris at T = 181-200 ms and severe fatigue at T = 151-180 ms and T = 201-230 ms, respectively .

Study of the elasticity of muscles when you change the training load

Estimation of the rate of muscle contraction was performed in terms of the elasticity of the gastrocnemius muscle, the direct and the biceps femoris. For this study, we used the method seysmomiotonografii (Anishkina & Antonets, 2000). This method evaluated the mechanical properties of muscles in terms of elasticity. As an index of elasticity we took frequency mechanical vibrations resulting dosed blow to the abdomen muscles. Testing was conducted before a workout for the entire survey period. The data obtained for each studied muscle built graphics index of elasticity, which reflect changes in the vibration frequencies of the muscles in the afternoons. The findings were summarized in Table 2.

Table 2. Change in the elasticity depending on the functional state of the muscle

Number p / n	Muscle elasticity index in Hz
1 Great	29.0-31.0
2 Good	31.1-33.0
3 Weak fatigue	33.1-35.0
4 Average fatigue	35.1-37.0
5 Severe fatigue	37.1-41.0

CONCLUSION

These studies have provided evidence of change in the index of elasticity of the muscles and the muscles on time for each subject the athlete for a long period of training (up to five months).

We investigated the relationship between the parameters that determine the functional state of the neuromuscular apparatus athletes (rate elasticity of muscles - F while the inclusion of muscles - T) and the change in training load and found a correlation between them. Identified by average total correlation coefficients between the parameters determining the functional state of the athletes and the training load: exercise with weights, $r=0.812$ at $0.01<p<0.05$, jumping exercises, $r=0.793$ at $p>0.01$, running exercises $r=0.732$ at $p<0.05$.

The studies were conducted on athletes of various skill levels and found varying degrees of adaptation to training loads. It was determined that with the advanced training of athletes reduced turn-on time of the muscles and reduces the value of the index of elasticity of the muscles.

The resulting correlations were the basis for the development of model performance changes in the functional state of sportsmen and the period of adaptation according to the execution of the training load. Response of an athlete (the degree of adaptation) should correspond to the characteristics of the model training process.

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A COMPARATIVE ANALYSIS OF HANDBALL TACTICS IN SERBIA, GERMANY AND SPAIN

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SUMMARY

The aim of this paper is to highlight specific characteristics of team handball in Serbia, Germany and Spain using comparative analysis of tactics. Handball tactics can be defined as the deliberate and planned activity of an individual, a group of players or a team, the purpose of which is to predict some particular situation during the game or to predict the entire course of the game and relying on that prediction to find the best solutions. Germany and Spain are two countries with the best handball leagues, so the characteristics of the tactics used in these leagues may represent the model of success in team handball, which gives this study a special significance. For many years has Serbia dominated the global and the European handball scene and a large number of Serbian coaches and players has significantly influenced the development of team handball in Germany and Spain. Among other things, this paper studies the analysis of their impact on the development of team handball tactics in these countries.

Keywords: handball, team handball, tactics, handball league.

INTRODUCTION

Team handball is a modern and very popular game in our country and the rest of the world. This is the reason why it makes part of the Olympic Games program in both, male and female competitions. It is a very dynamic, attractive and interesting game with a ball, which implements continuous alternation of offense and defense phases, while both teams play in an active and organized manner in order to achieve victory.

During more than a hundred-year long history of this game, the offense has always been given more attention than to the defense. Nowadays, tactics is completely different and much more attention during the training process is devoted to preparation of the defense tactics. Analyzing and comparing contemporary team handball and team handball during its first ten years of existence, it can be concluded that great progress has been made in the field of physical, technical and tactical approach to the game. Thirty years ago, a 190 cm tall player was one of the tallest players on the court, but today this is the minimum required height for a good backcourt player.

Serbian coaches and handball experts made a big contribution to the modernization of this sport throughout the world. Yugoslavian team handball school is famous and our clubs have participated in all European cups' finals, as well as our national team, which achieved remarkable results in the Olympic Games, European and World Championships.

In the initial phase of learning, a handball game is very simple and each individual quickly understands and implements it. This game, with all its rules, requirements and content, suits most of the population in terms of its anthropometric dimensions of people. It influences and develops all personal psychomotor and intellectual characteristics and it is almost ideal sport for the purpose of comprehensive development of young people.

PREVIOUS RESEARCH

One of the first authors in former Yugoslavia that started dealing with the issues mentioned above was Pavlin. He wrote the "The team handball technique and tactics" script. This script, intended for students of faculty of sport and physical education, among other things, also discusses defense playing systems.

In the year 1982 in Zagreb, a book written by two authors, Tomljanović and Malić (1982) and titled "Team Handball - Theory and Practice" was published. In the chapters "Offense playing tactics" and "Defense playing tactics" of this book, various systems of playing the defense are treated in detail, as well as the methodical procedure for coordinating different systems of offense and defense.

Later on, Momčilo Pivač published a textbook named "Team Handball – Tactics" (1997), analyzing offense and defense tactics, as well as the most important playing systems in detail.

In the book named "Handball" (1978), in addition to a detailed analysis of the technique training of team handball players, Ion Const Germanesku reviewed a new and at that moment contemporary approach to applying zone formations.

A large number of researches has been published on the European Handball Federation (EHF) seminars. One of the most prominent EHF lecturers is our famous national team player and coach Branislav Pokrajac. In his studies he analyzes offense tactics, offense philosophy, defense tactics and also a playing style of certain national teams participating in European and World Championships in team handball.

THE OBJECT, THE PROBLEM AND THE GOAL OF THE RESEARCH

The object of this study is the tactics in team handball. Tactics in team handball could be defined as the conceived and planned activity of an individual player, a group of players or an entire team, whose purpose is to predict a particular situation during the game or the entire course of the game and to find the best solutions based on this prediction (Pivač, 1999).

The problem of the research is tactics in three different countries: Serbia, Germany and Spain.

The goal of the research is to highlight specific characteristics of team handball tactics in Serbia, Germany and Spain, using its comparative analysis.

THEORETICAL REVIEW OF THE PROBLEM

Team handball enjoys huge popularity in Germany and we may definitely say that it is the second most important national sport, right after soccer. German Handball Federation is the largest national team handball federation in the world, which experienced the expansion particularly in the last ten years. Its popularity reached its peak in 2007, when the German national team won the gold medal for the third time, beating Poland in the World Championship final in Cologne, on February 4th, 2007. Previously, the German national handball team won the World Championships in 1938 and 1978. Our famous handball coach - Vlado Štencl was largely responsible for this particular success in 1978. He took over the bench of the German national team after winning the gold medal with the national team of Yugoslavia in Munich, in 1972. From the very beginning, he had enjoyed great popularity and respect of the German federation and the media. After spectacular victory of Germany against the favored Soviet Union (20:19) at the World Championships in Copenhagen in 1978, he was given nicknames such as: "the wizard" and "the king of Copenhagen".

Good conditions for practice and the organization of matches have also contributed to the large number of young people being engaged in handball clubs throughout Germany. Out of this wealthy training base some of the most successful team handball player of international stature sprung. To begin with Heiner Brand, continuing with Volker Zerbe, Christian Schwarzer, Torsten Jansen, and Stefan Kretzschmar to Michael Kraus. One of the major preconditions for the massification of team handball in Germany was also an exceptional sports infrastructure. Several major clubs moved from small sports halls to very modern multifunctional sports halls that were prepared to receive large number of supporters.

In addition to the success of the national team, German team handball achieved some really good results in the club competitions as well. In 2007, three German clubs won some of the European club competitions: "THW Kiel" won the EHF Champions League, "SC Magdeburg" won the EHF Cup and "HSV Hamburg" won the European Cup Winners' Cup. These achievements justified the epithet of the world's best handball league, which was attributed to the German Bundes League a long time ago.

The main characteristic of the team handball in Germany is an outstanding physical condition of players on all playing positions. They upgrade their anthropometric characteristics and physical capacities continuously working on the development of motor skills that are defined as predictors of success in team handball. Those motor skills certainly are: strength, speed and endurance. Good

physical preparedness of players resulted in applying the specific game tactics in the German clubs, in both offence and defense. One won't see the richness and the variety of tactical combinations there. The game play is mostly based on individual and group actions. Tactical combinations that include all players (team tactics) are very rarely prepared. Crossing and dragging combinations between backcourt offensive players and creating overload situations at the wing player position are usually applied in the attack to quickly create favorable situation to shoot. Left and right backcourt offensive players are generally considerably tall, capable of extremely powerful shot from the distance of more than 9 meters. Pascal Hens, Holger Glandorf and Michael Müller are considered to be the most successful players in this position. Backcourt offensive players also seek to achieve the shot from the positions nearer to the opponent's goal by feinting in the situations 1-on-1. It is not rare that the number of goals at the end of the game is extremely elevated, as a consequence of relatively short attacks and very frequent shooting at the goal. Regarding the game play of wing offensive players, they usually wait for the creation of overload situation to achieve the largest possible angle for a shot at the goal. We can say that the most effective tactical tool of the wing offensive players' game play is a fast-break. In Germany, wing offensive players (speed is the main characteristic of wing offensive players in the whole world) have extraordinary sprinting capabilities and they initiate fast-breaks running just after the moment of conquering the ball in defense. Very successful German wing offensive players are Stefan Kretzschmar (currently a former player), Dominik Klein, Torsten Jansen and Florian Kehrmann.

If we analyze the defensive tactics, we can observe that the most frequently used defensive formation is 6-0 formation. This defense formation is known to be flat and wide and the easiest way to overcome it is shooting from the backcourt positions, from a distance of over 9 meters. However, the way the 6-0 zone defense is being played in Germany is very specific, characterized by defensive players deeply going out of the zone to prevent shots by fouling. We can say that German players play the 6-0 defense with a touch of individual man-to-man defense. Considering the fact that most German clubs have extremely tall players (approximately 2 meters of body height), blocking is frequently used as a defensive tool. Quick wing offensive players sometimes get defensive assignments as the forward defensive player in the zone 5-1 formation or in a combined defense formation 5 + "Indian".

Team handball is a sport which has a great number of sympathizers all over Europe. A large number of European countries has national professional competitions with high level of quality. However, two of them are obviously on somewhat higher level than the others. These are German Bundes League and Spanish Asobal League, the latter having some of the most successful clubs in Europe, such as Portland San Antonio, Barcelona and Ciudad Real.

As a confirmation of the quality of Spanish clubs serves the fact that in the last 15 years Spanish clubs participated in all the final stages of the EHF Champions League almost every year. The Spanish national team did not have as much success. Spanish national team won two gold medals at the World Championships in Tunisia in 2005 and in Spain in 2013, three silver medals at the European Championships in 1996, 1998 and 2006, three bronze medals at the Olympic Games in 1996, 2000 and 2008, and one bronze medal each at the World Championships and European Championships in 2011 and 2014. In the recent years the Spanish national team has been playing with more confidence, while other national teams see them as one of the favorites.

Handball game tactics in Spain is very rich and diverse. Numerous coaches from former Yugoslavia and the USSR, who brought with them huge tactical knowledge and experience, probably gave great contribution to this diversity. This is owed to the fact that they came from the countries which, in as far back as the seventies and the eighties, had a quality handball school and a lot of success on the international handball scene. It is not uncommon that the Spanish teams have from 10 to 15 pre-prepared actions, initiation combinations. This permits a very good tactical outplaying and finding the right solution against various types of defenses. This should not be considered as reducing handball to narrow tactical schemes, but rather as a great possibility for organizing extraordinary team and individual actions, while expressing some superior technical abilities of the players. When it comes to the characteristics of defense tactics, the Spanish mainly perform the classical 6-0 defensive formation, just slightly going out of the zone in the direction of the offensive player with the ball. What can frequently be seen is the transition from 6-0 to

5-1, while there are teams, such as Ciudad Real that along with Barcelona has been one of the most successful Spanish teams, which plays the 5-1 defensive formation throughout the season. This defensive zone formation is characterized by five defenders distributed on the 6 meters line and one forward defender at 7-8 meters distance from the goal. This defensive players' layout offers a possibility to prevent the offensive combination by constantly blocking the principal organizer of the team's attack, trying to intercept or steal the ball. In most cases, the offensive players are forced to withdraw from the zone of active attack. The player who plays at the forward position in the defense formation has to be one of the fastest, most agile and technically and tactically well-prepared. He bears a large load of work: attacking the central backcourt player and staying with him, regardless of whether the ball is in his possession or not. We should not forget that the main task of the forward defensive player is ball interception.

Ciudad Real was the club whose playing tactics has been largely influenced by an ex-player, currently working as a coach - Talant Dujshebaev. He is a Kyrgyz, a representative of the Russian handball school. He won the gold medal on the 1992 Summer Olympics, being the captain of the Unified Team (EUN). A year later he became the world champion with the national team of Russia. In 1995, he was granted the Spanish nationality and playing the central backcourt position became the main organizer of the Spanish national team game play. In June 2005, he stopped playing actively handball and resumed his sports career as a coach. However, during the season 2006/2007, due to the injury of the main organizer of Ciudad Real's game play, Slovenian Uroš Zorman, Dujshebaev returned to the court and led his club to winning the European Super Cup, and after that of the national championship. What also characterized Ciudad Real's game play was the ability to constantly change the pace of the game. Their tactics, for which German clubs were unable to find an adequate response, was slowing down the offensive game play, good preparation of the finish of the offensive combination and finally sudden and rapid solution, ending with the shot on the goal.

Intensive practice of handball and big efforts on its popularization in the former Yugoslavia began soon after the end of the World War II. Thanks to its dynamism, attractiveness and collectiveness, handball quickly conquered a large number of young people. At the beginning, there were no elaborated tactical systems, neither in defense, nor in the offense. There has been a great extent of improvisation, including the dominance of individual technical and tactical skills and physical preparedness. The success of a team depended mainly on the game play and the level of knowledge of one or two players in the team. This kind of practice did not last long. As soon as ten years later, professional trainings started to be organized for coaches, who developed clearer idea of systems and variants of game play in attack and defense. The development of handball in former Yugoslavia took place under the strong influence of Romanian, German and Soviet school of handball. The quality of work and dedication to the practice resulted in the first important title for our national team. In the year 1972 in Munich, the national team of Yugoslavia won the gold medal. This medal gains a special luster, if we think of the fact that this was the first time that a small handball has been included in the program of the Olympic Games. Winning this gold medal made Yugoslavian handball become a role model for others. Innovations in attack and defense game play, introduced to the game by our national team, started being adopted by others, even by those who we have learned from before. Since that period until recently, our handball has played a significant role in both, men's and women's competitions. During the last fifteen years, our national team could not boast of great success just until 2012, when it reappeared on the European scene by winning a silver medal at the European Championships held in Serbia. Earlier important result has been the conquest of the bronze medal at 2001 World Championships in France, and also winning the bronze medal at 1996 European Championships in Spain before that. Regarding the success of our clubs on the international handball scene, *Metaloplastika* Šabac had the most of it by winning the Champions League in 1985 and 1986. During this period *Metaloplastika's* players constituted the backbone of the Yugoslavian national team that won the gold medal at the Olympic Games in Los Angeles in 1984. Players that even today continue being famous are: left wing player Mile Isaković, left backcourt player Veselin Vujović, central backcourt player Milan Kalina, right backcourt player, Jovica Cvetković and Aleksandar Kuzmanovski, pivot Veselin Vuković and the goalkeeper Mirko Bašić. At that time Metaloplastika team was famous for 3-2-1 zone defense, which represented the trademark of the Yugoslav national

team. This type of defense was introduced by our famous handball expert – Vlado Štencl in 1972, where he won the gold medal at the Olympic Games in Munich as a leader of national team of Yugoslavia.

Since many of our handball players from the eighties work now as coaches in Spanish and French clubs, this zone defense type started to be played effectively in those regions. This zone defense equally satisfies all the defense principles: the principle of width, depth and density. It belongs to the group of deep zone formations and it is the only representative of three-line-zone defense formation.

Even though the 3-2-1 defense formation provided us with medals at all the major international competitions, nowadays this defense is not being played in such a large scale anymore. The main reason for this is that it is the most demanding defense formation which causes that generally just a small number of couches dispose of enough time and will to deal with it (Pokrajac, 2010). Nowadays, Croatian national team usually opts to defend in 3-2-1 zone formation and due to this fact it has had a lot of success during the last years. French national team should also thank its often applied 3-2-1 defense formation for the results achieved in the last ten years.

When it comes to the offense tactics, sound team play that engages a greater number of offensive players is still being nurtured in the Serbian handball. The transition of the wing player entering from his position to the position of pivot and attack organization with two pivots can often be seen. This represents one of the basic tactical variants that imply initiating the attack with one pivot (three backcourts and two wings) and then, during the same attack, one of the players penetrates to the 6 meters line acting as a second pivot. In this manner, attacking team creates a tactical problem to defending players by testing their ability to adjust to this change and by obligating them to find an adequate response to the offense with one and with two pivots, during a single attack. If this transformation of playing with one pivot to playing with two of them does not give a positive result, the player that entered the position of the second pivot goes back to his original position and the attack continues. The main idea of this kind of attacks is not trying to make this play once and see if it produces a positive result or not. This can only happen occasionally. The main idea is that, during a single attack, the attacking team combines several different combinations with one or with two pivots. This represents a strong tactical blow that brings the defending team into a very difficult situation, especially if it is not always the same attack player that transforms to the position of the second pivot.

We may say that today there is nothing there that could be said to represent any special quality of Serbian handball. We refer to the tactics that made us successful in the past. Modern tactical combinations require extraordinary physical preparedness of players, which, we must admit, is not one of the qualities that could generally be noted in our players lately. Our best players are generally being contracted by clubs in European leagues with better quality (Spain, Germany). There is no recognizable style of game play in the national team that we had in the eighties, while frequent changes of national team coaches contribute to discontinuity of preparation of our best players' selection.

CONCLUSION

This paper is an attempt to analyze tactics of handball game play in Spain, Germany and Serbia, giving us an insight into the similarities and differences between the ways handball is played in these three countries. Is it really possible to speak of the differences in tactics in times when information flow is large and fast, when it is so easy to simply get a good insight into the playing style of any team in Europe or in the world, and perhaps even "copy" some tactical variant? This could be the subject of a different discussion. I believe that once there may have existed very pronounced differences between national handball schools; however, the fact that coaches leave to work in the clubs abroad and the frequent international seminars hosted by the European Handball Federation (EHF) have largely contributed to the approximation of handball techniques and tactics among countries. The most successful teams use similar tactical combinations in attack and defense today. In Spain, Germany and Serbia, the most frequent defense zone system is the 6-0 formation that is played very aggressively with obligatory collaboration of all players. Teams are generally prepared to implement two or three different defense formations. Just in the rare cases, when a team chases the result, they decide to use *man-to-man* and *pressing* defenses. Attack is played quickly, dynamically and with elevated rhythm. Players move and attack towards the goal, even when they don't hold the ball in their hands.

Finally, based on the personal experience as a player and many years of playing in the most successful handball leagues of Europe, I should certainly be able to point out the most important characteristics of a successful team (model of success in handball). I believe that there are no big differences between the top clubs, neither in terms of tactics, nor in terms of technical preparedness of players. It is very often said that "anybody can win anybody" and this really is true. A lot of things depend on the mental power of the team, and only 1 or 2 attacks may determine the winner. Just a few small details characterize the best European clubs. They include: improved shot efficiency, good defense, few committed fouls less and a couple of more defensive blocks. We can say that the secret of success is in as simple a game play as possible, accompanied with good finishing realization.

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JUMPING ABILITIES OF VERTICAL AND HORIZONTAL DIRECTION IN BASKETBALl

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SUMMARY

Introduction: The aim of this study was to determine the impact of vertical to horizontal jumping abilities of 19 basketball players from BC Konstantin in Nis (Serbian Basketball League, Super League of Serbia), from 18 to 30 years old.

Methods: For estimation of high jumping abilities vertical jump from running with one foot take-off, Abalak – Bosco jump, countermovement jump and squat jump were used, while with the standing long jump, triple jump and the triple jump on one leg horizontal jumping abilities were determined. For determining the parameters of explosive leg strength of vertical direction, "Myotest" - Myotest Performance Measuring System and Tensiometer contact platform (Quattro Jump) were used, while the horizontal type of explosive strength was determined by measuring tape.

Results: Canonical correlation and regression analysis led to results indicated a statistically significant correlation between vertical and horizontal type explosive leg strength with top basletball players.

Conclusion: Vertical type of explosive leg strength of top players really significantly affected the manifestation of a horizontal direction and thus it confirmed the link between these two areas.

Keywords: Explosive leg strength, jumps, top basketball players, Myotest, Quattro Jump.

INTRODUCTION

Basketball is a dynamic sport characterized by complex structures of movement and the successful engagement requires a specific motor skills such as accuracy, speed, agility, explosive power. Taking into account that the basketball goal is elevated to the height, there is the fact that players with increased levels of explosive leg strength are in advantage.

This sport game is one of those games that are exposed to very frequent changes in training methods, which is caused by changes in game rules, and there has been intensification of all forms of movement. Players have become faster, stronger, more explosive, more agile (Čvorović, 2010). For developing of explosive strength as one of the most important motoric skill various forms of training are used. However, recently, there is one specific and relatively well-accepted form of the development of this ability, SAQ method. It consists of a combined speed training, agility and quickness. Given the versatility required from the players in modern basketball, this method is very effective in working with basketball players.

Otherwise, the explosive strength as a dynamic strength is the ability to manifest the maximum strength for maximum short time (various jumping, running at 100m and 200m, sport games, hits in martial arts). It is genetically conditioned by about 80%. The best results are obtained from 18-22 years old, and from 28, it starts to decrease.

This study compared two types of explosive leg strength in basketball players, of vertical and horizontal directions. The assumption is that two mentioned types are interrelated and significantly influenced by each other. The aim of this study was to determine the impact of vertical to horizontal jumping abilities of 19 basketball players from BC Konstantin in Nis (Serbian Basketball League, Super League of Serbia), from 18 to 30 years old.

METHODS

Sample of examinees

The study was carried out on a sample of 19 basketball players from BC Konstantin in Nis (Serbian Basketball League, Super League of Serbia), from 18 to 30 years old.

Sample of measuring instruments

To estimate vertical jumping abilities four tests of which three had a higher number of parameters were used: *high jump from running with one foot take-off* (HJ1), *Abalak – Bosco jump* (ABJ(h) - height, ABJ(P) - power, ABJ(F) - force and ABJ(v) - speed), *countermovement jump* (CMJ(tE) – time of eccentric contractions, CMJ(pikE) - maximum (peak) of eccentric contractions, CMJ(tK) – time of concentric contractions, CMJ(pikK) - maximum (peak) concentric contraction) and *squat jump* (SJ(s) – time of concentric contractions, SJ(kg) - maximum (peak) of concentric contraction).

For the assessment of horizontal jumping abilities the following tests were used: standing long jump (LONGJ), triple jump (TRIPL) and triple jump on one leg (TRIPL1).

All used tests were taken from the site Topend Sports http://www.topendsports.com/testing/tests/hop.htm).

For determining the parameters of explosive leg strength vertical type "Myotest" - Myotest Performance Measuring System (wireless accelerometer for assessing the intensity of explosive muscle strength) and Tensiometer contact platform (Quattro Jump) were used, while the horizontal type of explosive strength was determined by measuring tape.

Statistical analysis

Data processing was performed with statistical package Statistica 7.0, and canonical correlation and regression analysis were used.

RESULTS

Table 1: *Canonical correlation analysis of vertical and horizontal jumping abilities*

	Can.R	Can.R^2	Chи-sqr.	df	p
0	.997	.995	71.55	33	.000**

Canonical correlation analysis

There was a single significant canonical correlation of vertical and horizontal jumping abilities of basketball players (Table 1) at the level of p <.01, explained by the size of the canonical correlation coefficient (Can.R = .997), which turned into a significant function amounts p = .000. The coefficient of determination (Can.R^2 = .995) explains the percentage of relation of two systems, and the impact of vertical to horizontal jumping abilities is 99.5%. The strucure of canonical factors (Table 2) for the vertical jumping abilities shows that the definition of the factors is the most affected by high jump from running with one foot take-off (HJ1 - 0.51), speed of Abalak - Bosco jump (ABJ(v) -0.43) and time of concentric contraction of squat jump (SJ(s) -0.41), while the horizontal jumping abilities are the most affected by triple jump (TRIPL -0.94).

It is noted that there is one general factor explaining the success of horizontal jumping abilities of basketball players.

Table 2: *Canonical factors*

	Root 1		Root 1
HJ1	-0.51	LONGJ	-0.90
ABJ(h)	-0.10	TRIPL	-0.94
ABJ(P)	-0.27	TRIPL1	-0.12
ABJ(F)	-0.12		
ABJ(v)	-0.43		
CMJ(tE)	-0.18		
CMJ(pikE)	0.12		
CMJ(tK)	-0.14		
CMJ(pikK)	-0.08		
SJ(s)	0.41		
SJ(kg)	-0.33		

Regression analysis

Table 3: *Regression analysis of vertical and horizontal jumping abilities*

	LONGJ	TRIPL	TRIPL1
HJ1	**.002****	**.007****	.496
ABJ(h)	.590	.721	.421
ABJ(P)	.609	.698	.102
ABJ(F)	.067	.026*	.772
ABJ(v)	.733	.289	.606
CMJ(tE)	.736	.577	.503
CMJ(pikE)	**.008****	**.003****	.733
CMJ(tK)	.165	.080	.863
CMJ(pikK)	.668	.086	.863
SJ(s)	**.003****	**.001****	.616
SJ(kg)	.508	.839	.955
Q	**.005****	**.004****	**.775**

Results of regression analysis indicate a statistically significant impact of vertical jumping ability to standing long jump (LONGJ .005) and triple jump (TRIPL .004). In the third test of horizontal jumping ability there is no statistically significant impact.

At the individual level, a statistically significant correlation can be seen between the following tests:

Standing long jump (LONGJ) has a significant relation with high jump from running with one foot take-off (HJ1 .002), maximum eccentric contractions of countermovement jump (CMJ(pikE) .008) and with time of concentric contraction of squat jump (SJ(s) .003);

Triple jump (TRIPL) has a significant relation with high jump from running with one foot take-off (HJ1 .007), with force of Abalak - Bosco jump (ABJ(F) .026), maximum eccentric contractions of countermovement jump (CMJ(pikE) .003) and time of concentric contraction of squat jump (SJ(s) .001).

DISCUSSION AND CONCLUSION

In modern basketball one of the most important factors determining top athletes certainly are the body size and physical condition. Constitution of player will determine the position in the team, while the high intensity requires players to have a high level of fitness (Drinkwater, Pyne, & McKenna, 2008). A basketball match involves an average of 46 ± 12 rebounds for each player, with or without eccentric-concentric phase (McIennes, Carlson & McKenna, 1995). Research involving male and female basketball players showed that squat jump and countermovement jump correlated with performance during maximal isometric strength of leg extensions (Hakkinen, 1991). The role of maximal strength can also be very important for the development of explosive power. Explosive strength that was achieved during maximal leg extensions can be also a very important indicator of neuromuscular performance of basketball players (Gillam, 1985; Maffiuletti et al., 2000). Explosive strength represents the dimension of anaerobic capacity, and its values are high in all sports that require explosiveness and fast maximal energy production. Coaches and other experts in this field in the future could be usefully monitor and improve through the training process, one of the variables that is most important to a particular sport (Popadić-Gaćeša, Barak, & Grujić, 2009). In this research 145 top athletes were included (14 boxers, 17 wrestlers, 27 hockey players, 23 volleyball players, 20 handball players, 25 basketball players and 19 football players). The results obtained in the test of explosive strength showed that the highest value was achieved by basketball and volleyball players compared to other tested athletes.

Explosive strength is one of success determinants in all the activities that require the performance of maximum muscle force as soon as possible (Newton & Kreamer, 1994). The ability to perform explosive movement is of great importance for athletic performance and success in sport. Development of strength, power, speed of force development, are becoming of greater importance than the training itself at the time of performance of some movement task (Gašić et al., 2011).

Some studies indicating the different variations of plyometric training for explosive strength should also be noted (Matavulj et al., 2001; Lehnert et al., 2013; Asadi, 2013; MORSALIM et al., 2014), as well as some other variants of training (Santos & Janeiro, 2011; Santos & Janeiro, 2012; Fachini et al., 2013).

In conclusion it can be said that the starting premise was correct. Vertical type of explosive leg strength of top players really significantly affected the manifestation of a horizontal direction and thus it confirmed the link between these two areas.

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THE IMPACT OF MORPHOLOGICAL CHARACTERISTICS ON AGILITY IN BASKETBALL PLAYERS

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SUMMARY

The study was conducted in order to determine the impact of morphological characteristics on agility in top basketball players. 12 top basketball players from BC "Konstantin" competing in the Basketball League of Serbia and Super League of Serbia were tested. For evaluation of morphological characteristics seven anthropometric measures were applied: body height, leg length, foot length, abdomen circumference, body weight, abdominal skinfold and lower leg skinfold. Agility was estimated by Agility T-test, Hexagon Agility Test and Illinois Agility Test. Canonical correlation and regression analysis led to results showing a statistically significant impact of morphological characteristics on agility primarily on the multivariate level. For individual variables fewer statistically significant impacts were recorded.

Keywords: Morphological characteristics, agility, basketball

INTRODUCTION

Development of basketball requires a dynamics involving of large number of directional changes in order to create better field position. Taking into account the size of the field, the number of players in the game and the character of the game, in order to achieve superior results, it is necessary for movement to take place with unabated dynamics and control of motion. For this reason, the success of today's basketball depends on agility development. Therefore, it is necessary to pay special attention to agility when organizing basketball training process, starting with the youngest age groups, to seniors (Trunić, 2007). In addition, the development of agility should be specialized and adapted to gaming position, because player at each position has specific goals and objectives during a basketball game, but also a different physical constitution, very important for basketball, especially in the area of longitudinal dimensionality of the skeleton.

Agility, otherwise, represents a very complex ability depending on many other factors, coordination, strength, speed, endurance, balance, morphological characteristics. Bompa (1999) treats agility as combined ability of basic skills of speed and coordination, while Gredelj, Metikoš, Hošek, and Momirović (1975) rank it among the skills that are subordinate to mechanism for structuring movement, along with coordination abilities and speed of alternative movements.

Since the constitution of body defined as morphological characteristics is strongly associated with the field of human motorics, the idea of this study was to compare some anthropometric measures with part of basic motorics in the form of agility in top basketball players. It is assumed that morphological characteristics should have a positive impact on the results of the agility consistent with its role in human movement.

METHODS

Sample of examinees

For the purposes of this study 12 top basketball players from basketball club (BC) "Konstantin", competing in the Basketball League of Serbia and Super League of Serbia were tested with the aim of

determining the impact of morphological characteristics on agility.

Sample of measuring instruments

For evaluation of morphological characteristics seven anthropometric measures were applied: body height (HEIGHT), leg length (LLENGTH), foot length (FLENGTH), abdomen circumference (ACIRC), body weight (WEIGHT), abdominal skinfold (ASKIN) and lower leg skinfold (LLSKIN). All of the measurements were taken according to the methods proposed by the International Biological Programme (Weiner & Lourie, 1969).

Agility was estimated by Agility T-test (TTEST), Hexagon Agility Test (HEXAG) and Illinois Agility Test (ILLIN). All used tests were taken from the site TopendSports http://www.topendsports.com/testing/agility.htm).

Statistical procedures

Data processing was performed with statistical package Statistica 7.0, and canonical correlation and regression analysis were performed.

RESULTS

Canonical correlation analysis

Table 1. Canonical correlation analysis between morphological characteristics and agility

	Can.R	Can.R^2	Chi-sqr.	df	p
0	.994	.988	39.89	21	**.008****

Table 1 shows the level of correlation between morphological characteristics (predictor) and agility (criterion) of basketball players. There was a single significant canonical correlation of these areas at the level of p <.01. Explained by the size of the canonical correlation coefficient (Can.R = .994), which turned into a significant function it aomunts p=.008. The coefficient of determination (Can.R^2 = .988) explains the percentage of relation of two systems, and the impact of the predictor on the criterion was 98.8%.

Table 2. Canonical factors

	Root 1		Root 1
HEIGHT	0.83	TTEST	0.96
LLENGTH	0.69	HEXAG	0.74
FLENGTH	0.48	ILLIN	0.83
ACIRC	0.63		
WEIGHT	0.77		
ASKIN	0.40		
LLSKIN	0.62		

The strucure of canonical factors (Table 2) on the left side (morphological characteristics) shows the definition of the factors is most influenced by body height (HEIGHT 0.83) and body weight (WEIGHT 0.77), while the right side (agility) is mostly defined by Agility T-test (TTEST 0.96).

Based on the obtained results it can be concluded that there is one general factor explaining the success of top basketball players agility.

Regression analysis

Table 3. Regression analysis between morphological characteristics and agility

	TTEST	HEXAG	ILLIN
HEIGHT	.455	.474	.374
LLENGTH	.791	.489	.217
FLENGTH	.926	.837	.455
ACIRC	.248	.683	.369
WEIGHT	.233	.114	**.048***
ASKIN	**.034***	.629	.155
LLSKIN	.336	.606	.196
Q	**.021***	**.024***	**.043***

The results of regression analysis (Table 3) indicate a statistically significant impact of morphological characteristics on all tests of agility (TTEST .021; HEXAG .024; ILLIN .043). At the individual level, a statistically significant correlation can be seen in abdomen skinfolds of the (ASKIN) with Agility T-test (TTEST .034) and in body weight (WEIGHT) with Illinois Agility Test (ILLIN .048).

From these results it can be seen a statistically significant impact of a small number of predictor measures on the criterion at the univariate level (only two), however, anthropometric measures in this case acted as a strong predictor of the system, and each made a contribution which was reflected in the multivariate impact.

DISCUSSION AND CONCLUSION

At the present level of development, selection is increasingly present in every sphere of human activity and thus the sport. For a successful and efficient selection of sport scientific research, analysis and studies are invaluable, whose results can be directly applied in everyday sport practice. To make the selection of high quality, a multidisciplinary approach is needed, as development of a human is being the integrative process (Karišik, Goranović, & Valdevit, 2011).

It is well known that sport result of top athletes largely depends on the level of motor abilities, functional abilities, and in particular morphological characteristics, so these characteristics are considered as the most important dimensions of the latent structure of the anthropological status (Krsmanović & Krulanović, 2008). Morphological characteristics and motor abilities are closely related, and significantly affect the realization of motor tasks in basketball. Over the morphological structure motor skills are manifesting and these two areas to the growing number of research (Zaciorski, 1975; Milanović, 2007; Živković, Goranović, Marković, & Branković, 2010) are treated integrally and they are simultaneously studied. Morphological characteristics are of particular importance for orientation and selection in most of the sports disciplines, and this is evident in the equation of specifications success in certain sports games, and with any specific position function in team, morphological dimensions occupy one of the most important positions.

For a large number of sports disciplines morphological structure is already generally known mostly influences sport performance, although, no doubt, the coefficients of participation of certain morphological dimensions in the equation of specification changes in function of development of techniques and tactics and modern world achievements in a particular sport (Živković et al., 2010).

Over the morphological characteristics results in agility are manifested as in subject of research by Jakovljević, Karalejić, Pajić, Gardašević, and Mandić (2011) who examined the influence of anthropometric characteristics on the results of agility tests in 14 years old basketball players and got a modest but significant impact of anthropometric variables on the results of agility tests. Dizdar, Trninić, and Matković (1996) on the basis of results obtained in their research concluded that external players (guards and wings) have a high

level of speed (speed of reaction, speed of movement frequency and speed of a single movement), agility, explosive strength, coordination, accuracy and endurance (all three energy capacity), while the internal players (centers and wings) have high longitudinal and transversal dimensionality of the skeleton, a greater amount of muscle mass and subcutaneous adipose tissue and a greater level of absolute, static and repetitive strength.

Correlation of anthropometry and motorics in sport generally, but also in basketball, is beyond doubt. For this research it can be said too, cause the results showed that morphological characteristics, in global, significantly influenced the manifestation of agility in top basketball players. It was not recorded a number of significant impacts on the individual level (individual measures to a single test). However, when morphological characteristics were viewed as united set, a statistically significant association was observed for all agility tests and thus the initial assumption was confirmed.

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APPLICATION OF PLYOMETRIC METHOD IN DEVELOPMENT OF SPECIFIC MOTOR EXPLOSIVE ABILITIES

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SUMMARY

On a sample of 18 Nis high school students aged 16 a longitudinal study was conducted in order to determine the effect of the plyometric method of work model on the development of the explosive strength in jumping disciplines – long jump and high jump. Applied experimental program was carried out in a two-month cycle of three hours per week, within the school sports section. Two measurements were performed – the initial and final ones. The obtained results were statistically analyzed and presented across multiple tables. Based on the above said, it was concluded that the applied program with all elements produced statistically positive and significant results.

Keywords: plyometrics, explosive strength, long jump, high jump

INTRODUCTION

Modern physical education teaching is a very complex educational process, abundant in varied methodological approaches addressing natural and anthropological abilities and characteristics of children and youth. While science and technology have accelerated life and social development in many areas school buildings and facilities have retained the flavor of the ancient times, leaving development mainly to the knowledge and enthusiasm of the teachers. Unfortunately, poor equpment of the hall and sports courts as well as the lack of concern of the society for the physical development of children, have forced the teachers of physical education to further engage in research and application of most appropriate working methods in order to get the best results.

Application of plyometric methods in developing explosive strength of schoolchildren has been one of the most interesting training innovation in teaching over the past few years. It is not a recreational activity, but a very complex and specific motor dimension. This method must be used in conjunction with other methods for the development in a simple frame of the training process. It is never applied separately. To make it effective all actions should be performed technically correct with a gradual increase in the load applying the proper periodization (Radcliffe & Farentinos, 2003).

The basic principle is grounded on the use of the force of gravity to quickly stretch the muscles in landing from a height in eccentric contractions, when an elastic potential energy is produced for the most efficient realisation of the concentric muscle contraction in long and high jump. The main purpose of plyometric method is reflected in the development of largest possible reactive force, but one should be careful because it can be applied only after the age of fourteen, i.e. in older primary school graders or high school students (Čoh, 2003, Jukic 2005).

This study aims to determine the impact of the specific plyometric work program on the development of explosive strength in the long and heigh jump in the city of Nis high school students.

METHOD

The sample in this study was drawn from a population of the high school students from Nis, chronological age sixteen + - six months, included in regular physical education curricula, who among other things, met all health and other criteria and were involved in school sports section with three

hours per week. The study was conducted on eighteen male subjects who volunteered for the experiment.

Sample criterion variables

- Sprint long jump
- Sprint high jump

The experimental program outline

Exploring the impact of the plyometric method model on the development of efficiency in jumping disciplines in high school students, was realized with three additional classes, in the school sports section, lasting for 60 days.

Two measurements were performed, initial at the beginning of the treatment, and final at the end of a two-month work. In designing a model of the plyometric method exercises subjects are already familiar with, and are easily applicable in the existing conditions, were used. Mainly circuit training was used in the development of strength while care was taken for the order of the exercises to be such that they are not performed with the same muscle groups, and that after vigorous exercises always followed exercises with smaller loads and smaller number of repeatings.

TABLE 1. Plyometric jumping exercises and the recovery of the organism

	JUMPING EXERCISES (interval method)	NO. OF SERIES	NO. OF REPETITIONS (times)	ACTIVE REST (minutes)
VERTICAL JUMPS	Vertical both leg hurdle jumps (hight 40-50 cm)	3-5	5-7	2-4
	Vertical one leg hurdle jumps (hight 20-30 cm)	3-4	4-5	3-5
	Vertical stair hops up – down (hight 15-30 cm)	3-6	6-8	3-6
HORIZONTAL JUMPS	Triple jump	4-5	5-7	2-4
	Five jump	4-6	3-4	3-5
	Ten jump	3-4	3-4	4-6
	One leg jump L then D (20-30 cm)	2-4	2-3	5-7
DEPTH-HIGH JUMPS (landing from height and take-off)	20cm + take-off	5-7	6-8	2-5
	30cm + take-off	4-6	4-6	3-5
	40cm + take-off	3-6	3-5	3-5
	50cm + take-off	2-5	2-4	4-6
DEPTH-LONG JUMPS (landing from height and long take-off)	20cm + two step long jump	5-7	6-8	2-5
	30cm + two step long jump	4-6	4-6	3-5
	40cm + two step long jump	3-6	3-5	3-5
	50cm + two step long jump	2-5	2-4	4-6

Most previous studies, (Read and Cisar, 2001; Weir et al., 1994), have been assessing the optimal duration of the recovery breaks between intervals of work in physical education classes, and training process of different age students. Based on the recommended and experimentally determined values of the duration of recovery rest, this paper presents a model of the jumping training methodology, Table 1.

Data processing method

The results were statistically analyzed and presented in a number of tables.

Following were calculated:

1. Basic descriptive statistical parameters for determining results in jumping disciplines.

2. Discriminative measurement

- Skewness
- Kurtosis

3. Multivariate methods

- Canonical discriminant analysis of multivariate and univariate level

RESEARCH RESULTS

Basic statistical parameters of specific- motor abilities

TABLE 1. Basic statistical parameters for the estimation of specific- motor abilities on the initial measurement.

Spec. motor. tests	N	Mean	Min.	Max.	Std. Dev.	Skewn.	Kurtos.
SKDALJ	18	351	310	42	4.63	.523	.864
SKVIS	18	122	95	142	3.98	.381	.953

Analysing Table 1 showing the basic statistical parameters of the specific motor abilities it can be concluded that by comparing the results of the standard deviation (St. Dev) with a range of maximum (Max.) and minimum (Min). results one may infer normal sensitivity of the selected tests. In the intervals of the minimum (Min.) annd maximum (Max). results there are at least five standard deviations (St. Dev.), indicating a significant dispersion, i.e. sensibility of the specific motor tests. Values of skewness and kurtosis are within the limits of the normal distribution of results.

TABLE 2. Intercorrelational matrix in the initial measurement

Spec. Motor. tests	**SKDALJ**	**SKVIS**
SKDALJ	1.00	
SKVIS	.71	1.00

Intercorrelational matrix contains mainly low positive and negative correlation coefficients. The range within which correlation coefficients vary is from .00 to .68, which is the highest value obtained for this sample. Analysis of the intercorrelation matrix obtained within these motor tests, hypothesized to represent the latent abilities, shows that the resulting sets of variables are not homogeneous enough. The largest correlations were obtained between the specific motor tests of the high jump and long jump .76.

TABLE 3. Basic statistical parameters for assessing specific motor abilities in the final measurement

Spec. motor. tests	N	Mean	Min.	Max.	Std. Dev.	Skewn.	Kurtos.
SKDALJ	18	376	315	455	.360	.622	.831
SKVIS	18	128	97	151	.485	.373	.622

Analysing Table 3. showing the basic statistical parameters of the specific motor abilities it can be concluded that by comparing the results of the standard deviation (St. Dev) with a range of maximum (Max.) and minimum (Min). results one may infer normal sensitivity of the selected tests. In

the intervals of the minimum (Min.) annd maximum (Max). results there are at least five standard deviations (St. Dev.), indicating a significant dispersion, i.e. sensibility of the specific motor tests. Values of skewness and kurtosis are within the limits of the normal distribution of results.

TABLE 4. Intercorrelational matrix results of specific motor abilities in the final measurement

Spec. Motor. tests	**SKDALJ**	**SKVIS**
SKDALJ	1.00	
SKVIS	-.80	1.00

Intercorrelational matrix Table 4. contains mainly low positive and negative correlation coefficients. The range within which correlation coefficients vary is from .01 to -.80, which is the highest value obtained for this sample. Analysis of the intercorrelation matrix indicates that variables of the specific motor tests are not homogeneous enough. The largest correlations were obtained between the tests: vertical jump (SKVIS) and long jump (SKDALJ) -.80.

Analysis of changes between initial and final measurements of subjects tested by T-test

Table 5. contains the results of T-test of the specific motor abilities between the initial and final measurements of subjects. Analysis of the coefficient of T-value and its significance (P) indicate that statistically significant difference exists in both test of the specific motor abilities in the final measurement in relation to the initial state.

TABLE 5. Significance of differences of specific motor abilities between the initial and final measurements

Functional tests	Mean IN	Mean FI	T-Value	df	P
SKDALJ	351	376	2.86	2	.004*
SKVIS	122	128	3.45	2	.000*

3.3 Analysis of changes between the initial and final measurements by canonical discriminant analysis

In this study, in order to determine the global quantitative changes between the initial and final measurements of subjects in a specific area of motor abilities, by discriminant analysis following was calculated:

- Coefficient of discrimination square is shown through EUGENVALUE
- The canonical correlation coefficient is shown through CANONICAL R
- Separation is displayed through BERTOL test Wilks' lambda
- The statistical significance of each variable is indicated by a chi-square test.
- Degrees of freedom are shown through DF
- Possible error in rejecting the hypotheses where the actual value of the canonical correlation is equal to zero, is given by SIG.

Canonical discriminant analysis in specific motor abilities

Discriminant analysis in this paper was used to determine whether there was a statistically significant difference between the results of the initial and final measurements of the specific motor abilities, and then to identify jumping disciplines that

provide the greatest contribution to the determined difference or discrimination.

TABLE 6. Significance of isolated discriminant function

Disc Func.	Eugenvalue	Canonical R	Wilks' Lambda	Chi-Sqr.	df	Sig
1	.334	580	.626	43.12	2	.032*

Table 6 shows significant discriminant function of high intensity CR =58,0%, which indicates the correlation of data set on the basis of which a discriminant analysis of the obtained results was performed. The results of discriminant strength of the subjects' specific motor abilities in jumping events are presented by Wilks' Lambda test which was high (.626), suggesting that the differences between the initial and final measurement in the space of specific motor abilities in the experimental group are significant (Sig. = 032), because the size of the chi-square test has a high value (Chi-Sqr = 43.12).

The obtained results show that there are statistically significant global differences in specific motor abilities between the initial and final measurements in subjects.

TABLE 7: Factor structure of the isolated discriminant function

Spec.Motor. tests	Root 1
SKVIS	.523
SKDALJ	.480

Table 7. gives the structure of the discriminant function of the specific motor abilities variables participation in jumping events in the formation of significant discriminant functions. Displayed group centroids represent the arithmetic mean of the initial and final measurements results. In order to check the significance of differences between the initial and final measurements in the experimental group two jumping events were measured (long and high jump), which are supposed to be good predictors of the study area - specific motor abilities. The results show that the largest contribution to the discriminant function had a sprint high jump (SKVIS .532), sprint long jump (SKDALJ .480).

The obtained results of discriminant analysis in the final compared to the initial measurement indicate that under the influence of the experimental models of explosive strength there has been a statistically significant change in the specific motor abilities in jumping events in researched subjects.

DISCUSSION

Based on the object and purpose of the study the following conclusions are drawn:

Canonical discriminant analysis:

1.Results of canonical discriminant function indicate that in the final compared to the initial measurement there were statistically significant changes in the level of results in the sprint high jump.

2.Results of canonical discriminant function indicate that in the final compared to the initial measurement there were statistically significant changes in the level of results in the long jump.

3. When using circuit method for developing jumping abilities by plyometric method during physical education classes, scope, intensity and recovery of the organism should be adapted to the individual abilities and characteristics of students.

CONCLUSION

The duration and content of aerobic activities for recovery should depend on the structure of the selected exercises for the development of the jumping abilities, load volume, number of series, number of repetitions within the series and the pace of the exercises performance. It is only by proper use of the aerobic activity for rapid recovery of students

in the rest intervals in physical education classes that it is possible to regenerate the body and prepare it for the next interval work.

Due to the specifics of the lyometric method for developing jumping ability, physical education teachers should have basic knowledge of the methods of recovery. Therefore together with the contents of the load and working methods it is necessary also to program and plan assets on which the quality of recovery depends.

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THE HISTORICAL ASPECTS OF DOPING IN SPORT

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SUMMARY

The aim of this paper is to present the historical aspects of doping in sport and offer a chronological overview of the first doping substances and the methods for reconstruction the genesis of the problem of doping which modern sport is facing. The attempts to use stimulating substances to improve physical abilities are not a consequence of modern sport and instead have their roots in antiquity. Numerous historical sources confirm that soldiers in the period BC used various plant extracts which helped them to improve their physical strength and endurance, increase their readiness for combat, excite their attention and cause a heightened emotional response. The tradition of the use of stimulating substances has presented itself in a new guise in more recent history in the field of sport where the desire for achieving sports success has united doctors, pharmacists, trainers and athletes in their work on developing ever more sophisticated doping procedures which would lead to sports success, and which could not be detected using modern methods of testing.

Keywords: history, stimulating substances, anti-doping, WADA

Doping, which is usually defined as the use of illegal substances and methods with the aim of improving the ability of an athlete has been around much longer than we could possibly imagine. The very word doping was first officially used in 1889 in an English dictionary (Müller, 2010). At that time, the word was used only to designate medicine which, in addition had other components, also contained opium which at the time was given only to horses. The word doping was also used among some of the nation in Africa, such as the members of the Zulu tribe, who used the remains of grapes to prepare an alcoholic beverage and called it "dop". Their warriors would use this drink as a stimulant for fighting or during religious rituals which required the increased emotional activity of an individual. Over time, the term doping began to be used more widely, to denote all substances which had stimulating characteristics.

However incredible it sounds, doping was not always an illegal in sport. During the 19th and the beginning of the 20th century, it was believed that medicine and science in general should give their contribution to moving the limits of sports achievement. At the time, it was not forbidden or considered morally unacceptable to use various stimulating substances which could help an athlete to be more successful during competitions, whether in the case of running, riding a bicycle, lifting weights or some other demanding sports discipline. Science and medicine were considered disciplines tasked with improving the quality of life, which also referred to athletes who would, thanks to doping, be more successful in the competitions. The acceptance of doping at the end of the 19th and the beginning of the 20th century was not only not reprehensible or a particular kind of sport scandal, but instead represented a means of keeping up with the times and the latest scientific achievements. This is one of the reasons why doping in the period between the 1970s and even prior to it was the topic of interest of neither the media nor the authorities, and as a result, we only have very few documented data on the use of doping prior to World War II (WWII). The only scandal in sport which could be considered the first doping affair occurred at the end of the 19th century and was related to instances in which managers or trainers doped their athletes without their knowledge, which, once it became known, become the hot topic of public discussion. Namely, they were mostly managers and trainers who prior to working with people were engaged in working with race horses in training. In horse racing, where the turnover of money was extensive, doping horses

using various stimulating substances was not unheard of. These trainers brought many of their bad habits from horse racing with them when they began working with athletes.

In certain types of endurance sports, such as professional cycling for example, the culture of doping also has a very long and rich tradition. Not only in professional cycling, but also in running and swimming, doping was used in competitions throughout the middle and the end of the 19th century. The first known case of athlete doping in more recent history occurred in 1865 when Dutch swimmers, who competed in a swimming match in a canal in Amsterdam, used stimulating substances which increased their endurance (Yesalis & Bahrke, 2005). In the following decade a great number of athletes, swimmers, cyclists, long-distance runners, boxers used stimulating substances in order to improve their results. At that time, endurance disciplines enjoyed a great popularity, especially a discipline known as pedestrianism, which consisted of walking and running over a six-day period (Noakes, 2006). The high demands of these ultra-marathon disciplines led to the development of a culture of the artificial improvement of abilities. The trainers, in their attempt to maintain and improve the energy capacity of athletes and postpone the onset of fatigue, tried various chemicals which were considered to be stimulating substances. Some of these substances, such as strychnine, had to be used very carefully, since grater doses than those allowed could result in poisoning, and even death. Caffeine, cocaine, alcohol, lumps of sugar dipped in ether and nitroglycerine were among those most frequently used stimulants during the second half of the 19th and the beginning of the 20th century (Müller, 2010). Certain trainers of the time had their own "magical" formulas which they used when working with their athletes. They tried not to reveal their secret stimulating substances to other trainers or their athletes because in that case, their advantage gained in using stimulating substances would have been neutralized. And what is perhaps most interesting, is that doping at that time was not illegal. There were no rules or regulations which would prevent athletes from using doping (Rosen, 2008).

Man's attempts at improving his physical abilities and thus achieving better sports results does not go back a single century, as the listed examples from the more recent history of sport might indicate, but in fact they go back a lot further. It is considered that doping with the aim of improving physical abilities was used even in the era Before Christ (BC). According to the reports of Philostratus and Galen, various medications were used with the aim of improving physical abilities and sports results towards the end of the third century BC (Burstin, 1963). Doctors from ancient China studied the use of a substance known as *ma huang*, which was obtained by extraction from the plant *efedra*. This substance, which was used as a medicine for subsiding cough and the improvement of circulation, was also used to improve physical abilities as far back a five thousand years (Abourashed, El-Alfy, Khan, & Walker, 2003). The Hindu doctor Sutruta recommended the eating of bovine testicles to increase the maturity and strength of young men. Similar attempts to use testicles as food was noted among the Huns, who prior to going into battle always ate testicles in their meals (Chinery, 1983). The Olympic Games in Ancient Greece, which took place in the period between 776 BC and 393 AD (Anno Domini), were also not free of their doping scandals. At these Olympic Games, the contestants used hallucinogenic mushrooms with the aim of improving their physical abilities (Burstin, 1963; Prokop, 1970; 1972; Hanley, 1983). This ancient method of doping was strictly forbidden in the Games then, as it is today. However, the consequences that the athletes faced at the time were much stricter than those of today. According to some authors (Prokop, 2002) in certain cases athletes caught while using doping were even sentenced to death. When the Roman emperor Theodosius I banned the Olympic Games from taking place in 394 AD (Savić, 2008) one of the reasons he gave was that the games had become a 'venue of corruption, doping and the degradation of human dignity' (Dirix & Strubois, 1998). Even though there are certain data on the use of stimulating substance in Ancient Greece and in the middle ages, we cannot definitively determine the extent to which doping occurred during these sports manifestations such as the Games in Ancient Greece or very harsh competitions such as the gladiator games in Ancient Rome. Whether we are dealing only with sporadic cases of doping or a regular and widespread practice, and whether the substances used at the time as doping substances had only a slight placebo effect or whether they actually increased human abilities on physiological grounds will remain unknown. What we do know for sure is that the winners at the Olympic Games in Greece received extensive rewards which could provide financial security for

the rest of their lives (Savić, 2008), so there was a clear incentive for the use of doping.

The use of stimulating substances in the far past was noted amongst some nations who lived in Latin America. The Incas, under the influence of stimulating substances were able to run distances of over 1000 kilometers in only five days (D'Altroy, 1992). It is believed that they used coffee, guarana, the kola nut, and mate tea, which is prepared from the dry leaves and twigs of the *jerba mate* (Yerba mate) plant for doping (Wadler & Hainline, 1989). All of the aforementioned plants represent high sources of caffeine whose stimulating effect has been confirmed in numerous studies (Bloomer, McCarthy, Farney, & Harvey, 2011; James, Bloomer, Cox, Davis, Desbrow, & Graham, 2011). The inhabitants of Latin America were also familiar with the use of more serious narcotics for the purpose of improving their physical abilities. One such stimulant were cocaine leaves, which today are used to produce high quality narcotics, and whose trade is strictly prohibited the world over.

Later, the athletes involved in endurance disciplines began to increasingly use strychnine, caffeine, cocaine, alcohol either individually or in combination. Among the substances which were meant to instigate above-human physical abilities in the second half of the 19th century, a particular potion known as "vin Mariani" began to gain notoriety. This potion was first produced and patented in 1863 by Angelo Mariani. The potion was made of Bordeaux wine and the coca extract. This drink has been prohibited in Germany since the Law on Narcotics (Opiates) was passed in 1920 (Eckart, 2003).

During the 1930s, scientists isolated testosterone and tried to synthetize it in their laboratories. In the following few decades, scientists, but also athletes and trainers, began experimenting with testosterone, increasing, among other things, the strength and aggressiveness of the athletes. These experiments were performed both in laboratories as well as in sports arenas and training halls.

The second stimulating substances which also soon began to be widely used in sport were amphetamines. During WW II they were used in the army, and after the war were also used in sport. This doping substance increased concentration, reduced fatigue and led to an increase in results. In the middle of the 20th century, the first anabolic steroids emerged. At that time, during the 1950s, the first scandals occurred, which would unravel in the same way as modern-day scandals, accompanied by great media attention and reactions of the authorities in the field of sport and public life. Over time, the use of doping became one of the criteria which meant the difference between amateur and professional athletes. There was a widespread opinion that amateur athletes do not use doping and that they only participate in competitions for the love of sport, relying only on their God-given abilities, while that was not expected of professional athletes. They, competing with the aim of achieving as great profit as possible, did not refrain from using doping. As a result, a great number of sports organizations, including the International Olympic Committee (IOC), used this to mock professional athletes, creating a climate in which being a professional athlete was not as important as being an amateur athlete. Over the last few decades, the situation has changed and today professional athletes are expected not to use doping, and the attitude toward doping is shaped by the regulations which today are determined by the World Anti Doping Agency (WADA).

The increased use of mineral drugs and poisons such as arsenic, as well as an improvement in the level of knowledge on the use of herbal medicine, have probably led to their increased use in paramedical purposes, where we could also include doping in sport. The definition and refinement of alkaloids and other active substances obtained from plants, as well as their structural description, have been increased by synthetically obtained pharmaceuticals which created a good basis for the beginning of a new era in modern doping in sport. One of these ingredients, which can be classified as one of the pioneer substances of the modern age, was developed in 1887 and is known as alfametilfeniletilamin or amphetamine. Methamphetamine, which is a compound similar to amphetamine, was probably discovered as early as 1893, but officially it is believed to have been crystallized in 1919 by Japanese scientists. Methamphetamine is a doping substance which is much more powerful than the aforementioned amphetamine, and at the same time is easier to use. It is easily dissolved in water, can be inhaled, injected, snorted or taken in the form of pills. In the 1930s, scientists discovered that methamphetamine can be used to widen the nasal passages and that this stimulates the nervous system. In 1932 the pharmaceutical company Smith, Kline & French launched a new product "Benzedrine" which was

sold as an inhaler for opening nasal passages. Amphetamines gained in popularity and use among athletes about fifty years after they were first discovered in 1887. The reason for this can be found in the fact that the characteristics and effects of this new drug on the market were neither confirmed nor documented by high quality research until the middle of the 20th century. In the meantime, athletes tried various ways to improve their physical abilities, or at least decrease the fatigue which they experienced during long term participation in endurance disciplines (marathon running, swimming, riding a bicycle). It is assumed that German athletes at the Olympic Games held in 1936 in Berlin extensively used methamphetamines as doping. During the 1950s, scientists for the first time used serious and methodologically sound means to study the effects of amphetamines on success in sport. In 1959, the American Medical Association published papers which were based on two studies focusing on the effects of methamphetamines on sports results. One of the papers was entitled "Amphetamine Sulfate and Athletic Performance" (Smith & Beecher, 1959) and was considered a classical study in the field of methamphetamine use in sport. In this study, the effects of amphetamines on elite athletes, runners, swimmers and shot putters were studied. It was carried out with the help of researchers from Harvard University. They confirmed that certain amounts of amphetamines improved the physical abilities of all three groups of athletes. The greatest improvement was noted for the shot putters who after taking amphetamines were able to improve their scores by 3 to 4%. A close second to them were runners, who scored improvements of 1.5%, while the improvement of the scores of swimmers was the smallest (approximately 1.16%). The authors indicated that, in addition to the fact that the improvement of the swimmers seemed to be small, it was not negligible. This improvement could be sufficient to help an Olympic level swimmer, whose ultimate limits were the semi-finals in the Olympic Games, to reach a level which would turn him into a gold medal winner.

There were several attempts by researchers in the field of medicine, pharmacology, but also sport and sport training to determine which circumstances can be considered the first abuse of doping in sport. In these attempts, lists of names of athletes were drawn up, all of whom participated in world and continental competitions, and whose performances were tied to the use of doping. Among these athletes, there were those who are believed to have died suddenly and prematurely due to the use of doping. Considering that the attitude towards doping was different in the past, which was described at the beginning of this paper, not a lot of attention was devoted to whether an athlete had used a stimulating substance or not, and thus there are not a lot of historically valid documents which could shed more light on it. One of the more successful attempts at reconstructing the history of doping in sport was made by Ludwig Prokop who in several of his publications, although quite briefly and generally, wrote about the first cases and personalities whose names are associated with the use of doping (Prokop, 1957, 1970, 1972, 2002). Following the data included in his work, the first case of doping was discovered in 1865 at a swimming competition which was held in 1865 in the English Channel or as the French refer to it, La Manche (Pini, 1964). The first athlete whose untimely death is connected to the use of doping was the British cyclist Arthur Linton. It is assumed that his death was caused by the use of a substance also known as "trimetil" during a bicycle ride from Bordeaux to Paris. This very demanding race covered a stretch of 560 kilometers. In some cases, when attempts were made to discover the cause of death of the famous cyclist, strychnine was listed as the cause. Arthur Linton was an exceptional cyclist who, following a very successful racing season in 1894 was voted the most successful cyclist in the world. Only two years later, Arthur Linton was dead at the age of 28. The official records show that his death is listed as the result of typhoid fever which he contracted; however, historians, writers, researchers and experts in the field of doping claim that the real cause of his death was the use of doping substances. A fact which confirms their suspicions was that Arthur Linton trained with the famous trainer James Warburton, who was well-known for his public support of the use of various methods for the improvement of physical abilities using doping. He was known to carry around with him a black vile with a secret potion in it, which he gave to his cyclists who had experienced extreme fatigue during a race. At the same time James Warburton had been a very successful long-distance runner in his youth. He had competed in various races, ranging from 5 to 50 kilometers. Some authors consider him the first ultra marathon runner, since according to certain data he on one occasion ran 24 hours without stopping. It was at this time that he became familiar

with the effects of various stimulating substances which he intensively used later as a trainer. Warburton, like most trainers and managers at the time, kept the secret of the ingredients of the potions which he gave to his athletes in order to improve their physical abilities and to recover from fatigue. Considering that it was never determined which stimulating substances Warburton had worked with, we can only speculate about them being beverages based on strychnine, trimetil, cocaine which, at the time, were very popular among athletes. James Warburton was finally officially banned from working in sport in Great Britain in 1897 as a result of charges of using doping on his athletes. The case is considered the first official disqualification in sport as a result of the use of doping for the purpose of a win. The ban that James Warburton received was issued by the British National Cycling Union (Woodland, 2003).

This and other similar cases contributed to the problem of doping being considered more carefully during the 1920s in sports competitions. High officials and organizers of sports events expressed significant concern for the use of doping and the evident health deterioration of athletes following its use. Once we add to that the issue of the ethical justifiability of using doping, the decision of the International Amateur Athlete Federation (IAAF) is quite understandable. In 1928 it issued the first written prohibition on the use of doping at athletic competitions. Up until 1970, most sports federations introduced doping control which they used to check for the use of illegal substances among athletes.

The IOC in 1967 founded its own medical committee which compiled the first list of illegal substances. This list was very short and consisted of only 20 stimulating substances and narcotics which were considered detrimental for the health of athletes. It was the committee's task to investigate the cases of drug consumption at competitions and to act in an advisory capacity in terms of the measures which should be taken so as to preserve the integrity of the Olympic movement. The medical committee of the IOC banned the use of stimulating substances, introduced testing to control the athletes, as well as the signing of contracts which prohibited the athletes from using doping at competitions. The work of the medical committee of the IOC will attempt to achieve the following two aims. First, to prevent the detrimental effect on the health of the athletes which would come about as the result of the use of doping and the other is to provide a fair competition in the spirit of fair-play. The increasingly more frequent scandals in numerous sports, but maybe most among professional cyclists who were not allowed to participate in the Olympic Games, contributed to doping being an issue that can no longer be ignored in sport. The first testing on the use of doping at the Olympic Games took place in 1968 in Mexico. That was the year the committee officially introduced testing at both the summer and winter games (Müller, 2010). As the use of doping methods became more frequent, certain shortcomings of the anti-doping methods were determined, which the scientists, primarily the pharmacists, attempted to overcome as soon as possible. One of the more significant shortcomings in the testing procedures which were used at the time was the inability to control substances which had a long-term effect and maintained a higher level of physical abilities even following their excretion from the body. This was the case with anabolic substances which even had an effect long after their natural or forced removal from the human body. The problem was solved with the introduction of doping testing, not only during competitions, but also prior to and following competitions during the entire year. Even though there was a lot of opposition to such an approach in the anti-doping policy, the Olympic officials along with the highest representatives of the international federations in various sports accepted the practice of testing athletes at any given time during the year, which is the basis for the entire system of doping control today. In order for the work of reducing doping to be more operational, soon regional and national anti-doping agencies were formed. Their aim was to unite the work of sports associations and local governments, aided by the public sector in the fight against doping.

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FACTORS OF MOTOR SKILL CHANGES IN DANCERS INFLUENCED BY PROPRIOCEPTIVE TRAINING AND TRAINING WITH THE JUMPING ROPE

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SUMMARY

Introduction: The main goal of the research was to determine factor structures of motor skills in dancers after the implementation of the proprioceptive training program and training with the jumping rope, because these represent the essence of the effect achieved by the implemented program.

Methods: The research was undertaken on the sample of 84 participants – young dancers of both sexes with the age range from 11 to 16 years old. The participants were randomly divided in two groups, the experimental one (N=44) which was a part of the three month experimental training program with 40 training units, and the control group (N=40) which trained following the standard dance program. The experimental program consisted of proprioceptive exercises on the balance board and trampoline, and exercises with the jumping rope. The research utilized 8 variables to evaluate motor skills.

Results: On the basis of the results, it can be observed that both measurements (initial and final) indicated two latent dimensions, while an important restructuring of latent dimensions occurred in the final measurement, namely, after the realized program the dimensions were integrated into a common form which is supposed to significantly help more efficacious performance of dance structures.

Keywords: factor structure, efficacious movement, performance of dance structures.

INTRODUCTION

Dance belongs to the group of poly-structural conventional sports. Many researches performed on dancers indicate the significant influence of anthropological elements on dance in general including dancesport. (Oreb, 1989; Zagorc, Karpljuk & Friedl, 1999; Kostić, Zagorc & Uzunović, 2004; Lukić & Bijelić, 2006; Uzunović, 2008; Uzunović, Kostić & Miletić, 2009; Vlašić, Oreb, Prlenda & Zagorc, 2011).

Proprioception can be seen as a complex functioning of neuromuscular system implying transfer of information from peripheral receptors via afferent and efferent neural pathways, which enables body to maintain stability and orientation during static and dynamic activities (Laskowski, Newcomer-Aney & Smith, 1997). Proprioceptive training stimulates activation of proprioceptors and this enables optimal body reaction in urgent situations that could cause injury (Jukić, 2003).

Proprioception has rarely been implemented as an experimental program in dance, even though it is of crucial significance for dancers, both in injury prevention as well as in improvement of dance technique and performance. Batson (2009) emphasizes that it is necessary to work on confirmation of proprioceptive programs that are especially designed for dance, while the effects of targeted proprioceptive exercises on dancers' technique, excluding children, were noted even in 1992 (Green-Gilbert & Smith). Wolf-Cvitak, Grčić-Zubčević & Dolančić (2002) marked how acquisition of certain movements in poly-structural conventional sports can be accelerated by reliance on kinesthetic feeling. Lukić (2010) concluded that there were positive changes in all analyzed balance tests, in one test of coordination (MAGOSS) and in

the quality of dance technique performance after the implementation of proprioceptive program. This leads to conclusion that the content of training programs in dancesport should be based on the usage of proprioceptive training. Researching the changes of morphological characteristics, motor skills and functional abilities, Srdić (2012) affirmed that the proprioceptive training and training with the jumping rope produced significant statistical difference and quantitative changes (effects) of dancers' anthropological elements (in the participants of the experimental group as compared to the control group). The three month exercising program caused statistically significant changes in the structure of dancers' motor skills, which can be attributed to the implementation of the program – proprioceptive training and training with the jumping rope (Srdić, 2013).

The jumping rope is used at the beginning of the training for warming up and for developing a series of motor skills such as speed, coordination, reaction time, explosive strength, agility, balance, rhythm and kinesthetic and proprioceptive sensitivity. Lee (2003) pointed out that the jumping rope training improves dynamic balance. Concerning motoric and functional abilities Bašić, and Bašić (2005) emphasize that the jumping rope training affects development of the following motor skills: anaerobic endurance, speed and reaction time, agility, rhythm and balance, explosive strength, coordination and kinesthetic and proprioceptive sensitivity.

Procedural effects of kinesiological programs can be determined if there is a group of parametric values to be used for evaluation of the effects, if one is familiar with the transformational procedure, and if the appropriate group of analytic procedures is applied for evaluation of the effects (Bonacin, Bilić & Bonacin, 2008).

RESEARCH METHODOLOGY

Sample

The research was performed on the sample of 84 participants – young dancers of both sexes with the age range from 11 to 16 years old from the following dance clubs: Dance club "Gemma" from Banja Luka, dance club "City Jazz" from Banja Luka, dance club "Bolero" from Banja Luka and dance club "Orion" from Pale. The participants were randomly divided in two groups, the experimental one (N=44) which was a part of a three month experimental training program, and the control group (N=40) which trained following the standard dance program. All of the participants are registered in their respective dance associations and are competing in the national competitions of Bosnia and Herzegovina or they competed at least 3 months prior to the implementation of the experimental program. The dance classification of competitors is I (international) and A (the highest national).

During the selection of the participants, it was observed that all the participants are from 11 to 16, medically examined, regularly attended the experimental program, and were registered in the current year as the competitors in their respective dance association at the level of Bosnia and Herzegovina.

Sample of variables

For evaluation of the motor skills the following variables were applied: variables for evaluation of the balance (Flamingo balance test - MFLAMI), variables for evaluation of segmented speed-movement frequency (hand tapping – MTAPRU, foot tapping – MTAPNO), variables for evaluation of legs' explosive strength (standing long jump – MFESDM, Sergeant jump test – MFEVIS), variables for evaluation of coordination – realization of rhythmic structures (thumping with hands and feet – MBUBRN) and variables for evaluation of agility (lateral change of the speed of movement to the left side – MLATBL, lateral change of the speed of movement to the right side – MLATBD).

Experimental program

The experimental program was realized during three months, and it consisted from proprioceptive program (exercises on the balance board and trampoline) and jumping rope training. There were total of 40 training units. At the beginning of each dance training, there was a warm-up session lasting 10-15 minutes, after which there was the experimental program lasting 15-20 minutes. Duration of single exercises from the experimental program was from 30 seconds to 2 minutes. Within the experimental program, there were 13 trainings performed on the balance board, 13 trainings performed with the jumping rope, 12 trainings on

trampoline and 2 trainings combining the balance board and trampoline.

Data analysis methodology

The data analysis in this research was accomplished via statistical-mathematical procedures involving the program package SPSS 14 or STATISTICS 6. The factor analysis was used for determination of factor structure with previously calculated correlation of the applied variables in two program conditions.

RESULTS AND DISCUSSION

Correlation of variables

Table 1 shows correlations of the applied variables for evaluation of the motor skills in the initial measurement giving us the information about their correlation. At first glance, it can be seen that the variable for evaluation of balance doesn't show significant statistical correlation with the rest of the motor skill variables, apart from the variables (MTAPNO -0.217) and (MFESDM -0.223), and even these have low values. There can be various reasons why the variable for evaluation of balance doesn't show statistically significant correlation with other variables. One possible explanation is that this motor skill hasn't been given enough attention in the realization of the training process. A second explanation is that the participants use other faculties in evaluation of balance. The variables for evaluation of movement frequency (MTAPRU and MTAPNO) are connected with the explosive strength variable (MFESDM) and agility variables (MLATBL and MLATBD). The agility variables show significant statistical correlation with the explosive strength and movement frequency variables, and a bit weaker, but still statistically significant correlation with the variables for evaluation of coordination.

Table 1. Correlation of motor skill variables in the initial measurement

	MFLAMI	MTAPRU	MTAPNO	MBUBRN	MFESDM	MFEVIS	MLATBL	MLATBD
MFLAMI	1							
MTAPRU	-0.065	1						
MTAPNO	-0.217	0.417	1					
MBUBRN	-0.066	0.136	0.21	1				
MFESDM	-0.223	0.366	0.378	0.226	1			
MFEVIS	-0.175	0.229	0.437	0.272	0.64	1		
MLATBL	-0.006	-0.434	-0.275	-0.161	-0.617	-0.45	1	
MLATBD	0.1	-0.406	-0.319	-0.198	-0.65	-0.519	0.883	1

The significance of coefficient is at the level of 99% and 95%; R 0.01= 0.2736; R 0.05= 0.2115.

Table 2 shows correlations of the applied variables for evaluation of motor skills in the final measurement which give the information about their correlation. The analysis of Table 2 shows that the final measurement revealed statistically significant correlations as compared to the initial measurement. In the final measurement, the variable for evaluation of balance showed statistically significant correlation with the explosive strength and agility variables. Additionally, the variables for evaluation of the movement frequency (MTAPRU and MTAPNO) showed statistically significant correlation in the final measurement with the explosive strength variables (MFESDM and MFESVM), the agility variables (MLATBL and MLATBD) and coordination variable (MBUBRN). As compared to the initial measurement, the agility variables showed statistically significant correlation with all the motor skill variables in the final measurement.

Table 2. Correlation of motor skill variables in the final measurement

	MFLAMI	MTAPRU	MTAPNO	MBUBRN	MFESDM	MFEVIS	MLATBL	MLATBD
MFLAMI	1							
MTAPRU	-0.178	1						
MTAPNO	-0.074	0.37	1					
MBUBRN	-0.026	0.329	0.203	1				
MFESDM	-0.376	0.45	0.378	0.232	1			
MFEVIS	-0.162	0.256	0.378	0.32	0.57	1		
MLATBL	0.288	-0.498	-0.163	-0.198	-0.59	-0.319	1	
MLATBD	0.212	-0.547	-0.199	-0.148	-0.593	-0.316	0.879	1

The significance of coefficient is at the level of 99% and 95%; R 0.01= 0.2736; R 0.05= 0.2115.

Generally, it can be observed that correlation of the variables in the final measurement is slightly higher as compared to the initial measurement. It should certainly be marked that the final measurement resulted in lower number of zero or close to zero values of correlation, therefore it can be expected that the correlation results in the final measurement will reflect the real values of phenomena, which are presupposed in this research or at least which are investigated. Based on the coefficient value of correlation revealed in the final measurement, it can be concluded that there were several statistically significant correlations among the applied variables. The correlation results are not surprising because the correlation is derived from the common basis of training process in dance. Judging from the results of correlational values for all variables, it can be assumed that the positive correlations of all the applied variables contribute to compactness of the dancers' training process. It can be inferred that the correlation of variables has been derived from the essence of the dance training process, which is focused on qualitative and quantitative improvement of the necessary motoric skills of participants – young dancers. All the applied variables are interconnected in the training process system which produces positive changes of dancers' necessary motor skills. Higher correlations can be also associated with the correctly programmed and applied proprioceptive training and training with the jumping rope, which are adapted to the needs and abilities of young dancers, taking into account their morphological, motor, cognitive, emotional and other faculties.

Factor structures as global changes

The factor structure of the analyzed phenomena is always one of the key things for understanding the effect of the program, because the induced changes are also reflected in the position and the structure of latent dimensions. The latent dimensions in this study are obtained as the main components, and they are rotated to Varimax and Promax position (structure).

Table 3 shows factor structure of motor skills in the initial measurement rotated to Promax position (structure). The table shows that in the initial measurement two clear latent dimensions were isolated. The first latent dimension represents complex composite of agility, coordination, movement frequency and explosiveness, because it was best defined by variables for evaluation of agility to the right and left side (MLATBL and MLATBD), coordination (MBUBRN), vertical jump (MFESVM) and speed of hand movement (MTAPRU). The second latent dimension describes balance, frequency and explosiveness; because it is defined by the variables for evaluation of balance (MFLAMI), speed of the leg movement (MTAPNO) and horizontal jump (MFESDM). The correlation of isolated latent dimensions of motor skills in the initial measurement is relatively low and has the value of 0.2667. This means that the motor structure in the initial measurement was relatively divergent and incoherent. The reason for this can be found in the former training practices undergone by the participants, which probably favored isolated, disconnected development of certain motor skills.

Table 3. Obliquely rotated Promax structure of motor skills in the initial measurement and with the correlation factor (LD01, LD02 = factors)

Variables	LD01	LD02
MFLAMI	-0.2148	0.8136
MTAPRU	-0.5550	-0.1069
MTAPNO	-0.2939	-0.5849
MFESDM	-0.1460	-0.4101
MFESVM	-0.7196	-0.2694
MBUBRN	-0.5503	-0.4014
MLATBL	0.9611	-0.1833
MLATBD	0.9265	-0.0533
	LD01	LD02
LD01	1.0000	0.2667
LD02	0.2667	1.0000

Table 4. Obliquely rotated Promax structure of motor skills in the final measurement (LD01, LD02 =factors)

Variables	LD01	LD02
MFLAMI	0.5699	0.1678
MTAPRU	-0.4809	0.3626
MTAPNO	0.0923	0.7741
MFESDM	0.1446	0.7292
MFESVM	-0.6184	0.3535
MBUBRN	-0.1209	0.6901
MLATBL	0.9379	0.0608
MLATBD	0.9236	0.0421
	LD01	LD02
LD01	1.0000	-0.4218
LD02	-0.4218	1.0000

Table 4 presents the factor structure of motor skills in the final measurement rotated to Promax position (structure). This table shows that two latent dimensions were isolated in the final measurement as well as in the initial measurement. As it can be noticed, there were obvious global changes of motor skills in the final measurement, because the structure of latent dimensions reveals certain specificities. The first latent dimension now consists of agility, movement frequency, explosiveness and balance which were the makeup of the second latent dimension in the initial measurement. The second latent dimension describes movement frequency, explosiveness and coordination which shifted here from the first latent dimension in the initial measurement. The results are in agreement with the former researches concerning effects of the proprioceptive training on the muscle strength abilities (Heitkamp, Horstmann, Mayer, Weller & Dickhuth, 2001), agility (Malliou et al., 2004; Yaggie & Campbell, 2006) and horizontal jump (Ziegler, Gibson & McBride, 2002; Kovacs, Birmingham, Forwell & Litchfield, 2004) and also when it comes to influence of the jumping rope training on development of coordination, agility, kinesthetic and proprioceptive sensitivity (Bašić, M. & Bašić D, 2005).

It can be concluded that coordination dominates in the structure of latent dimensions, but with other factors being very pronounced. It is also observable that explosiveness significantly contributes to latent dimensions, and it can be said that this is greatly related to controlled energy. The isolated latent dimensions additionally describe motion control, but from the position of the flow of information channels (frequency) and the engagement of the muscle units,

so it can be claimed that this is related to the stimulation of locomotor system, which is in agreement with Šebić-Zuhrić, Rađo and Bonacin (2007), who conclude that proprioceptive training accelerated formation of global control structures and enabled local differentiation that resulted in higher range and better quality of motion. Correlation of the isolated latent dimensions of motor skills in the final measurement is now much more pronounced and it has a value of -0.4218, which means that there was a significant restructuring of latent dimensions, in the way that they were integrated in the common form after the implementation of the program which is supposed to significantly help more efficacious performance of dance structures.

CONCLUSION

The aim of the research was to determine factor structures as global changes in dancers after the implementation of the proprioceptive training program and jumping rope training. The analysis of the applied variables in both measurements showed statistically significant correlation in the final measurement as compared to the initial one. In the factor analysis before and after the experimental program, two latent dimensions were isolated. Correlation of the isolated latent dimensions of motor skills in the initial measurement is relatively low (0.2667). The structure of latent dimensions in the final measurement is dominated by coordination and explosiveness (controlled energy). The isolated latent dimensions also describe motion control, but from the position of the flow of information channels (frequency) and the engagement of the muscle units, so it can be claimed that this is related to stimulation of locomotor system. Correlation of the isolated latent dimensions of motor skills after the experimental program is more pronounced (0.4218); this means that there was a significant restructuring of latent dimensions which should help more efficacious movement in the performance of dance structures. The results can be used in planning and more purposeful application of the proprioceptive and jumping rope training in the training process of dancers.

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DIFFERENCES IN MORPHOLOGICAL CHARACTERISTICS AND MOTOR ABILITIES BETWEEN VOLLEYBALL PLAYERS AND UNTRAINED GIRLS 14 YEARS OLD

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SUMMARY

Introduction: The aim of this study was to determine differences in morphological characteristics and motor abilities volleyball players and untrained girls aged 14 years. The tasks of the study were: to examine the morphological characteristics and motor skills in volleyball players aged 14 years, to examine the morphological characteristics and motor abilities in untrained girls aged 14 years and to compare the morphological characteristics and motor abilities between the two groups. Based on the goals and objectives of the research there are two hypotheses as follows: H1 - There is a statistically significant difference in the variables that explain the morphological space between the volleyball players and untrained girls ages 14 and H2 - There is a statistically significant difference in variables that explain the motor space between the volleyball players and untrained girls aged 14 years.

Methods: The paper applied Non-experimental research method based on the principle transversal study. The sample consisted of 80 female students aged 14 years, were divided into two subgroups. The first sub-sample was a group of women involved in the training process (volleyball), and the second of a group that is not engaged in physical activity outside of physical education classes. The sample of variables is also divided into two sub-samples and the variables for the evaluation of morphological characteristics (body height, body weight and body mass index) and the variables for motor skills - running 20 meters, "H" test, forward bend on the bench, shoulder flex bat , throwing a medicine ball (2kg), Abalakov test - block Abalakov test - with the swing arms. Data obtained during the survey, were analyzed using descriptive and comparative statistics, using SPSS19.0. From the area of comparative statistics, we used the T-test for small dependent samples.

Results: The results indicate that there is a statistically significant difference in favor of female volleyball players for the following variables: body height, body weight, "H" test, test Abalakov - Block Abalakov test - with the swing arms. The hypotheses were partially confirmed.

Conclusion: Based on everything written, it can be concluded that the volleyball team successfully in those activities that are specific to the beach, and the other skills correctly implemented within the physical education classes at school.

Keywords: volleyball, differences, morphological characteristics, motor abilities

INTRODUCTION

Permanent research interest in sports is the problem of choosing the method, content and organization of training process, and in recent years extensive research had been carried out at home and abroad, so that organized physical activity could contribute to the optimal development of the anthropological dimension of both sexes at all ages, regardless of their ability and quality (Milanović, Jukić, Nakić, & Čustonja, 2003). Human capabilities and characteristics can be most successfully developed during so-called sensitive periods or rather phases of rapid development of motor skills (Ugarković, 1996).

With this agrees growing number of authors (Nešić, 2002; Bompa, 2005; Gortsila, Theos, Nesic, & Maridaki, 2013; Nešić, Ilić, & Majstorović, 2013) indicating that in the ontogenetic period, based on the principles of nature, person achieves the most important phase of development of certain abilities and characteristics of the individual, and also the

increase of adaptive capabilities and particularly favorable preconditions for the formation of certain motor skills (Jakovljevic, Karalejic, Pajic, Macura, & Erculj, 2012; Markovic, Mirkov, Nedeljkovic, & Jaric, 2014). That is why, in the last few years, there was an increased interest in the inclusion of children and adolescents in sports activity because the process of growing up, according to some researchers (Dopsaj, 1994; Milanović et al., 2003; Stojanović, Kostić, & Nešić, 2010), is particularly sensitive to the possibility of manifesting positive, but also the negative impacts.

The aim of this study was to examine whether there are statistically significant differences in morphological characteristics and motor abilities between the volleyball players and untrained girls aged 14 years, as well as to determine which of the tested variables gives the largest contribution to the determined difference. The tasks of the study were: to examine the morphological characteristics and motor skills of female volleyball players 14 years old, to examine the morphological characteristics and motor abilities of untrained girls 14 years old and to compare the morphological characteristics and motor abilities between the two groups.

Based on the aim and objectives of the research there are two hypotheses as follows: H1 - There is a statistically significant difference in the variables that explain the morphological space between the volleyball players and untrained girls aged 14 and H2 - There is no statistically significant difference in variables that explain the motor space between the volleyball players and untrained girl aged 14 years.

METHODS

The paper applied non-experimental research method based on the transversal study principle. It has a qualitative and quantitative approach. The qualitative approach involves description and observation, and quantitative approach involves testing and measurement method.

Sample of examinees

The sample was drawn from a student population of primary school children in the city of Belgrade. The sample was divided into two subgroups, namely: sub-sample of 40 female volleyball players (pioneer selection Volleyball Club "Red Star") and the sub-sample of 40 untrained girls (elementary school students, "Marko Oreškovic" from Belgrade). Subjects were 14±6 months old during the evaluation of anthropometric characteristics and motor abilities.

Sample of measuring instruments

On 11th April 2014, from 10:00 to 13:00h (in accordance with the procedures of the Declaration of Helsinki), the measurements of certain morphological characteristics and testing of motor skills was conducted on primary school students of "Marko Oreškovic" elementary school (in the hall of the Faculty of Sport and Physical Education in Belgrade). The next day (at the same time in the same place and with the same measurer) the same battery of tests was carried out on female volleyball players VC "Red Star" - Belgrade. Testing was performed by using a battery of tests, with a break between the two attempts of 2 minutes (the better result taken as the final). Prior to testing, body weight and height was measured. This was followed by a standardized warm-up for 10 minutes and rest for 5 minutes during which a detailed explanation and demonstration was performed of each test selected to assess motor skills. All subjects were dressed in sports gear. During testing, the air temperature was between 18 and 22°C. The protocols of this study were approved by the Ethics Committee of the Faculty of Sport and Physical Education, University of Belgrade. As mentioned earlyer, the sample of variables is divided into two subsamples, the variables measuring morphological characteristics:

- Body height (tv)
- Body weight (tm)
- Body mass index (BMI)

and variables for assessment of motor abilities (seven variables):

- For assessment speed - high start 20 meter run (trc_20)
- For assessment of agility - modified "X" test (X_test)
- For assessment of hip joint flexibility - bench bend (dpk)
- For flexibility of arms and shoulders - shoulder flex bat (isk_pal)
- For instantaneous power of arms and shoulders - 2 kg medicin ball throw (bm)

- For explosive power of the leg extensor muscles - "Abalakov" test without the arm swing (abl_b)
- For explosive power of the leg extensor muscles - "Abalakov" test with the arm swing (abl_z).

Morphological characteristics were measured by standard protocols and standard equipment. Body height was measured by Martin anthropometry. The result is read with an accuracy of 0.1cm. Body mass was measured with medical scales (Tanita Inner Scan Body, BC - 601). The result is read with an accuracy of 0.1 kg. The body mass index was determined according to the formula tm / tv2.

Motor abilities were evaluated according to standard protocols (Martin, Jackson, Morrow, & Liemohn, 1998) and using standardized tests as follows: *high start 20 meter run* - test for the evaluation of movement speed. Measurements were performed according to the protocol described by Bjelica and Fratrić (2011). The result is given with an accuracy of 0.1 seconds. *The modified "X" test* - for assessing agility. Instruments: cones and a stopwatch with an accuracy of 0.1 seconds. The initial position of the subject: subject stands in the center of the square. Task: subject attempts to cross the path, which is shown in Figure1, as fast as he can.

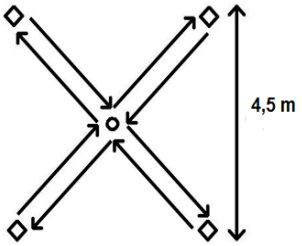

Figure 1. The modified "X" Test

Bench bend - test for assessment of flexibility in the hip and lumbar region of the spinal column. Measurements were performed according to the protocol described in Martin et al. (1998). The result is read with an accuracy of 0.1 cm. Shoulder flex bat - a test for the assessment of mobility in the shoulder joint. Measurement was conducted according to the protocol described by Gruić, Ohnjec, & Vuleta (2011) result is read with an accuracy of 0.5 cm. *Throwing a medicine ball (2 kg) - test for assessing explosive power shoulder belt.* Measurement was conducted in accordance with the protocol described in Neši et al. (2013) result is read with an accuracy of 1.0 cm. *"Abalakov" test without the arm swing* - test for assessing explosive knee extensor muscle force and *"Abalakov" test with the arm swing*, which also assesses the explosive force of leg extensor muscles. Result is read with an accuracy of 0.5 cm.

Statistical data analysis

Data obtained during the research, was analyzed using descriptive and comparative statistics, with SPSS 19.0. From the comparative statistics area, we used the t-test for small dependent samples.

RESULTS

Information wich allow understanding of the issues and objectives of this research, were obtained by applying statistical methods for processing data. Table 1 presents the results of the basic descriptive indicators of morphological characteristics and motor abilities for female volleyball player, whereas Table 2 shows the results of basic descriptive indicators of morphological characteristics and motor ability of untrained girls. Descriptive indicators presented in Tables 1 and 2 are: the minimum, maximum, average (Mean), standard deviation (SD) and coefficient of variation (CV).

In Table 3, the results of comparative statistical analysis can be seen, showing the measured variables between which there is a statistically significant difference, and where there is none. Based on the obtained results it can be concluded that the difference is shown in the following variables: body height, body weight, "X" test, "Abalakov" test without the arm swing and "Abalakov" test with the arm swing.

Table 1. Results of basic descriptive indicators of morphological characteristics and motor abilities of female volleyball player

Variables	N	Minimum	Maximum	Mean	SD	CV
tv_o	40	150.00	190.00	171.575	8.409	0.049
tm_o	40	44.00	75.00	58.225	8.672	0.148
bmi_o	40	16.65	26.67	19.746	2.401	0.121
trc_20_o	40	3.19	4.28	362.950	23.279	0.064
X_test_o	40	9.27	13.08	1075.650	89.066	0.082
dpk_o	40	-15.00	11.00	-2.150	6.750	-3.139
isk_pal_o	40	45.00	94.00	65.625	11.306	0.172
bm_o	40	470.00	980.00	676.375	131.344	0.194
abl_b_o	40	25.00	48.00	39.650	5.493	0.138
abl_z_o	40	33.00	56.00	44.325	5.984	0.135

Table 2. Results of basic descriptive indicators of morphological characteristics and motor ability of untrained girls

Variables	N	Minimum	Maximum	Mean	SD	CV
tv_n	40	151.00	177.00	162.450	7.085	0.0439
tm_n	40	38.00	73.00	53.150	9.302	0.175
bmi_n	40	14.84	26.84	20.091	2.952	0.146
trc_20_n	40	3.28	4.32	372.275	2.705	0.072
X_test_n	40	9.34	13.41	1183.925	9.837	0.083
dpk_n	40	-15.00	6.00	-3.625	5.882	-1.622
isk_pal_n	40	54.00	89.00	69.850	9.005	0.128
bm_n	40	420.00	880.00	635.000	105.733	0.166
abl_b_n	40	25.00	43.00	33.650	3.634	0.108
abl_z_n	40	28.00	52.00	39.725	4.814	0.121

Table 3. Results of comparative statistical analysis of morphological characteristics and motor abilities

	t	df	Sig. (2-tailed)
tv_o - tv_n	5.153	39	.000
tm_o - tm_n	2.533	39	.015
bmi_o - bmi_n	-0.540	39	.592
trc_20_o - trc_20_n	-1.754	39	.087
X_test_o - X_test_n	-4.796	39	.000
dpk_o - dpk_n	0.948	39	.349
isk_pal_o - isk_pal_n	-1.689	39	.099
bm_o - bm_n	1.679	39	.101
abl_b_o - abl_b_n	6.988	39	.000
abl_z_o - abl_z_n	4.860	39	.000

DISCUSSION

Rather logical distribution of statistical significance in the tested variables can be seen in the analysis of obtained results. In fact, it is only natural that the body height of volleyball players is higher (p=.000), because those kids were selected for sports branch in which height plays a crucial role. Thus the body weight of female volleyball players in relation to untrained girls is statistically significantly greater (p=.015). Results of comparative statistical analysis of variable body mass index, showed no statistically significant difference (p=.592), which supports the fact that the values of these variables in both subsamples are within normal limits. As for the motor variables, it can be concluded that the difference is shown in three variables, namely: "X" test (p=.000), "Abalakov" test without the arm swing (p=.000) and "Abalakov" test with the arm swing (p=.000). This indicates that female volleyball players have performed better in those variables that are specific for the game of volleyball. This fact fits into one of the basic principles of training, that the locomotor apparatus of athletes is best expressed in those conditions in which they are trained (Janković & Marelić, 1995; Nešić, 2005). As for other variables, there were no statistically significant differences because these are motor skills that are treated and manifested in physical education classes. In other words, the variables for which no statistically significant differences were found (body mass index, forward bend on the bench, shoulder flex bat and throwing a medicine) are those that corespond in the activities they are engaged with (volleyball players - training, untrained girls - physical education).

CONCLUSION

Based on everything written we can conclude that practicing volleyball in sensitive period of the motor skills development, in which tested subjects are, contributes to the manifestation of motor skills better in specific movements and manipulations of volleyball. On the other hand, the basic motor skills (one might say natural forms of movement) of girls aged 14 years, regardless of whether they are in training or not, did not show significant differences, which can be attributed to the physical education classes applied in accordance with the program and the tasks that are set before it. The obtained results suggest that both hypotheses are partly confirmed, there was no statistically significant difference in all of the variables, but in some. Future studies should increase the sample of subjects, and will thereby avoid accidental errors. In analogy, the increase of the number of measurements, may also increase accuracy of the research.

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DIFFERENCE IN SOME MORPHOLOGICAL CHARACTERISTICS BETWEEN ELITE YOUNG JUDOKAS OF DIFFERENT WEIGHT CATEGORIES

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SUMMARY

Judo is high intensive combat sports where athletes are divided in weight categories. Improving morphological and physiological characteristics of judo athletes are important for success in sport combat. The aim of this research was to determine if there are significant difference in some anthropometric measures between light weight (-55kg, -60kg, -66kg) and medium weight judokas, members of the cadet national team of Serbia. The research was carried out on a sample of 50 young judokas, aged 15 to 17. The analysis of the results of the arithmetic means of the tests used showed that there are significant differences (medium weight judokas had better results in 10 from 13 applied tests).

Keywords: judo, cadet, light-weight, medium-weight, anthropometric tests.

INTRODUCTION

Judo is Japanese martial art and Olympic sport in which can be described as a combative, high intensity sport. To win a combat athlete attempts to throw the opponent onto his back or to control him during groundwork combat. Judoka need to develop specific technical and tactical skills with the support of good physical fitness (Thomas, Cox, LeGal, Verde, & Smith, 1989). Morphological and physiological characteristics of judo athletes correlate with technical factors performed during a judo fight (Claessens, Beunen, Wellens, & Geldof, 1987; Thomas et al, 1989; Callister, Callister, Staron, Fleck, Tesch, & Dudley, 1991; Ebine, Yoneda, Hase, Aihara, Aihara, Akaike, ... & Tsuyuki, K. 1991; Kim, Kim, & Han, 1996; Borkowski, Faff, & Starczewska-Czapowska, 2001). Improving in some of the abovementioned variables may have a positive influence on performing the techniques during the fight (Franchini, Takito, & Bertuzzi, 2005). High-level judokas had larger circumferences (contracted arm, forearm, wrist and leg) and bone diameters (femur and humerus epicondyles) when compared to national-level judokas of lower competitive level (Franchini, Takito, Kiss, & Strerkowicz, S., 2005).

Physical fitness and some anthropometrical variables are considered important for high performance in judo competition (Sikorski, Mickiewitz, Majle, & Laksa, 1987; Thomas et al, 1989). In a competition judokas are divided by weight, and it has been supposed that high level judokas should have low level of adipose tissue (Kubo et al, 2006) and higher level of fat-free mass (FFM) (Kubo, Chishaki, Nakamura, Muramatsu, Yamamoto, Ito, M., ... & Kukidome, 2006). In addition, high level judokas had a lower body fat percentage than less qualified judokas in USA ranking (Callister et al., 1991). We need to take into a consideration that this foundlings were maybe a consequence of physiological adaptations to long-term judo training. Aim of this research was to establish morphological profile of elite young Serbian judokas and to compare results between light and medium weight categories.

METHODS

Sample of participants

This research was carried out on a sample of 50 young judokas, aged 15 to 17. The participants, by wining a medal in the Serbian Regional

Championship, qualified for a place on the list of potential national team members for the European Championship and the Balkan Championship. All of the participants volunteered to participate in the testing and were previously informed about the testing protocol described in the study project material. They were divided into two groups: light weight group (categories under 55kg, under 60kg and under 66kg) and medium weight group (categories under 73kg, under 81kg and under 90kg).

Measuring instruments

The selected anthropometric tests enabled the accurate evaluation of latent morphologic dimensions. Tests were conducted with methodology recommended by International Biological Program (Weiner, Lourie, 1969). Anthropometric tests were designed to cover all for latent spaces of morphological dimensions:

Longitudinal dimensionality of the skeleton: Body height (AVIST), leg length (ADUNO), arm length (ADURU). Transversal dimensions of the skeleton: acromial diameter (ASIRA), pelvic diameter (ASIKA), hip diameter (ASIKU). Volumes and body mass: thorax circumference (AOGKS), relaxed arm circumference (AONAD), thigh circumference (AOBUT) and body mass (AMAST). Subcutaneous adipose tissue: triceps skinfold (AKNNA), subscapular skinfold (AKNLE) and abdominal skinfold (AKNTR).

Data collection and analysis

All of the measuring of the participants was carried out in the morning hours. The air temperature in the facility was optimal for the realization of the testing. The order of the tests of measuring was planned in advance and determined for all the groups of participants based on the stop system and circular form of work. The statistical data analyses were calculated using the IBM SPSS 19 statistical program. The basic descriptive parameters were calculated. In order to determine the statistically significant difference, the student t-test for independent samples was used.

RESULTS

The parameters of the distribution of anthropometric measures among the judokas are shown in Tables. 1 and 2. For each variable the following values were determined: the arithmetic means (MEAN), the median (MED), the minimal result (MIN), maximum result (MAX), the result range (RANGE) and the standard deviation (SD). For each variable the critical values of kurtosis (Kurt) and skewness (Skew) were given.

By gaining insight into table 1, where the basic parameters of the distribution of the applied variables of anthropometric measures for judokas of light-weight categories, we can note that the most of the results are well-grouped and have a normal distribution around the means.

The measure of the result distribution indicates that most variables are well suited for the measuring of morphological characteristics in the group of selected athletes, expect for the variables leg length and abdominal skinfold. For these variables we can say that a small number of participants had extremely higher or lower values of results obtained.

Average height for light-weight judokas was 168,20±5,63cm, while minimal was 155,20 and maximal was 182 cm. The rest of the longitudinal dimensionalities (arm and leg length) were in alignment with the height. For transversal dimensions of the skeleton following results were obtained: mean value of acromial diameter was 38,04 ±1,85cm (with minimal value of 35,50 and maximal value of 41,80 cm), mean value of pelvic diameter 26,51±1,10 (with minimum 23,50 and maximum of 28,50 cm), and hip diameter 30,61±1,18 cm (with 28,80 and maximum of 33,00 cm). Results of the transversal dimensionality in judokas of light-weight categories were in accordance with the results of previous research (Nurkić, 2003; Cicović, Zdrale, 2013).

Table1. Basic descriptive parameters for anthropometric variables for judokas of light-weight categories

VARIABLE	N	MEAN	MED	MIN	MAX	RANGE	SD	Skew	Kurt
AVIST	25	168,44	168,20	155,20	182,00	26,80	5,63	0,00	0,67
ADUNO	25	95,52	94,80	85,00	107,70	22,70	4,03	0,52	3,79
ADURU	25	76,30	76,80	65,30	84,60	19,30	5,24	-0,40	-0,69
ASIRA	25	38,04	37,60	35,50	41,80	6,30	1,85	0,54	-0,48
ASIKA	25	26,51	26,60	23,50	28,50	5,00	1,10	-0,68	1,40
ASIKU	25	30,61	30,30	28,80	33,00	4,20	1,18	0,48	-0,40
AOGK	25	84,56	85,00	78,20	92,50	14,30	4,54	0,19	-0,98
AONAD	25	27,58	27,50	21,00	35,50	14,50	3,98	0,15	-0,42
AOBUT	25	50,18	50,00	48,00	53,30	5,30	1,45	0,85	0,59
AMAST	25	59,44	60,00	53,00	68,00	15,00	4,74	0,26	-1,31
AKNNA	25	7,80	7,20	5,40	13,20	7,80	2,01	1,24	1,58
AKNLE	25	6,80	6,60	5,60	9,20	3,60	0,87	0,85	0,65
AKNTR	25	7,35	6,80	5,00	13,20	8,20	1,89	1,80	3,34

Values of body mass and circumferences have shown us that selected sample had longer period of training activities. Mean body mass was 59,44±4,74 kg (with minimal 53 kg and maximal 68kg) , which was to be expected due to the fact that the participants were from the categories -55kg, -60kg and -66kg.

Skinfold variables were selected to measure subcutaneous adipose tissue on the most important muscle regions. Results obtained were very low which was to be expected in the light-weight well trained sample.

Table2. Basic descriptive parameters for anthropometric variables for judokas of medium-weight categories

VARIABLE	N	MEAN	MED	MIN	MAX	RANGE	SD	Skew	Kurt
AVIST	25	175,32	178,00	162,30	186,60	24,30	7,44	-0,63	-0,59
ADUNO	25	98,96	99,70	91,60	110,50	18,90	5,02	0,40	0,66
ADURU	25	74,69	75,80	65,40	83,20	17,80	5,49	-0,20	-0,88
ASIRA	25	40,09	41,00	37,20	42,80	5,60	1,86	-0,32	-1,17
ASIKA	25	28,33	28,70	25,40	30,50	5,10	1,27	-0,95	1,33
ASIKU	25	32,37	32,30	31,30	33,80	2,50	0,80	0,45	-0,92
AOGKS	25	92,21	92,55	85,30	98,30	13,00	4,16	-0,17	-0,99
AONAD	25	28,51	28,00	21,00	35,20	14,20	4,11	0,12	-0,53
AOBUT	25	57,25	57,00	45,30	67,00	21,70	5,68	-0,03	0,80
AMAST	25	76,13	74,00	68,00	89,00	21,00	6,47	0,71	-0,47
AKNNA	25	9,79	8,60	6,00	17,20	11,20	3,09	1,07	0,71
AKNLE	25	8,77	8,20	6,40	11,60	5,20	1,78	0,32	-1,40
AKNTR	25	10,51	11,20	4,60	17,40	12,80	4,48	0,20	-1,47

By analyzing table 2, where the basic parameters of the distribution of the applied variables of anthropometric measures for judokas of medium-weight categories, we can note that the most of the results are well-grouped and have a normal distribution around the means, expect for the acromial diameter and some of the skinfolds measured. Authors assume that bigger difference in body mass (from 73 to 90 kg) had influence on these results.

Average height for medium-weight judokas was 175,32±7,44 cm, while minimal was 162,30 cm and maximal was 186,60 cm. The rest of the longitudinal dimensionalities (arm and leg length) were in alignment with the height. Rest of the longitudinal dimensions had also a normal distribution. Transversal dimensions had a good dispersion of the

results (acromial diameter 40,09±1,86 cm, pelvic diameter 28,33±1,27 cm and hip diameter 32,37±0,80 cm). Mean body mass was 76,13± 6,74 kg, ranged from 68 to 89kg. Circumferences range is higher than in light weight judokas but that was expected.

Skinfold thickness of medium-weight judokas ranged from 8,77mm (subscapular) to 10,51mm (abdominal). Results had been very well spread and higher than in light-weight judokas due to a higher body mass of the participants, despite they are all same age.

In order to show if there are statistical differences in morphological characteristics between medium and light-weight judokas in tables 3,4,5 and 6 we have given results of the student t-test.

Table 3. Differences of the arithmetic means (longitudinal dimensionality)

Variables	MEAN	SD	N	T	DF	P
AVISTL	166,29	5,17				
AVISTS	175,32	7,44	25	-4,53	24	**0,00**
ADUNOL	93,89	3,12				
ADUNOS	98,96	5,02	25	-3,80	24	**0,00**
ADURUL	74,16	5,49				
ADURUS	74,69	5,49	25	-0,30	24	0,77

By analyzing the results of the arithmetic means of the tests that measured longitudinal dimensionality of the skeleton, we can note that the difference is manifested in such a way that the medium weight judokas had higher results in body height and leg length, while in arm length there is a difference that is not statistically important.

Table 4.Differences of the arithmetic means (transversal dimensionality)

Variables	MEAN	SD	N	T	DF	P
ASIRAL	37,70	1,50				
ASIRAS	40,09	1,86	25	-3,4	24	**0,00**
ASIKAL	26,27	1,20				
ASIKAS	28,33	1,27	25	-4,8	24	**0,00**
ASIKUL	30,34	1,19				
ASIKUS	32,37	0,80	25	-4,7	24	**0,00**

By reviewing the arithmetic means of the tests that measured transversal dimensionality of the skeleton, we can clearly note that medium weight judokas had statistically higher statistically in allof the applied variables, so thez have larger acromial, shoulder and hip diameter.

Table 5. Differences of the arithmetic means (Volumes and body mass)

Variables	MEAN	SD	N	T	DF	P
AOGKSL	85,52	4,90				
AOGKSS	92,21	4,17	25	-3,8	24	**0,00**
AONADL	26,05	3,85				
AONADS	28,51	4,11	25	-1,7	24	0,10
AOBUTL	50,74	2,65				
AOBUTS	57,25	5,68	25	-4,0	24	**0,00**
AMASTL	58,87	5,14				
AMASTS	76,13	6,47	25	-7,1	24	0,00

By analyzing the results of the arithmetic means of the tests that measured volumes and body mass, we can note that the there is statistically significant difference in all applied variables (body mass, thorax

and thigh circumference) expect for the variable relaxed arm circumference. We can state that the medium weight judokas had bigger circumferences than light-weight judokas.

Table 6.Differences of the arithmetic means (Subcutaneous adipose tissue)

Variables	MEAN	SD	N	T	DF	P
AKNNAL	8,21	2,31				
AKNNAS	9,79	3,09	25	-1,57	24	0,14
AKNLEL	6,89	0,99				
AKNLES	8,77	1,78	25	-3,41	24	**0,00**
AKNTRL	7,57	2,38				
AKNTRS	10,51	4,48	25	-2,09	24	**0,05**

If we look into table 6, where difference of arithmetic mean of subcutaneous adipose tissue are shown, we can see that there were significant differences in variables subscapular and abdominal skinfold while in the variable relaxed arm skinfold significant differences were not found. The obtained difference is manifested in such a way that the light-weight judokas had lower level of subcutaneous adipose tissue on measured regions.

DISSCUSION

Comparing with the results of Nurkic (2003) and Cicović, Zdrale (2013), who used number of same variables, we can say that all of the results were of similar values. Explanation lies in the fact that the sample was selected judokas, national team members of the same age but different generation (Nurkic, 2003) or different country (Cicović, Zdrale, 2013). It was to be expected that judokas in medium weight categories have higher values of longitudinal dimensionality. In addition medium-weight judokas from our research (aged 15 to 17) had almost equal height compared to members of Brazil senior national team (175,3 cm to 176.2 respectively) (Franchini, Takito, Kiss, & Strerkowicz, 2005).

Results of the transversal dimensionality in judokas of light-weight categories were in accordance with the results of previous research (Nurkić, 2003, Cicović, Zdrale, 2013). Medium-weight judokas had statistically higher values which were similar to results obtained in study conducted by Sertić, Segedi & Žvan (2007) on sophmore college population. According to these results we can assume that medium-weight judokas were of older biological age.

We identifiedsignificantly higher values of body circumferences for medium-weight judokas due to a higher body mass. Still, these values are significantly lower then values obtained in research conducted by Almansba, Sterkowicz, Belkacem, Sterkowicz-Przybycień, & Mahdad, (2010) which had tested Algerian Olympic team members.

It has been shown (Drid, Ostojic, Maksimovic, Pejcic, Matić, & Obadov, 2009; Bala, & Drid, 2010; Katralli, & Goudar, 2012) that judokas have lower level of subcutaneousadipose tissue compared to untrained people of same age. In addition our results were lower (better) than results of Drid et al. (2009) and Bala & Drid (2010) whoconducted their research on the judokas of almost same age (14 to16 years). Thus there are significant differences between light and medium weight judokas, both groups had a very good result. Obviously, the sample which was assembled from only elite young judokas,who had been training for a long period, contributed to get these results.

CONCLUSION

Most important aim of training process is to transform motoric skills, functional ability and some of the morphologicalcharacteristics (Bratić, Nurkić, Cicović, 2014) because that leads to better performance on a sport field. By determining morphological models we gain excellent basis for sport selection. Results will also help in programing of training regimes. Research results could be used as a control model for judo coaches of youth categories.

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MODEL OF EVALUATING THE SITUATIONAL EFFICIENCY OF THE GOALKEEPER IN TOP QUALITY HANDBALL

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SUMMARY

According to handball experts the goalkeeper is the most important player in determining the situational effectiveness and the scoring success of his team. Given that the effect of the goalkeeper is specific, we should pay special attention to individual aspects and differential work in the education and training process. Previous studies of situational efficiency in handball studied the efficiency regarding the playing positions, efficiency regarding the shooting zones, and efficiency in relation to the different ways of shooting. Regarding the goalkeeper, the position's overall situational efficiency was generally defined only by defence parameters, which is somewhat understandable, because this is the goalkeeper's dominant activity. The aim of this research is, on the basis of previous models, to suggest an improved and more pragmatic evaluation model of the situational effectiveness of the goalkeeper, which will contain the parameters recorded at matches of the top national teams in recent times. Therefore, in this paper, a methodological approach for evaluating the impact of situational effect of the goalkeepers in men's senior handball matches is described. In addition to directly evaluating the effect, the model can be used in the process of selecting a goalkeeper and as a component of evaluation of the real quality of the team. Based on the proposed model it is possible to monitor the progress of each goalkeeper in the game during the season and during his entire sports career. The results of monitoring provide the coaches with a quality feedback that indicates the state of preparedness of the goalkeeper, and can be used for more effective planning, programming, implementation, monitoring, and analysis of the sports training.

Keywords: handball, goalkeeper, model

INTRODUCTION

According to handball experts the goalkeeper is the most important player in determining the situational effectiveness and the scoring success of his team (Rogulj, 2000). The game rules of handball distinguish the goalkeeper as a separate entity and assign him with specific technical and tactical actions that are significantly different from those of the players in the field. The position that he has in the game enables maximum exposure of individual qualities and motor creativity and asserts a need for functional cooperation with the other players. The goalkeeper's tactical tasks by order of importance and chronologically are: to prevent the opponent's implementation of their final attack, either by interrupting the counterattack or by direct save of the shot; in principle, after saving the shot, to reach the ball as quickly as possible and bring it under control; to start an attack for his team in a purposeful and effective way; to participate in an attack by his team as a player in the field as needed. The goalkeeper operates independently in a limited space and most directly affects the outcome of any opponent's attempt to implement a final attack and, due to this special responsibility he contributes to the positive or negative emotional state of the team more than other players. Given that the effect of the goalkeeper is specific, we should pay special attention to individual aspects and differential work in the education and training process.

The evaluation of the performance of players is implemented through four types of indicators of situational activities, and these are: the parameters of situational efficiency in the attack; the parameters of situational efficiency in the defence; the parameters of situational inefficiency in the attack;

and the parameters of situational inefficiency in the defence.

Previous studies of situational efficiency in handball studied the efficiency regarding the playing positions (Gruić, Vuleta, & Milanović, 2006; Ohnjec, Vuleta, Milanović, & Gruić, 2008), efficiency regarding the shooting zones (Pokrajac, 2008; Rogulj, 2000), and efficiency in relation to the different ways of shooting (Delija & Šimenc, 1994; Vuleta, Bedić, & Gruić, 2003). Furthermore, they studied the differences between the frequency and effectiveness of the shot in relation to the performance of the team (Apitzsch & Liu, 1997; Taborsky, 2008), the influence of the elements of tactics on the performance and impact of final attack variables on the final result of the match (Srhoj, Rogulj, & Naumovski, 2001; Rogulj, Srhoj, & Srhoj, 2004; Rogulj & Srhoj, 2009).

Regarding the goalkeeper, the position's overall situational efficiency was generally defined only by defence parameters, which is somewhat understandable, because this is the goalkeeper's dominant activity. Most commonly the efficiency is shown by the percentage of success in defence, or by the ratio of defence to goals, or by the total number of shots. By inspecting the scientific literature, two models of evaluating the situational efficiency of the goalkeeper were found so far. The first was proposed by Rogulj (1997). By this model, on the basis of monitoring and statistical analysis of the situational indicators of the goalkeeper's game and his contribution to the determination of the results of matches in top quality handball, the weight of significance for individual elements were established, or associated corresponding points, as a starting point for creating a simple model of monitoring the effectiveness of the goalkeeper in situational conditions of the game.

Table 1. Weight of importance of the situational efficiency of the goalkeeper

Goal scored from external position	-0.7
Goal saved from outside positions	0.85
Goal scored from wing positions	-0.55
Goal saved from wing position	0.95
Goal scored from the line position (from the position of the circle runner, from counterattack, from the passage of players on the line or from 7 metre line)	-0.4
Save from line positions	1.6
Score by a direct shot at goal	2
Successful assists for counterattack	1.6
Unsuccessful assists for counterattack	1

The observed frequency of an individual situational activity of the goalkeeper in the game is multiplied with the corresponding weight of importance of this activity and summed (Table 1). The resulting scores are converted into a score of the goalkeeper's game in the Table 2.

Table 2.

GAME RATING	POINTS
1	- (-12)
1.5	(-11) – (-8)
2	(-7) – (-4)
2.5	(-3) – 0
3	1 – 4
3.5	5 – 8
4	9 – 12
4.5	13 -16
5	17 -

The other model was proposed by Cvenić (2008), and it contains only the parameters of the goalkeeper's defence situational activities. To evaluate the efficiency of the goalkeeper in handball we use a specially prepared methodology. It includes several steps:

The model is based on the established average defence efficiency of the goalkeeper from different positions recorded at the European Championship games. From the recorded averages the inversely scaled coefficients of efficiency defences for each type of kick were determined, which are multiplied with the corresponding frequency of the defence and summed. In this way, the total defence efficiency of the goalkeeper is expressed in points.

The formula is:

E = nO9M * 0.574 + nOKR * 0.615 + nO7M * 0.762 + +nO6M * 0.765 + nOKN * 0.802 + nOPR * 0.832

If we want to get the relative efficiency of each individual goalkeeper then the value (E) should be divided by minutes in a match shown in hours:

$$E\,r = E/t\,(h)$$

The aim of this research is, on the basis of previous models, to suggest an improved and more pragmatic evaluation model of the situational effectiveness of the goalkeeper, which will contain the parameters recorded at matches of the top national teams in recent times.

METHODS

Sample of examinees

The holders of the information in this paper are handball matches. 101 matches played in the World Championships in handball held in Croatia in 2009 were analysed. The data were collected through an official statistical protocol applied by IHF.

Sample of measuring instruments

12 standard parameters of the situational efficiency of the goalkeeper were analysed, as following:

- Save of shot from outer positions (SS 9m) – save of shot from the position of the lateral external or external medium players outside the 9 metre line.
- Goal scored from external position (PG 9m) - goal scored by a shot from the position of lateral external or external medium players outside the 9 metre line.
- Save of shot from wing position (SS Wing) - save of shot from a position on the left and right wings.
- Goal scored from the wing position (PG Wing) - goal scored from a shot on the left and right wings.
- Save of shot from the 6 metre line (SS 6m) – save of shot from the goal area line by the circular attacker or another player who participates in the line game.
- Goal scored from the 6 metre line (6m PG) - goal scored by a shot from the goal area line by the circular attacker or another player who participates in the line game.
- Save of counterattack shot (SS FB) – save of a shot from an individual, group, or collective counterattack.
- Goal scored from a counterattack (PG FB) - goal scored from an individual, group, or collective counterattack.
- Save of shot from passage deception (SS BT) – save of shot sent after the passing of the attacker by deception from the goal area line.
- Goal scored from passage deception (PG BT) – goal scored from a shot after the passing of the attacker by deception from the goal area line.
- Save of shot from the 7 metre line (7m SS) – save of a penalty throw from the 7 metre line.
- Goal received from the 7 metre line (PG 7m) – goal received from a penalty from the 7 metre line.

Study protocol and data collection and processing methods

The data were registered and recorded by a video analysis using a software package *Match Analysis System* by company AGS – sport d.o.o. from Zagreb. The aforementioned program allows the user to create variables that he wants to record. Before every game the user has to upload the game on the Internet server through which the program operates. After that the basic information about the game is entered: team names, location, date and time, and the final score of the match. To each recorded event the program gives a point in time which allows the interruption and repetition of video analysis and the deleting of the events if an error occurred.

In the second step the coefficients of the importance of individual variables in the determination of the score success were evaluated,

and by Kruskal-Wallis ANOVA test for independent samples the differences between successful and unsuccessful teams were calculated. Furthermore, the normalisation of the parameter of difference "H" on a scale of 1 to 5 by was made by the following relation:

$$k_z = \frac{4 \times H}{H}_{max} + 1$$

Where:

kz = coefficient of importance of individual variables

H = parameter of Kruskal-Wallis test

Hmax = maximum value of the Kruskal-Wallis test within each group of variables

The situational performance of the goalkeeper is defined as the sum of the products of the recorded frequency and the corresponding coefficients of the importance of all the variables:

$$SUIZ_p = \sum_{v=1}^{n} f_v \times k_z$$

Where:

SUIZp = the situational effect of goalkeeper (S)

kz = the coefficient of importance of individual variables

By the basic description parameters of arithmetic, mean, and standard deviation, we defined five quality grades of such formed variables which correspond to a scale of 1 to 5, and are used for evaluating the situational impact of the goalkeeper. By comparison with the qualitative normative we arrive to the performance evaluation of the goalkeeper.

In order to increase the sensitivity of the assessment a discreditation was made by the relation:

$$OU - OR + \frac{S - DGR}{GGR - DGR}$$

Where:

OU = impact assessment goalkeeper

OR = score qualitative class

S = situational effect of past

DGR = lower limit qualitative class

GGR = upper limit of the qualitative grades

RESULTS AND DISCUSSION

Table 1 presents the coefficient of importance of individual variables obtained by the previously described methodological approach. It is evident that the greatest difference between the winning and losing team is generated in a positive direction by a number of saved shots from external positions (9m SS = 5), and then by the saved shots from the wing position (Wing SS = 2.34) and saved shots from 7 metres (7m SS = 2.28). The saved shots from the central line position by the pivot, during the passing of the attacker or from counterattack, showed slightly lower coefficients of importance. The results are consistent with the current scientific knowledge (Foretić, Rogulj, & Trninić, 2010), and empirical findings that the goalkeeper's save efficiency from the wing and external positions contributes most to successful results. These are so-called "mandatory" saves because those are demanding positions for the attackers (greater distances or a small angle of shooting). Effectively saving these shots is an essential prerequisite for the efficient functioning of each zone defence, especially shallow ones.

Table 1. The coefficient of importance of individual variables

VARIABLE	k_z
6m SS	1.10
Wing SS	2.34
9m SS	5
7m SS	2.28
FB SS	1.30
BT SS	1.35
6m PG	-2.50
Wing S PG	-2.45
9m S PG	-1.30
7m S PG	-1.22
FB S PG	-5
BT S PG	-1.62

Besides that, shots from external positions are the most common and because of the greater shooting distance the saved ball is more easily controlled, allowing for rapid implementation of the counter-attack. The lower coefficients of importance of defence shots from the line positions are a result of lower frequency of these modes of implementation and greater efficiency due to the favourable shot angle and shorter distance.

The largest negative coefficient refers to the goals scored from transition attacks (FB with PG = -5). A higher number of goals scored from the transition is the best indicator of the result and qualitative difference between successful and unsuccessful teams (Foretić et al., 2010). Therefore, it is important for the goalkeeper, in addition to a large number of saves from external and wing positions, to concede fewer goals from counterattacks.

In the next step the situational effect of the goalkeeper is calculated as the sum of the products of recorded frequencies and the corresponding coefficients of the importance of all the variables, namely:

*S= { f 6m SS * 1,10 } + { f Wing SS * 2,34 } + { f 9m SS * 5 } + { f 7m SS * 2,28 } + { f FB SS * 1,30 } + { f BT SS * 1,35 } - { f 6m PG * 2,50 } - { f Wing S PG * 2,45 } - { f 9m S PG * 1,30 } - { f 7m S PG * 1,22 } - { f FB S PG * 5 } - { f BT S PG * 1,62 }*

In the final step, the recorded situational effect for the individual goalkeeper is compared with the qualitative standards (Table 2) in order to reach a final appraisal of the goalkeeper's effect in the game on a scale of 1-5 (Table 2). This model of evaluation of the goalkeeper's effect in the game can be considered as reliable and objective as it is based on scientific facts. The model is designed for senior male handball, and it should be taken with a grain of salt when used for younger age groups or in women's handball.

Table 2. The qualitative classes for evaluating the effectiveness of the goalkeeper

GRADE	1	2	3	4	5
S	> (-62.63)	(-62.62) – (-29.89)	(-29.88) – 2.85	2.84 – 35.59	35.58 >

CONCLUSION

Only the effectiveness determined on the basis of objective indicators may be useful to the coach and the goalkeeper as a starting point for planning and programming of the training process. Therefore, in this paper, a methodological approach for evaluating the impact of situational effect of the goalkeepers in men's senior handball matches is described. In addition to directly evaluating the effect, the model can be used in the process of selecting a goalkeeper and as a component of evaluation of the real quality of the team. Based on the proposed model it is possible to monitor the progress of each goalkeeper in the game during the season and during his entire sports career. The results of monitoring provide the coaches with a quality feedback that indicates the state of preparedness of the goalkeeper, and can be used for more effective planning, programming, implementation, monitoring, and analysis of the sports training. Finally, the proposed model can be a starting point for creating a computer program that would speed up and improve the very procedure of calculation.

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DIFFERENCE IN SELECTED AGILITY TESTS BETWEEN ELITE AND SUB ELITE JUDOKAS

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SUMMARY

The aim of this research is to examine the differences between chosen agility tests among competitors from JC Kinezis from Nish of international and national level. Sample of the examinees is consisted of 20 competitors of JC Kinezis from Nish (international and national ranking), divided into two groups. Statistically significant differences are spotted at all three tests, this implicates that competitors who achieve better results on competition also have better results at agility tests.

Keywords: judo, T-test, Kamikaze test, Illinois test

INTRODUCTION

Judo is dynamic, complex and physically very demanding sport. It is characterized by activity of high intensity that lists 5 min as long as the fight lasts (Radovanović, Bratić i Nurkić, 2009). For combat sports as judo is, there is a rule that in theirs specific moving structures are presented numerous changes. Large number o researches examine requirements which judo fighter has to fulfill in order to achieve high results (Franchini, Takito & Bertuzzi, 2005; Ebine, Yoneda, Hase, 1991; Radovanović, Bratić & Nurkić, 2009), but there are almost no research that examine the effect of the agility on the result in judo. Agility demands complex expression of mobility abilities, changing direction and repeated acceleration and slowing with continual control of movement in vertical and horizontal direction (Verstegen & Marcello, 2001). Agility is a type of speed, integral part of coordination and ability of maintaining the balance and proper body position to change the direction of movement (Čoh, 2003; Metikoš, Milanović, Prot, Jukić, & Marković, 2003; Twist & Benicky, 1995). Precisely these skills could contribute to more effective performance of judo techniques and they directly affect the sport results.

The example of the research of agility in combat sports we can find in Koropanovsky`s research (2011) who established the differences in mobility abilities of karate fighters who compete both in katas and fights. Marković, Mišigoj-Duraković, & Trninić (2005) emphasize that competitors who achieve better results on competitions also achieve better results at agility tests. They examined 13 best Croatian taekwondo female fighters. Similar tests for estimation of this ability used Hachana et al. (2014) on the sample of 95 young football players of federal and regional ranking. Gabbet (2002) compared the results of 159 players of junior and senior age in Australian national league.

The aim of this research is to examine the differences between chosen agility tests among competitors from JC Kinezis from Nish of international and federal ranking.

METHODES

Sample of participants

The sample of the examinees is consisted of 20 competitors of JC Kinezis from Nish (international and national ranking), divided into two groups. All examinees voluntarily came to testing and they were, in advance, informed about testing protocol described in the project of the research. 24 hours before testing the examinees didn't have training and they had no injuries that could influence on the test results. Procedure for collecting data satisfied international ethical standards and was in accordance with Helsinki declaration. Testing is

done in the premises of Faculty of sport and physical education.

Sample of variables

The chosen tests for this study are based on their usage in previous studies. Tests used for assessment of agility were taken from Brown (2000). Every test is performed three times with pause between repetitions. The aim was to compensate consumable anaerobic sources of energy, and for the results the best time was taken. Before testing examinees had standard 15 min warm up, the same as they have before their competition.

Agility test and speed were measured by photo cells (Brower Timing System, Salt Lake City, UT, USA)

T-test (TT) consists of four markers placed in T shape. One at the start (A), one at 10m distance, two at the same line at 5m distance from the both sides (C, D). The examine starts from point A, runs to point B and touches base with the right hand, then running sideways to the point C, touch the base with left hand, then also running sideways, then goes to point D touch the base from the right side and then goes back running sideways to the base B, then runs backwards to the start. Passing the start line is considered to be the end of the test and time is stopped by switching photo cells. The best result of three was taken as the result and it was measured in hundredths of a second. The pause between measuring was 5-8 minutes.

Illinois test (ILN) is performed on the area 10 m long and 5m wide (distance between the start and the finish point). Four sticks are placed linear in the center of the testing area on the equal length (3,3m). The examine starts the test from the starting position by passing through photo cells, runs along the path drown till the finish. Passing the finish line is the end of the test, and the time which is stopped by passing by photo cells is taken as the variable. As the results of the test the best result of the three attempts measured in hundreds. The pause between measuring was 5-8 minutes.

Kamikaze test (KAM) is consisted of four lines. The first was the starting point, then three more lines at the distance 4, 8 and 12m from the start line. Test starts from the moment examine activates photo cells, runs to line of 4m, make turn of 180 degrees, goes back to the start line, continues with the same procedure to the 8m line and then to 12m line. Passing of the examine over the start line is considered to be the end of the test, and the time stopped by passing photo cells is taken as the variable. The best result of three measurements was taken as the result and it was measured in hundredths of a second. The pause between measures was 5-8 minutes.

Statistical data processing

Statistical data processing was done by the help of statistical program SPSS. The basic descriptive parameters and T test for independent samples were calculated.

RESULTS

The chart 1 shows basic descriptive statistic parameters of achieved results on agility test of international rank competitors.

Table 1. Basic descriptive parameters of the international rank competitors

		TT	KAM	ILN
N	Valid	10	10	10
	Missing	0	0	0
Mean		8,0170	13,8590	16,4680
Std. Error of Mean		,13266	,28793	,17068
Median		7,8550	13,7100	16,5050
Std. Deviation		,41950	,91052	,53975
Variance		,176	,829	,291
Skewness		,570	,001	-1,042
Std. Error of Skewness		,687	,687	,687
Kurtosis		-1,291	-1,480	1,901
Std. Error of Kurtosis		1,334	1,334	1,334
Range		1,16	2,49	1,86
Minimum		7,50	12,60	15,27
Maximum		8,66	15,09	17,13

Legend (TT – T Test, KAM- Kamikaze test, ILN Illinois test)

Table 2. Basic descriptive parameters of the national rank competitors.

		TT	KAM	ILN
N	Valid	10	10	10
	Missing	0	0	0
Mean		9,1590	15,8580	18,3510
Std. Error of Mean		,24086	,46482	,23227
Median		9,1450	15,7800	18,6100
Std. Deviation		,76166	1,46990	,73451
Variance		,580	2,161	,539
Skewness		-,191	-,003	-,146
Std. Error of Skewness		,687	,687	,687
Kurtosis		-,836	-,169	-1,861
Std. Error of Kurtosis		1,334	1,334	1,334
Range		2,16	4,94	1,92
Minimum		7,99	13,39	17,44
Maximum		10,15	18,33	19,36

Legend (TT – T Test, KAM- Kamikaze test, ILN Illinois test)

By gaining insight into the basic parameters of the distribution of the applied variables, in the applied agility tests (table 1 & table 2), we can note that the results are well-grouped and have a normal distribution around the means.

The measure of the result distribution indicates that most variables are well suited for the measuring of agility in the group of selected athletes. This is also confirmed by the values of the standard deviation and the range of results, which is a good indicator of the possibility of the differentiation of the results of the participants.

Table 3. T-test for independent samples (T- agility test)

		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
TT	Equal variances assumed	1,321	,265	-4,215	18	,001	-1,09700	,26024
	Equal variances not assumed			-4,215	14,626	,001	-1,09700	,26024

Table 4. T-test for independent samples (Kamikaze agility tests)

		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
KAM	Equal variances assumed	,488	,494	-3,782	18	,001	-1,85300	,48998
	Equal variances not assumed			-3,782	16,428	,002	-1,85300	,48998

Table 5. T-test for independent samples (Illinois agility test)

		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
ILN	Equal variances assumed	5,073	,037	-6,578	18	,000	-1,93700	,29446
	Equal variances not assumed			-6,578	16,251	,000	-1,93700	,29446

By analyzing the results of the arithmetic means of the agility tests, which indicate the differences in selected tests between the judokas of international and national rank, we can note that the difference is manifested in such a way that the judokas of international rank had significantly better scores than national rank judokas in all three applied tests.

DISCUSION

The results implicate logical relation between competitors of international and national rank in

agility as complex mobility role. Statistically significant differences are spotted at all three tests, this implicates that competitors who achieve better results on competition also have better results at agility tests. Mentioned authors also found the same results by testing examinees from combat sports. Korporanowski and associates emphasized that karate fighters who competes in fights achieve better results on agility test than the competitors in katas. On the other side Markovic and ass. (2005) confirmed that success of taekwondo competitors is directly proportional to the results of agility tests.

In judo agility finds its expression especially after IJF changed rules 2003. which limited grip fight and by that rule forced competitor to move and through movement and frequently changing directions build up the chance for attack.

Moving in KAM test is composed of changing moving backwards and forwards during which eccentric contraction change into concentric contraction. T-test is characterized by larger number of phases of acceleration and deceleration and that implies demonstration of explosive strength, four changing of direction where lateral movement is represented at both sides. Mentioned movements are represented also in judo fights and that justifies selection of tests for this study. Illinois test is the only one that is not appropriate for judo, because of continuous sunning of the examine during the test. But it is motorically more demanding than all the other tests and the most common in studies which examine motoring area. This battery of tests can be used to guide and select candidates for international judo competitions on the basis of the potential of the athletes, and to predict the success of certain judokas.

CONCLUSION

By analysis of given results we came to the conclusion that there are statistically significant differences among examined groups. The competitors of international rank who achieve better results on competitions than the competitors of federation rank achieve also better results on agility tests. Results could be used for athlete selection in judo. Study weaknesses are small sample, and also the fact that conduct study only deals with examination of differences of the results in chosen agility tests.

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THE EFFECTS OF TWO TYPES OF CONTRACTION IN DIFFERENT TESTING ENVIRONMENTS ON MUSCULAR OUTPUTS IN INEXPERIENCED RESISTANCE TRAINERS

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SUMMARY

Introduction: The advantage of an unstable training environment would be based on the importance of neuromuscular adaptations with increases in strength. It is purported that greater instability of the human-surface interface will stress the neuromuscular system to a greater extent than traditional resistance training methods using more stable benches and floors. Purpose of this study was to compare the effects of two types of contraction in different testing environments on muscular outputs in inexperienced resistance trainers. We tried to determine the differences in muscular outputs after concentric only and concentric followed after eccentric contraction on stable and unstable conditions. It was hypothesized that instability surface would provide significantly greater loss of elastic energy which will result in significantly smaller muscular outputs.

Methods: The sample consisted of 48 male students of Faculty of sport and Physical Education University of Nis. At the time of the study, none of the students was a professional athlete. The level of their physical fitness reflected the program's curriculum that included various practice, as well as their individual recreational practices (this included additional daily physical activities of at least one hour). None of the participants had taken part in organized and programmed resistance training in the past year.

Results: Obtained results have demonstrated that during the bench press exercise performed with a reduced training load (50% of 1RM) power deficit between eccentric concentric contraction and only concentric contraction significantly increased under instability surface (bench press exercise performed on a Swiss ball). The squat exercise test showed no statistically significant difference between the unstable and stable surface. Also, there was no significant changes between the type of the contraction.

Conclusion: Our results point out the conclusion that resistance training under unstable conditions is a more effective for increasing values of muscular outputs in relation to resistance training under stable conditions. Because many sports disciplines requires the whole body to be stabilized and a large amount of power to be generated in a coordinated manner, for students of Faculty of Sport and Physical Education unstable resistance training may be a functional way to improve muscular outputs.

Keywords: bench press, squat, contraction, strength.

INTRODUCTION

The advantage of an unstable training environment would be based on the importance of neuromuscular adaptations with increases in strength. Strength gains can be attributed to increases in muscle cross-sectional area and to improvements in neuromuscular coordination (Behm, 1995). A number of researchers have reported that neural adaptations play the most important role in strength gains in the early portion of a resistance training program (Behm, 1995; Sale, 1988). It is purported that greater instability of the human-surface interface will stress the neuromuscular system to a greater extent than traditional resistance training methods using more stable benches and floors (Kornecki and Zschorlich, 1994).There are a limited number of studies that investigated the effects of stretch shortening cycle deficit on different instability surfaces. Greater

instability should challenge the neuromuscular system to a greater extent than stable conditions, possibly reducing maximal muscle output expressed as maximal strength and maximal power. However, it is likely that the pre-training performance level of the included participants may have influenced the magnitude of the changes (Wahl & Behm, 2008; Bratic, Radovanovic, Ignjatovic, Bojic, & Stojiljkovic, 2012).

Previous reports suggest that unstable resistance training may facilitate the neural adaptation of core-stabilizing muscles, resulting in improved core stability. The possibility of a reduced training load under unstable conditions may be compensated by high muscle activation and internal muscle tension providing similar training stresses (Kibele & Behm, 2005). These findings also suggest that instability resistance training may have a tendency to be more efficient at increasing muscle strength under unstable conditions. Previous studies concluded that short-term training programs of eight weeks tend to emphasize neural more than hypertrophic adaptations (Anderson & Behm, 2005; Behm, Drinkwater, Willardson, & Cowley, 2010).

Purpose of this study was to compare the effects of two types of contraction in different testing environments on muscular outputs in inexperienced resistance trainers. We tried to determine the differences in muscular outputs after concentric only and concentric followed after eccentric contraction on stable and unstable conditions. It was hypothesized that instability surface would provide significantly greater loss of elastic energy which will result in significantly smaller muscular outputs. For purpose of this study, the dynamic chest press and squats were used, since they are some of the most widely performed resistance training exercises. The results of this study should provide an answer to the question of the effectiveness of the use of stretch shortening cycle elastic energy under stable and unstable conditions.

METHODS

Sample of examinees

The sample consisted of 48 male subjects (aged 19-22), All of them were students of Faculty of sport and Physical Education University of Nis. At the time of the study, none of the university students was a professional athlete. The level of their physical fitness reflected the program's curriculum that included various practice, as well as their individual recreational practices (this included additional daily physical activities of at least one hour). None of the participants from this group had taken part in organized and programmed resistance training in the past year.

All of the participants had volunteered to take part in the study. They were informed regarding the main purpose of the study, procedures, and the experimental risks, and they all signed an informed consent document prior to the study. The procedures presented were in accordance with the ethical standards on human experimentation. The Human Investigation Committee of the Faculty of Sport and Physical Education in Nis approved the study. Standard medical screening was performed before the study. None of the participants showed any evidence of recent injury in their anamnesis or clinical report.

Sample of measuring instruments

Familiarization. Prior to the study, the participants were exposed to familiarization sessions. Before data collection, the participants were given an orientation session where they were instructed on the proper technique of both exercises, in particular on unstable surfaces. Emphasis was placed on achieving a knee angle of 90° during the squats. The participants had another familiarization session specifically designed for the testing procedures. All participants had the same number of familiarization session before the testing procedures, and were instructed not to engage in exhausting exercise for a period of 48 hours prior to testing. They were warned to refrain from eating or drinking energy or caffeine drinks for two hours prior to the testing. The participants were allowed to drink non-caffeinated liquids *ad libitum* before testing.

Study setting. All of the testing sessions took place in a gymnasium. Prior to testing, the participants warmed up for approximately 10-15 minutes of submaximal intensity aerobic activity on stationary bikes and/or step machines and short bouts of dynamic muscle stretching.

1RM Testing. The participants underwent a one-repetition maximum (1RM) test on a stable surface. Prior to each 1RM test, two warm-up sets were performed: first with 8 repetitions at approximately 50% of 1RM, and then with 4 repetitions at

approximately 70% 1RM. Next, single attempts with increasingly heavier resistance of at least 2.5 kg were performed until each participant reached the greatest weight that he could lift once with correct technique. A 3-minute rest period was given between each lift. The 1RM was achieved within 3-6 attempts. For safety, two spotters were present at all times. Correct chest press technique involved lowering the bar in a controlled manner until it lightly touched the chest, after which the bar was lifted back to the start position with elbows fully extended. Careful attention was paid to ensuring the bar did not bounce off the chest, especially on the exercise ball. No compensatory motion was allowed during the chest press movement. Barbell squats on a stable surface were performed from full extension to a knee angle of 90° while the participant held the barbell on his back. The participants were monitored in order to ensure that they lifted the barbell without significant deviation from a line perpendicular to the floor. The tempo of each 1RM attempt was not controlled so that as long as good technique was adhered to, the participants could take as long as required to complete the lift.

Testing under stable and unstable conditions. All of the exercises were performed with a previously established 50% 1RM. Although 80% of 1RM is usually required to improve muscle strength [9], from our experience the use of more than 50% of 1RM under unstable conditions for the training of previous resistance training inexperienced subjects may be very dangerous and may lead to anxiety about falling. Under such conditions the validity of the measurements could be compromised.

Stable conditions were enabled by a flat bench. The participant's feet were placed wide enough to stabilize the body. The knee flexion angle was fixed at approximately 90° during the measurement. The participants were not allowed to lift their shoulders or buttocks from the bench or their feet from the floor. The unstable conditions were enabled by a Swiss ball with a diameter of 65 cm placed to support only the upper back, not the cervical area or head and with the participants' feet placed on the floor. Complete inflation of the ball was confirmed before each experiment. Barbell squats under stable conditions (floor of the gymnasium) and an unstable BOSU ball (BOSU; Fitness Quest, Canton, OH, USA) were performed from full extension to a knee angle of 90° while the participant held the barbell on his back. For safety reasons, two testers spotted the participants by standing on each side during the lift, and one tester stood behind the participants to impede a possible fall. In addition, the tester confirmed the consistency in the quality of the chest press and squat technique throughout the testing. If the attempt did not follow the instructions, the participant was asked to make another attempt for additional data collection.

Muscular outputs for each repetition were measured by means of the Fitrodyne dynamometer (Fitronic, Bratislava, Slovakia) according to the suggested protocol and under stable conditions. The validity and reliability of the device was confirmed previously (Jennings, Viljoen, Durandt, & Lambert, 2005). During each of the sessions, the participants were instructed to accelerate the barbell as fast as possible during the entire range of motion, during which the peak power and velocity of movement were measured by means of a computer-interfaced Fitrodyne attached to the barbell via a tether. All of the data were computed, based on Newton's second law, by using the appropriate software (Fitronic, Bratislava, Slovakia) in addition to the dynamometer.

Statistical analysis

The Kolmogorov-Smirnov test of normality was performed on all the variables. Differences between variables were determined using analysis of variance (ANOVA). Differences between individual variables were determined using Student's t-test. The data were described as means ± standard deviation (SD). Statistical significance was set at $p<0.05$ for all of the statistical analyses.

RESULTS

The results of study are summarized in Figure 1 and 2.

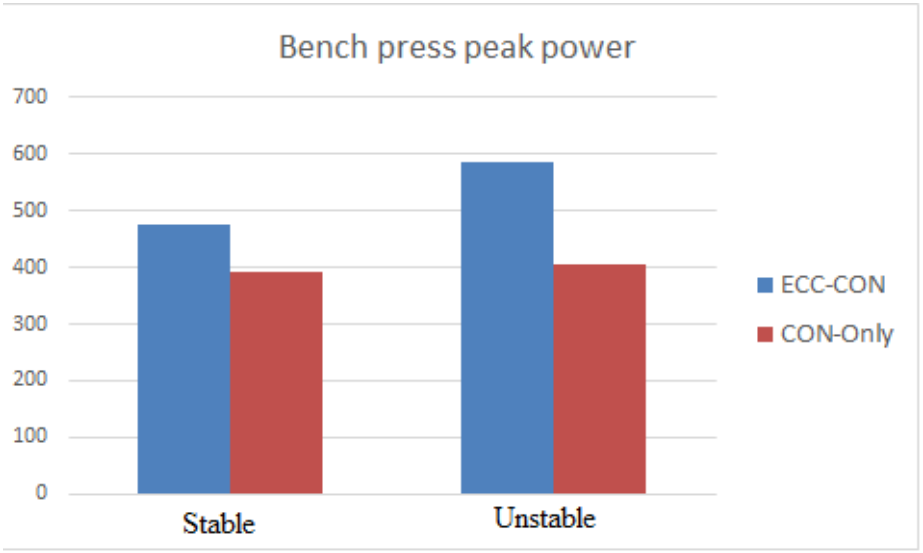

Figure 1. Mean values of peak power during bench press concentric followed after eccentric contraction (blue) and concentric only (red) on stable and unstable conditions.

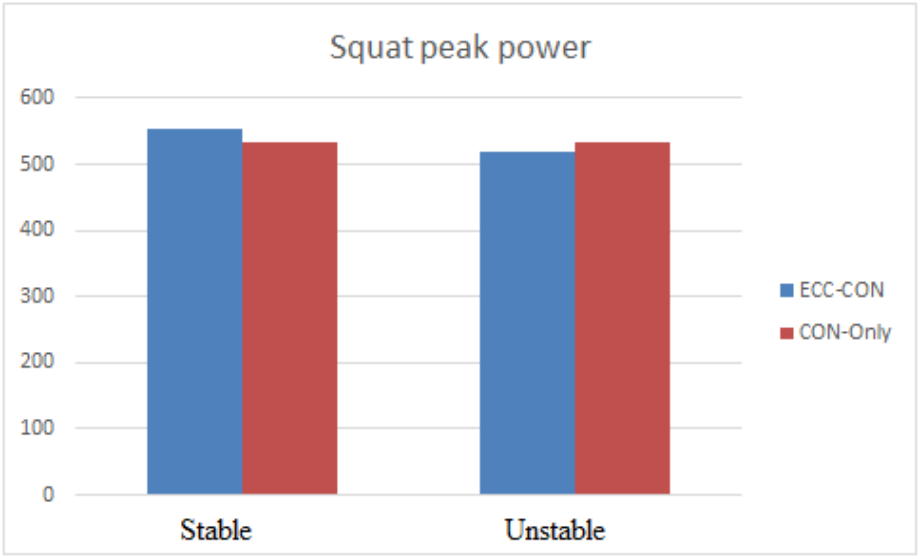

Figure 2. Mean values of peak power during squat concentric followed after eccentric contraction (blue) and concentric only (red) on stable and unstable conditions.

DISCUSSION

Obtained results have demonstrated that during the bench press exercise performed with a reduced training load (50% of 1RM) power deficit between eccentric concentric contraction and only concentric contraction significantly increased under instability surface (bench press exercise performed on a Swiss ball). The squat exercise test showed no statistically significant difference between the unstable and stable surface. Also, there was no significant changes between the type of the contraction.

Our results have demonstrated that instability resistance training may be considered as effective as traditional stable resistance training for inexperienced resistance trainers. It appears that instability resistance training, which reportedly uses lower forces, can increase muscular strength in

previously untrained young individuals similar to training with more stable machines employing heavier loads. Therefore, the chest press as a resistance exercise performed on a Swiss ball and the squats performed on BOSU ball, both with a reduced training load (50% of 1RM) can be recommended as a potentially effective training model for inexperienced resistance trainers to improve muscular outputs.

However, our results do not support the notion that resistance exercises performed on Swiss and BOSU balls are more efficacious than traditional stable exercises in inexperienced resistance training subjects. The reason for that we found in the fact that the ground- or flat-bench- based barbell squat and chest press exercises in inexperienced participants already provide a sufficient stimulus to the neuromuscular system. An additional stresses to the muscles acting as trunk stabilizers during chest press on a Swiss ball or squat on BOSU ball remains without an adaptive response. Therefore, acceleration of neurological adaptations the trunk stabilizer muscles is missing, which is probably the reason why there are no significant differences between groups in force, power and 1RM values in relation to the conditions, as the experimental factor. Previous study also indicated that there is no reduction in 1RM strength or any differences in muscle EMG activity for barbell chest press exercise on an unstable exercise ball when compared to stable flat surface (Goodman, Pearce, Nicholes, Gatt, & Fairweather, 2008). Our findings suggest that 50% of 1RM instability resistance training may be more applicable to muscular endurance rather than maximal strength training. Since the instability-induced deficits in force compared to traditional stable resistance training exercises may provide greater stabilizing functions and increases in trunk and limb muscle activation (Behm & Colado, 2012), training with 50% of 1RM under unstable conditions may be a solution for individuals who want to increase muscular outputs while avoiding muscle hypertrophy and training stresses associated with traditional ground based free weights lift.

CONCLUSION

Our results point out the conclusion that resistance training under unstable conditions is a more effective for increasing values of muscular outputs in relation to resistance training under stable conditions. The instability resistance training induced high core activation with 50% of 1RM can still provide sufficient stress on the muscular system to induce increasing of muscular outputs. Because many sports disciplines requires the whole body to be stabilized and a large amount of power to be generated in a coordinated manner, for students of Faculty of Sport and Physical Education unstable resistance training may be a functional way to improve muscular outputs.

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Physical Education

INFLUENCE AND LEADERSHIP ROLE IN THE MANAGEMENT OF STRATEGIC CHANGE IN THE FEMALE SPORT IN REPUBLIC OF SERBIA

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SUMMARY

Introduction: Sense of strategy is an important element in the management, under this sense means that the top management agrees with the direction in which their organization is trying to focus. The basis of the necessity of leadership management lies in the dynamic development of modern human society. A leader is one who can lead the organization in today's turbulent environment, because he is the one who can successfully cope with the changes. Leadership is based on a vision of how to survive and win in the changes. The latest knowledge in the field of human values, the development of consciousness and functioning of the human brain are providing us with valuable insights and tools with which we can fathom the most important drivers of human activities and to use them in a positive manner. Innovative leadership is crucial. Reliable communication and a strong sense of belonging among employees represent the basis of prosperity of the sports center.

Conclusion: It takes knowledge to successfully manage human capital, to attract, develop, retain and reward the right people to achieve set goals and follow a strategy center. To achieve best results, it is essential to organizing and managing human resources.

Keywords: management, leadership, change, women's sport productivity.

INTRODUCTION

Sense of strategy is an important element in the management and that means that the top management agrees with the direction in which their organization is trying to direct. In business environment, the basic resource of any organization are the people and their skills, which contribute to the achievement of organizational goals. Their creativity, innovation, motivation and awareness are characteristics that make them different from other resources in the enterprise. Therefore, female athletes are the most important resource in the creation of additional values in female sports of Serbia. People have more knowledge, and human resource management is increasingly difficult. It takes knowledge to successfully manage human capital, to attract, develop, retain and reward the right people to achieve set goals and follow a strategy of development of women's sport in RS. Good management of human resources is the most important business activity of each organization. To achieve better results business requires good organization and management of human resources. Concrete definitions are mainly based on its function of human resource management in order to successfully achieve organizational goals. The basis of the necessity of leadership management lies in the dynamic development of modern human society. The whole human knowledge today is doubled within 2.5 years. A leader is one who can lead the organization in today's turbulent environment, because he is the one who can successfully cope with the changes.

So, leadership and change are synonymous when we think about business leadership. The key to a good leader is in dealing with people, emotional role of a leader's primary. While management realizes organizing plans, the equivalent of leadership is communication between those who are on their way to achieving their visions. Determining direction can be a static feature, because the determination of the

direction it is not necessary that the person who ordered the route need to be moving towards purpose. Movement toward the goal, guidance, necessarily has a dynamic form, as one leading to the goal must be to the forefront of such changes. Daily turbulent changes in the environment are synonymous with the necessity of increasing the influence of leadership in management.

Theoretical considerations

Human resource management is positioned in the field of leadership and guidance of people in the organization, and is based on key categories of organizational behavior such as motivation, refers to individuals and groups, organizational socialization, organizational culture. Effective management of these resources requires certain theoretical knowledge, as well as specific methods, processes and procedures to potential human use, and to move toward its development. The use and development of human resources should be directed towards the realization of the ultimate aims of the organization, for example, the development of the organization and the development of its business politics. Human resource is an entity that is always at the beginning and end of each story, because he certainly has the most long-term consequences for an organization. It is therefore very important, almost essential, choosing the right collaborators devote enough quality time. It is very important to the selection process to devote enough attention and if, as dr Isak Adizes says: "The choice depends on the people by the people, it will never be perfect". Management revolution in the area of the business world kicked managers who need to be supported by the power of knowledge, skills and personal qualities. The process of copying new multidisciplinary management knowledge and skills is a dynamic process that ensures autonomous development of any organization. Managers as representatives of management and the company must be able to sovereign authority and personality changes and manage processes. Changes have become so complex and dynamic that from their knowledge and skills and their effects in the economy and society depends largely on the fate of the world order. Today they need ideas to survive in the sports market. A leader is one who sells idea. Today needs new concepts to the organization closer and more tightly connected with consumers. The manager's job is to conserve a given concept and in its own terms "push out" the maximum efficiency, the leader crashes valid concepts and offering new, often untested, concepts and ideas. Organizational model which can cope with all these changes is necessary. It is a high performance organization, with leaders throughout its structure to reflect the winning and the attacks from the environment translate into opportunities and long-term growth and development of the sports market.

Problem, object and purpose

The goal of human resource management is to create a scientific assumptions, methods and procedures in the realization and harmonization of the individualized and organizational goals. Conducting human resources, in the age in which we live, will represent the imperative of survival of any organization. Today, a large number of people with the required amount of money can buy the technology and begin production, but market advantage over competing organizations and the long-term survival in the market will be able to achieve only if they had qualified people, able to quickly, easily and efficiently solve problems. One of the most important factors of a successful business is certainly human resources, high quality and professional staff. This fact, of course, implies the need for continuous improvement of the entire system of knowledge. Improvement is reflected in the implementation of internal and external staff training, professional development, funding for further education or employment information in the field of art, providing a presence at seminars in the field of sport management. This encourages employees to follow innovations in the field, as well as ongoing changes and developments in the same, which reflects positively on the quality of the work.

In order to achieve certain goals in an organization, human resource management has to meet certain requirements, which will improve the work of the employees and hence their greater productivity. Through to the satisfaction and fulfillment of basic requirements and the most valuable resources in the company, we do fulfillment of the objectives pursued. If the management of human resources is not able to manage the human resources that may affect the business and profit in the worst case, the survival of the organization.

The main objective of human resource management is to achieve the following objectives:

- Functional purpose - HRM function is to contribute to the organization as long as necessary for it to achieve its goals and realize organizational strategy. This would mean that resources should be rational and more efficient to use in the pursuit of organizational goals.
- The organizational goal - as we have already pointed out, to organize the most important factor is the human resource, therefore we need to improve efficiency and to motivate employees in a better way and thus will meet the objectives of the organization.
- Social purpose - in everyday human relations social norms and value systems are very important in achieving good communications. To be ethically and socially responsible to the needs and challenges of society and minimize the negative impacts of these requirements on the business of the organization is also one of the important goals, not only for human resource management, but management as a whole.
- Personal goal - the satisfaction of employees is the most important for any organization, but it is not enough to satisfy the employees only to think of the business, it is necessary to assist them in realizing their personal goals. Only in this way can gain their trust, and employees will be happy and motivated for advancement and personal contribution to the organization.

Each of these goals influences the management of human resources, improving the performance of organizations.

Creativity and innovation have become indispensable components of enterprise management, and contributed to the increasing role of research and development. Strategy of human resource management should also contribute to the creativity of employees, and tactics for innovation to facilitate the implementation of new ideas. The key feature is that the modernization of business requires new knowledge and new professions that involve high levels of education and training. Individuals must be ready for training in order to adapt to change and keep their jobs.

When we think about motivation and reward systems set up one common question: if everything is unique and specifically is there anything that is similar? Whether we can do something to take as a starting point, as the benchmark against which we set a model? Answers to these questions are, thankfully check.

Leadership style is the way to establish a relationship between leaders and employees, and the manner in which the leader directs the behavior of subordinates and the means used to win or compel desired behavior. Basic criteria which distinguish styles are: access to leaders motivate subordinates - coercion or stimulus, the way in which a leader makes decisions, sources of power used to influence the subordinate, the ability of leaders to adapt their behavior to different situations. On these criteria, we distinguish classic styles and modern styles of leadership. Pioneer studies on leadership as Hawthorne and Iowa studies. These studies have examined the impact of three styles of leadership behavior and performance, including: autocratic, democratic and liberal. Ohio studies are the first interdisciplinary study of leadership based on teamwork psychologists, sociologists and economists. At the conclusion of these studies is based on the concept of "network management". The network has two dimensions: concern for people and concern for production. With the advancement in the horizontal axis, which is represented by concern for production, leaders have shown that they are oriented to the task, while advancing on a vertical axis, which is represented by concern for people, leaders have shown that they have a higher level of care for men.

Managerial Grid has proven itself in practice as a good way of testing the leaders, because they show that job satisfaction is as important as the productivity achieved.

Hypothetical tasks

Based on the subject, objectives and tasks of research, and the use of appropriate literature are defined by the following hypothetical tasks:

H1 -There is a statistically significant difference between respondents by socio-psychological factors

H2 - There is a statistically significant difference in emotional competence athlete

H3 - The achievement motive there was no statistically significant difference among sportswomen

H4 - The readiness of athlete to further education after completing career.

METHODS

When it comes to people know that there is a core of common human traits that the strict interpretation can be called "human nature". If you are in breach of the essence of human nature, making models and systems that rely on artificial and not natural to the human need, we will not be able to successfully manage in the long run, because sooner or later there is a conscious or unconscious "rebellion" inside - the very essence of our nature. Human value and meaning of human life are associated with that core. Also, the latest findings in the field of human values, the development of consciousness and functioning of the human brain are providing us with valuable insights and tools with which we can fathom the most important drivers of human activities and to use them in a positive way. Thanks to that we can say with quite a high level to analyze the specific job requirements and characteristics of individuals who work in the industry.

Two surveys included:

1) Survey, which is labeled A is:

Emotional competence in establishing relationships with other people

2) Survey, which is labeled P is:

achievement motivation.

RESULTS AND DISCUSSION

Table 1. The number (n) and percentage (%), the representation of women in emotional competence in establishing relationships with other people

	not competent	moderately competent	competent
n	49	200	63
%	15.71	64.10	20.19

Table 2. The number (n) and percentage (%), the representation of women in achievement motivation

	without motive	moderately motivated	motivated
n	27	195	90
%	8.65	62.50	28.85

The key factor in business success of any organization is motivated, competent and flexible staff who are satisfied with the direction in which to implement business activities, the business culture in the organization and management.

CONCLUSION

The process of copying new multidisciplinary management knowledge and skills is a dynamic process that ensures autonomous development of each individual. Leadership is important not only for our personal careers and the organizations in which we work for a further progress of society and the further development of the sport. We need leaders who will unite us with his energy and progressive human society. Changes have become so complex and dynamic that from their knowledge and skills and their effects in the economy and society depends largely on the fate of the world order. Human resource is an entity that is always at the beginning and end of each story, because he certainly has the most long-term consequences for an organization. It is therefore very important, almost essential, choosing the right collaborators devote enough quality time. The latest findings in the field of human values, the development of consciousness and functioning of the human brain are providing us with valuable insights and tools with which we can fathom the most important drivers of human activities and to use it in a positive way. People are different from each other and their type of personality and character should calculate the constant. Leadership is no reason to want to change people, on the contrary, these differences are to their advantage, not disadvantages. Leader is who builds climate team at the benefits and not the weaknesses of people. It will thus use talents of people completely, especially those that he does not have.

More actual concept of teamwork, which leads to a drastic increase in productivity achieving a synergetic effect and integrating knowledge of all individuals engaged in team. But successful teamwork is feasible only in those organizations where the company government makes democratic climate, respect for diversity, solidarity, flexibility, very represented the delegation of responsibilities and competencies of employees. These performances heavily depends on the style of leadership, although the employees and their ability to co-operation and functioning of the team. The golden rule of leadership is that the leader should treat people the way they want to be treated and what this concept is fully respected. Thanks to that we can say with quite a high level to analyze the specific requirements and characteristics of individuals who work in the industry. There should be as many women in Serbia sport to educate, encourage and motivate the work.

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COMPARATION OF RELIABILITY AND VALIDITYOF SOME TESTE WITH CONVENTIONAL AND EXEMPLARY MODEL FOR EVALUATION OF COORDINATION WITHIN THE SUBJECTS OF ABOVE AVERAGE MOTOR SKILLS

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SUMMARY

Introduction: Motor abilities are firstly genetically conditioned, but they are under a great influence of sport trainings. Within the athletes these abilities are complexly defined, or better say tests for their evaluation have low mutual correlation. In this context the same tests in different groups of subjects, such as those from normal and sport populations, do not define the same motor structures.

Methods: On the sample of 227 respondents with above average motor skills at age 18 to 26 years three composite motor tests were applied in the assessment of the motor ability-the coordination. The sample was divided into two subsamples. The first subsample consisted 121 male respondents and the second consisted 106 female respondents. In determining the reliability and validity, the classical and Guttman scale measurement model were applied on the results of the tests. Additionally, in regards to the tests validity definition its factorization with the component model was performed. The factor structure of the respondents two subsamples was compared using the Tucker method e.g. calculating the congruence coefficients.

Results: The applied tests showed a satisfactory degree of reliability and validity in the assessment of the motor ability-the coordination amongst male and female respondents and the calculation from the two applied measurement models showed that the Guttman model enabled methodological more correct definition of the reliability in respect to the classical model.

Conclusion: All applied tests have shown a satisfactory degree of reliability and validity for assessing motor-coordination ability of participants both male and female. Among respondents of male and female gender the highest degree of reliability in assessing coordination has shown the test 'Eight Ball by tilting'.

Keywords: reliability, validity, coordination, test, motor skills

INTRODUCTION

Motor abilities are firstly genetically conditioned, but they are under a great influence of sport trainings. Within the athletes these abilities are complexly defined, or better say tests for their evaluation have low mutual correlation. In this context the same tests in different groups of subjects, such as those from normal and sport populations, do not define the same motor structures.

Such complexity and differences in the existence and definition of motor skills, causes a need for the application of precise measuring instruments for their determination. However, considering that the measurement precision or particular characteristics of the measuring instruments are influenced by the methods of data processing, that complexity comes more to the fore. Therefore, it is often necessary to use more stringent methodological criteria, in which the processing of data from the same test should be performed by several different procedures to assess the motor abilities of the participants from different populations.

Based on these findings there have been set a goal of basic research to establish these measurement features: reliability and validity of some tests for assessing coordination with classical and Gutmans (image) model to measure the respondents both male and female gender with above average motor skills.

METHODS

Sample of examinees

The survey was conducted on a sample of 227 subjects with above average motor skills at age 18 to 26 years. The sample is part of a wider study, conducted by Naumovski and counterparts (2005). The sample was divided in two subsamples. One subsample is comprised of 121 male respondents and the other of 106 female subjects. Subsamples were consisted of students athletes from Skopje, who have been at least five years involved in continuous and programmed sports trainings and sports competitions of a higher rank in a given sport discipline.

Sample of measuring instruments

For realization of the objectives of this research three composite tests were applied and those are: 'insertion and skip' (KPROPRES), 'Eight Ball by tilting' (KOSUMAKA) and 'mobility on the ground ' (KPODPOD).

Statistical analysis

The test results were processed by appropriate statistical methods, and there was used the classical and Gutmans (image) measurement model. Based on this there were calculated basic descriptive statistical parameters: the arithmetic mean (X), standard deviation (SD), minimum score (MIN), maximum score (MAX).

In addition to the estimated parameters for defining the reliability of the tests and their particles are applied the following procedures: normality of the distribution of results for each test particle was tested with the Kolmogorov and Smirnov method (KS), Pearsons correlation coefficients (R); Odds of this definition of each particle based on the remaining particles (SMC), the projection of the particles on the first major component (H), communality (h2), Kaisers coefficient for representation of each particle calculated as the ratio between squared image - correlation (covariance on the error of measurement) and squared correlation coefficients between the particles (MSA), the particle projection to the first component image (HR), the coefficient for determination of the whole test (SMC), Kaisers coefficient representation for the entire test (MSA), Spearman- Brown coefficient ,on the basis of the average correlation of the particles, which is defined as the lower limit of reliability (SB1); Spearman-Browns reliability coefficient, based on the average correlation of particles (SB2); Krombahov α-ratio, based on projections of the particles on the first principal component, the minimum reliability index (ratio between the characteristic roots of the first component image and first principal component - a min, homogeneity index (ratio between the characteristic roots of the first component and the imago and the sum of the square multiple correlation (h), characteristic roots of the first major component (λ), the characteristic roots image for the first component (λR), percentage of valid variance of the first principal component (PCT%), percentage of valid variance component of the first imago (PCTR%).

Apart the previously applied statistical procedures, primarily to define the validity of the tests there has been carried out their factorization of the component models. Intercorrelation matrix of the tests is factored with co Hottelings method of the principal components, and the number of significant components is determined by the Guttman-Kaiser-Conn's criteria. In the case where were isolated more statistically significant main components they are transformed into curved position, with calculated parallel and orthogonal projections.

The factor structure that was obtained in both sub exemplary respondents is compared by calculating the coefficients of congruence, according to the method of Tucker.

RESULTS AND DISCUSSION

Data from the Kolmogorov-Smirnov procedure that are shown in Tables 1 and 3 , show the results of all applied motor tests within all particles in both sub exemplary respondents which did not differ significantly according to the statics from the normal distribution at the 1% or better say they quite match with the theoretical line of that allocation.

From table 1 and 3 you can see that the three tests in both sub exemplary, is noted that the first particles has arithmetic environment with unfavorable results in terms of the following characterized by oscillatory expressed and similar values. This indicates that within the tests has occurred that has led to learning the technique of their tasks. Accordingly, the first particle can be seen as a test executor which led to further sufficiently stable performance. Therefore, the application of these tests is recommended to initiate test trials, without measuring the results or processing the statistical procedures.

The sensitivity of the applied tests, or their particles in a general sense is satisfactory because most of them have parameters (SD, MIN and MAX), which is in reasonable proportion to the distance values corresponding arithmetic environments

In the tables 1 to 4 are shown further indicators of the reliability and validity of the tests applied in both sub exemplary. Inter correlation of the particles of tests in both sub exemplary is not shown on the table due to the limited text space ,but they are statistically significant and are characterized by a consistent structure. This indicates that most of the applied tests has primarily satisfactory reliability and unique subject to assessment.

The coefficients of determination (SMC) of the particles according to the classical model of measurement in all tests, mainly are according to their coefficients sub coordinations. Among male respondents they range from .71 to .91, while within the female respondents .76 to .95. These ratios within each test in both sub exemplary are characterized by significant mutual concessions.

Coefficients of the representation (MSA) according to Gutmanoviot (image) measurement model, has similar ratios in both sub exemplary respondents, males ranging from .78 by .95, while the female respondents from .76 to .95.

Projection of particles of all tests on the first major component (H) according to the classical model of measurement is high in both sub exemplary respondents. But in general they are higher among female respondents. Among male respondents in the test ' skip the theme' ranging is from .85 to .95, while the female students with the same test from .91 to .96. In test 'Eight Ball by tilting' projections of particles is ranging from .85 to .93 for male participants and .89 to .97 for the female students and the tests 'mobility on the ground' projections of particles move from .89 to .96 for male participants and .94 to .96 for the female students.

Projection of the particles of the first major component (HR), in Gutmans (image) measurement model, is also high in both sub exemplary respondents, but in general they are higher among female respondents. Among male respondents in the test ' skip the theme' are ranged from .81 to .92, while within the female students with the same test it is ranging from .88 to .97. In test 'Eight Ball by tilting' projections of particles is ranging from .79 to .90 for male participants and .85 to .96 for the female students and the tests 'mobility on the ground' projections of the particles ranges from .81 to .94 for male participants and .89 to .95 for the female students.

According to the above indicators, and taking into account both measurement models within the male respondents, highest reliability test has 'insertion and skip', followed by the tests 'Eight Ball by tilting' and 'mobility on the ground'. For female respondents the highest reliability has also test 'insertion and skip', and then it is followed by test 'Eight Ball by tilting' and 'mobility under'.

Looking at the reliability of the tests in general (Table 2 and 4) show that in both models (in the full and the reduced matrix) measurement, in both sub exemplary respondents is isolated one statistically significant main component. Its percentage of valid variance is satisfactory. However, those with male respondents are lower, especially in Gutmans model, which indicates that the particles in tests of female gender have better internal consistency or homogeneity.

Analyzing the data, and taking into consideration that the values of all coefficients by classical as well as by Gutmans (image) model, it is possible, though not much emphasized, to draw the conclusion that within the female respondents is shown higher reliability in all three tests for assessing coordination.

From the data of Table 5 and 6, you can see the factor validity of the tests applied to assess coordination. When factoring in the tests of male respondents are isolated two statistically significant principal components. Projection of the entire valid variance of both characteristic roots are low and they do not differ much, i.e. the value of the latter is declining sharply in relation to the first.

Table 1. Basic descriptive statistical parameters, test results and the distribution of particle factorization (H),in the tests for men

Tests	n	X	SD	MIN	MAX	KS	SMC	H	MSA	HR
KPROPRES	1	139,83	27,78	85,00	239,00		0,76	0,85	0,87	0,81
	2	134,01	26,32	81,00	196,00		0,89	0,95	0,87	0,92
	3	130,07	24,30	80,00	190,00		0,86	0,95	0,93	0,92
	4	130,32	24,98	80,00	212,00		0,83	0,94	0,95	0,91
	5	130,45	26,05	82,00	201,00		0,88	0,94	0,88	0,92
	6	128,63	25,37	80,00	199,00		0,86	0,91	0,87	0,89
KOSUMAKA	1	176,16	16,26	132,00	228,00		0,74	0,89	0,93	0,85
	2	173,65	15,44	132,00	212,00		0,81	0,93	0,92	0,89
	3	172,66	16,28	131,00	220,00		0,82	0,93	0,93	0,90
	4	172,22	15,15	135,00	215,00		0,81	0,92	0,90	0,89
	5	173,08	14,83	147,00	228,00		0,81	0,93	0,92	0,89
	6	174,06	17,21	130,00	252,00		0,63	0,85	0,96	0,79
KPODPOD	1	108,12	25,00	60,00	195,00		0,71	0,89	0,85	0,81
	2	98,76	20,70	60,00	169,00		0,87	0,96	0,83	0,92
	3	95,10	19,41	60,00	150,00		0,90	0,95	0,78	0,94
	4	93,46	20,38	59,00	165,00		0,91	0,96	0,78	0,94

Table 2. Coefficients of reliability and percentages of valid variance in the tests for men

Tests	n	SMC	MSA	SB	SB2	□	a min	h	□□	□□R	PCT(%)	PCTR(%)
KPROPRES	6	,845	,890	,970	,964	,963	,943	,947	5,09	4,80	84,88	80,05
KOSUMAKA	6	,768	,926	,952	,957	,956	,913	,981	4,95	4,52	82,47	75,29
KPODPOD	4	,848	,808	,957	,956	,950	,923	,962	3,53	3,26	88,34	81,54

Table 3. Basic descriptive statistical parameters, test results of the distribution of particle factorization (H), tests for women

Tests	n	X	SD	MIN	MAX	KS	SMC	H	MSA	HR
KPROPRES	1	177,51	39,51	100,00	287,00		0,81	0,91	0,94	0,88
	2	166,31	34,60	94,00	269,00		0,90	0,96	0,93	0,94
	3	163,18	35,97	92,00	271,00		0,94	0,97	0,89	0,96
	4	162,16	35,37	96,00	261,00		0,95	0,98	0,88	0,97
	5	161,49	36,52	94,00	256,00		0,91	0,96	0,93	0,94
	6	159,55	33,83	96,00	250,00		0,83	0,92	0,93	0,90
KOSUMAKA	1	202,65	25,87	169,00	270,00		0,76	0,89	0,94	0,85
	2	192,82	19,21	140,00	249,00		0,87	0,94	0,95	0,93
	3	194,63	18,13	163,00	238,00		0,85	0,94	0,95	0,92
	4	194,67	18,45	161,00	241,00		0,84	0,93	0,92	0,90
	5	192,92	18,41	165,00	238,00		0,93	0,97	0,87	0,96
	6	194,41	18,77	163,00	247,00		0,94	0,97	0,88	0,96
KPODPOD	1	129,45	33,17	80,00	276,00		0,84	0,94	0,82	0,89
	2	121,12	30,99	76,00	275,00		0,88	0,96	0,82	0,91
	3	115,12	24,96	79,00	232,00		0,93	0,96	0,76	0,95
	4	112,10	26,84	78,00	243,00		0,93	0,96	0,77	0,95

Table 4. Coefficient of reliability and percentages of valid variance within the tests for women

Tests	n	SMC	MSA	SB	SB2	□	a min	h	□□	□□R	PCT(%)	PCTR(%)
KPROPRES	6	,889	,917	,980	,979	,978	,965	,981	5,42	5,23	90,37	87,20
KOSUMAKA	6	,863	,916	,974	,974	,969	,956	,982	5,32	5,09	88,66	84,77
KPODPOD	4	,895	,789	,971	,967	,962	,943	,960	3,64	3,43	91,04	85,87

First curved factor is saturated with high screenings tests 'Eight Ball by tilting' - KOSUMAKA (.81) and 'mobility on the ground' - KPODPOD (.77). Second curved factor is saturated with the test 'insertion and skip'-KPROPRES whose projection is of a very high value (.98). This saturation is showing that all three tests are satisfactory in factor validity for measuring motor-coordination ability. However, there is a difference that is manifested by the fact that the test 'insertion and skip' (KPROPRES) is measured by one, and "Eight Ball by tilting '(KOSUMAKA) and' mobility on the ground '(KPODPOD), by another specific kind of body movement coordination within the respondents in this sample.

Table 5 Factor analyses for the tests for men

	Tests	**H**			**A**		**F**	
		H1	H2	h2	F1	F2	F1	F2
1	KPROPRES	,23	,95	,96	,00	,98	,04	,98
2	KOSUMAKA	,76	-,30	,67	,81	-,16	,80	-,12
3	KPODPOD	,79	,01	,63	,77	,16	,78	,20
□		1,26			1,00			
%		41,93			33,42			

Table 6 Factor analyses for the tests for woman

	Tests	F1	h2
1	KPROPRES	,67	,44
2	KOSUMAKA	,83	,68
3	KPODPOD	,71	,50
□		1,62	
%		54,13	

When factoring in the tests within the female respondents there is isolated one statistically significant main component. According to the percentage of valid variance of one and only isolated object of measurement (54.1%), in three tests, of course in a different, but satisfactory extent take part in existence of the main factor of coordination. The highest projection on the first principal component has the test 'Eight Ball with tilting'-KOSUMAKA (.83), then' mobility on the ground '-KPODPOD (.71), and the lowest' insertion and skip '-KPROPRES (.67).

Based on factorization of the three tests in both gender respondents it is noted that their validity can be defined differently. Tests 'Eight Ball by tilting' (KOSUMAKA) and 'mobility on the ground' (KPODPOD) within the men, are sufficiently valid to measure the first factor of coordination of body movements. The situation of the validity of three tests within the female gender is far clearer. All three tests are valid for measuring factors - coordination of body movements that can be defined with taking part of the whole body movements.

In analyzing the above results we can take into consideration the coefficient of congruence. It is statistically very important among the curve factors (.87). This means that the tests 'Eight Ball by tilting'

(KOSUMAKA) and 'mobility on the ground' (KPODPOD) is dominant while representing the factor of coordination, i.e. they have a higher degree of its validity for its measurement, in terms of coefficients of the congruence it is very similar with the single isolated factor in the female sex.

CONCLUSION

From the results we can conclude:

1. All applied tests have shown a satisfactory degree of reliability and validity for assessing motor-coordination ability of participants both male and female.

2. From the two applied models of measurement, Gutmans (image) model, has provided methodological clearer definition of reliability than the classical model.

3. Motor tests applied, showed a greater degree of reliability and validity in assessing coordination within the female gender respondents.

4. Highest degree of reliability under both systems of measurement within the respondents of both sexes has shown the test 'insertion and skip', followed by the tests 'Eight Ball by tilting' and 'mobility on the ground'.

5. In male respondents it is determined that the tests 'Eight Ball by tilting' and 'mobility on the ground' measure one common, and 'insertion and skip' measure another distinctive factor of coordination.

6. Within the female gender all three tests have the same object of measurement.

7. Among respondents of male and female gender the highest degree of reliability in assessing coordination has shown the test 'Eight Ball by tilting'.

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STUDY ON THE COMMUNICATIONS WITH THE PHYSICAL EDUCATION TEACHER

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SUMMARY

Introduction: One of the main tasks in the educational process is the effective communication between teachers and pupils. Ability of the teacher to communicate dynamically, non-standard and by different variable forms is a mastery that he/she acquires all the time during his/her professional engagements. And here due to age, professional experience and attitude to the problem are established different degrees of communications between teachers and pupils.

Methods: Purpose of this study is to reveal the reasons for the difficulties in the communications between teachers and pupils in attempt to better effectiveness of pedagogical interaction and the collaboration in the PE lessons at school. Subject of study are 50 pupils (27 boys and 23 girls, 4th class, 10-years-old) from school No 32 in Sofia. Special questionnaire with 13 fixed questions has been worked out and filled by the pupils. Results are calculated in percentage and analyzed. Results: 1 – very important is the pupils to feel themselves free, calm and comfortable at school but 1/5 from the pupils have problems in this attitude, 2 – only 3/5 of the pupils speak freely with their PE teacher, the other 2/5 have problems, 3 – 88% of the pupils trust their PE teacher, 12 % cannot assess, 4 – 88 % like to speak with the PE teacher, 12 % cannot assess, 5 – 75 % of the pupils have friends at school, the other 25 % do not have friends, 6 – 2/5 of the children play in the street with other children, the other 3/5 do not do this, 7 – 88 % of the pupils speak with their parents about school problems, the other 12 % do this very rarely, etc.

Conclusion: 1) In primary school age dominant is the emotional component and there must be directed the attention of the PE teachers. The character of the PE lessons allows this to happen, so that the school to be a pleasant place for the children. 2) Difficulties, problems and conflicts at school are inevitable but they can be solved. 3) Mutual trust between teachers and pupils is very important and it can be built during the educational process.

Keywords: communications, pedagogical interaction, 10-years-old pupils, physical education.

INTRODUCTION

Communication is defined as an interpersonal or group process in the base of which is the exchange of some results, acquired information, thoughts, conclusions, appraisals, feelings and emotions. And all this is due to conscious relations between people in their society. The purpose is co-ordination and harmonious joint operations (Desev, 1999). In the educational process all these joint operations refer acquisition of knowledge, skills and attitudes of young generation.

Communications can be realized in different forms of interaction between people and at least two persons are necessary. We speak about *interpersonal skills* which a man starts to acquire still from his cradle. Interpersonal skills we use every day in order to interact with other people. People who have developed strong interpersonal skills are usually more successful in both their professional and personal lives. Employers seek to hire people who will work well in a team and for this is necessary these people to be able to communicate effectively with the others around them.

One of the main tasks in the educational process is the effective communication between teachers and pupils. Ability of the teacher to communicate dynamically, non-standard and by different variable forms is a mastery that he/she acquires all the time during his/her professional engagements. More successful in their profession are teachers who have developed strong interpersonal skills. Furthermore,

teachers with good interpersonal skills are usually perceived as optimistic, calm and charismatic. These are qualities that a good teacher has to possess. And here due to age, professional experience and attitude to the problem are established different degrees of communications between teachers and pupils.

METHODS

Purpose of this study is to reveal the reasons for the difficulties in the communications between teachers and pupils in attempt to better effectiveness of pedagogical interaction and the collaboration in the PE lessons at school between them. Subject of study are 50 pupils (27 boys and 23 girls, 4th class, 10-years-old) from school № 32 in Sofia. The PE lessons were conducted by two teachers (a male and a female) with diplomas for physical education teachers.

Special questionnaire with 13 fixed questions has been worked out and filled by the pupils. Results are calculated in percentage and analyzed. The age 10-years-old as a whole can be defined as pre-puberty age both for girls and boys and this is the main reason to do our conclusions for the total contingent examined pupils without seeking differences in their answers due to their sex. Here we wish also to underline the interest and the excitement by the side of the pupils to the questions of the questionnaire.

RESULTS

In our analyses we will follow the questions according to their number and as they appear in the questionnaire.

*Question № 1"*Do you feel yourself well and comfortable at school?" with answers "Yes, No, To a certain extent, I do not know". The answers are 80% (n = 40) "Yes" and 20 % (n = 10) "To a certain extent". The time spent at school is very important for the pupils. Being at school has to be accompanied with feeling for security, comfort and calmness. At this age children are enough older to realize why they have to go to school and to feel themselves comfortable there. Though, we find that on every 5 children one is not satisfied from his/her stay at school.

*Question №2 "*Do you speak about what happens at school with your mother or your father? The answers here are "Yes, No, Not so much, I do not know" and the received answers are 90% (n=45) "Yes" and 10% (n=5) "No". Or in the families of the little children the problems in the class or of the school constantly are present among the themes of the "family's parliament". From the mouth of the little pupil very often go out expressions of the kind "Our teacher told". At this age the authority of the teacher is greater than the authority of the parent.

Question № 3 "Do you speak freely with your teacher in physical education?" with proposed answers "Yes, No, Not so much, I do not know". Here 60 % (n = 30) of the pupils answered "Yes", 20% (n = 10) answered "Not so much" and equal numbers of 5 pupils or 10% gave the answer "No" or "I do not know". We accept the received by us answers as acceptable for this age.

To feel well and sure at school and in the lessons of physical education the teacher constantly has to show his/her love to the little children. He / She constantly ought to encourage the pupils in their pursuits to acquire the necessary skills and knowledge. The good tone without raise of his/her voice is very important for the atmosphere in the class. Empathy and humanity of the physical education teacher can lead to free and helpful conversations.

Question № 4 "Do you have friends at school?" with answers "Yes, No, Not so many, I do not know". Here the answers are: 37 children or 74% have friends at school and 13 or 26% of the children have friends but not so many.

Question № 5 "Do you like to work in a group with other children from your class?"The children have answered in the following way: 20 of them or 40 % gave the answer "Yes", one or 2% answered "No", and 29 children or 58% gave the answer "Depends with whom".

The answers to question № 4 and question № 5 lead us to the conclusion that at age 10-years-old children already do choice who can be their friend and why or at this age they realize the moral qualities of the person.

Question № 6 "Do you like to play in the street or in front of your home with other children? The percentage to this question coincides with the percentage to question № 5 or 58 % or 29 children will play in the street if their mother allows them to do this, 20 of them or 40 % do like to play in the street or in front of their home and only one child (2%) does not like to do this.

Question № 7 "Do you feel fear to speak with your physical education teacher?" with answers "Yes, No, Not so much, I do not know". 36 children or 72 % gave answer "No", one child or 2% gave answer

"Yes", one child or 2% does not know, and 12 children or 24% gave the answer "Not so much".

Question № 7 to a great extent coincides with the content of question № 3. And here we register percentage of answers that do not differ too much. 30 children (60%) speak freely with their physical education teacher. 36 children (72%) do not feel fear to speak with him/her.

Going to school every child feels slightly uneasy because of the many unknowns there. Duty of the teachers is to overcome this uneasiness. Children of this age are active, dreamy, starving for changes. Teachers including physical education teachers have to secure the necessary conditions for the adaptation and incorporation of the children to the demands of the school life.

Question № 8 "Why do you feel difficulty to speak with your physical education teacher?" And here the variants for an answer are "I feel myself embarrassed, I do not feel the need to speak with him/her, I do not feel myself uneasy to speak with him/her, I do not want to speak with him/her, I do not know". The results show that even now when the pupils are in the 4th class and 10-years-old 40 % of them (n = 20) feel uneasy to speak with their physical education teacher. This percentage is embarrassing and the teacher has to do the necessary in help for the pupils. We say "the necessary" because the reasons for embarrassment can be different and then the method of approach has to be individual. The rest of the percentage shows that 50 % (n = 25) of the pupils do not feel difficulty to speak with their physical education teacher and 10 % (n = 5) do not know.

Question № 9 "Can you trust your physical education teacher and share your secrets with him/her?" with proposed answers "Yes, No, I do not know, I do not want to answer". To question № 9 we received the following answers: 90 % (n = 45) of the pupils really trust their physical education teacher, 3 pupils (6%) do not want to answer and 2 pupils (4%) do not know. This high percentage (90%) supports the answers of the other questions that the pupils like to speak with their physical education teacher and the contacts sometimes can deepen to sharing of some secrets.

The pupils of the primary school age are very observant little young persons and no weak side in the behavior of their teacher can escape from their eyes. Not only the teacher but they too are good psychologists. This obliges the teacher always to be perfect and careful during his/her communications with the pupils. Children copy things.

Question № 10 "Do you feel difficulty to give answer to your teacher in physical education?" with answers "Yes, No, Sometimes". The percentage distribution is: 40 % (n = 20) gave answer "No", 58 % (n = 29) answered "Sometimes" and only one pupil (2%) answered "Yes". Our conclusion is that the physical education teacher did the best from him/her to make the children much sure in their knowledge, more convincing and self-dependent.

Question № 11 "Do you like to have a talk with your physical education teacher?" with answers "Yes, No, I cannot judge". The answer of 45 pupils (90%) was "Yes" and 5 pupils (10%) answered "I cannot judge". These results lead us to the conclusion that the teacher of physical education is inside the problems of the pupils and the class, he/she has to take a side during discussions, to stop conflicts, etc.

Question № 12 "When you have difficulties at school whom you ask for help and advice?" The proposed answers are "My teachers, a classmate or a friend, my parents". And the received answers are: 25 pupils or 50% turn to their teachers, 15 pupils or 30 % seek advice from their parents and 10 pupils or 20% turn to a friend or a classmate. No analysis here is necessary. All depends on the trust that the children have to the people around them.

Question № 13 "What about most often you speak with your physical education teacher?" And the answers are: 80% (n = 40) discuss the educational content, 60% (n = 30) speak about their experiences, 26% (n = 13) want to clear attitudes in the class, 20% (n = 10) speak about misbehavior of classmates. Here the percentage is above 100 % as children gave more than one answer.

Before doing our conclusions we want to turn to the experience and views of some Bulgarian and foreign researchers (pedagogues or social psychologists).

Stoynova (2014) concludes that today the teacher is not only a teacher and he/she plays many other roles in the life of pupils. "He/she has to be a tutor, moderator, advisor, example to be followed, partner, or sometimes a friend. Children need all these shapes around themselves (Stoynova, 2014, 47). Here we will add that all these roles are connected with communications between the two sides – pupils and teachers and let us not forget the parents as a third side.

The teacher is a very important figure in the life of pupils, responsible to secure the necessary motivation for learning (Milenkova, 2013).

Today teachers are midst cultural wars while fulfilling their duties. They must be able to work in team, to be always competent and opened to the pupils and their aspirations (Kennedy, 1997).

The today's world of globalization and the newly built environment is connected with the ability of the people to control their emotions and to be in correct contacts between themselves (Недялкова et al., 2005).

Thomas Gordon (1918 – 2002) is one of the pioneers in teaching of communication skills and conflict resolution methods to teachers and parents. Gordon strongly believed that the use of coercive power damages relationships. Alternative is the skill of active listening and No-Lose Conflict Resolution (www.wikipedia.org/wiki/).

CONCLUSION

1) In primary school age dominant is the emotional component and there must be directed the attention of the physical education teachers. The character of the physical education lessons allows this to happen, so that the school to be a pleasant place for the children.

2) Difficulties, problems and conflicts at school are inevitable but they can be solved if the teacher has the skill, knowledge and patience to do it. Mutual trust between teachers and pupils is very important and it can be built during the educational process.

3) This research and questionnaire can be defined as pilot but similar to them can be used periodically by every teacher in order to clear for himself/herself the situation in the class and where to direct his/her attention in the future work with the pupils.

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EFFECT OF SEAS APPROACH ON CHILDREN'S POSTURE IN PRIMARY SCHOOL AGE

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SUMMARY

Introduction: Primary school children develop bad habits while sitting and standing posture and it is a base for posture deviations. Correct posture gives not only a smart appearance but also helps to prevent injury and illness of the spine. There are very few papers on Bulgarian language on alternative rehabilitation approaches for postural deviation like SEAS.

The aim of our study was to establish the effect of SEAS on posture in first grade children.

Methods: Design: prospective study, test-retest design. 30 girls and boys (mean age 7,5 years) with posture deviation were included in experiment. They were divided into two groups - experimental (EG, n=15, physical therapy based on SEAS) and control group (CG, n=15, no therapy). For the purposes of that study we used: comparative photo analysis, expert posture assessment and posture evaluation.

Results: Before experiment 13,3% of children in EG had posture type B (good) and 86,7% had posture type C (poor). After experimental physical therapy 46,7% of children in EG improved their posture type (from C to B type) and no one worsen. At the same time we found reduction of combined type of posture deviations in EG. In the CG 6,7% of children worsted their posture type and no one improved it.

Conclusion: The applied physical therapy improved posture in 47,4% of children and reduced number of combined posture deviations.

Our results recommend applying of SEAS approach in cases with postural deviation as a sole therapy or in combination with other therapies. SEAS can be used as a therapeutic tool and for the prevention of the posture deviations in children.

Keywords: posture deviation, posture types, physical therapy

INTRODUCTION

The modern history of children's posture involves an important episode of intense concern, followed by an equally interesting relaxation. Around 1900 American parents were told to devote a great deal of attention to the posture training of their children, but roughly fifty years later the campaign was receding dramatically. Posture history in other societies remains to be traced, but the beginnings of modern posture standards in Western Europe emerged in the seventeenth and eighteenth centuries. The end of the nineteenth century, as a flurry of posture advice emerged. Doctors stepped up their campaign, arguing that a number of modern conditions, including cramped school desks, were leading to widespread physical deformity (Susina, 2004).

Posture - It is your power foundation - a stacked framework from your feet through your legs, hips, spine and shoulders to your head. The neutral position from which all movement arises (McGill, 2007). The body is in some ways like a machine; its parts are accurately adjusted to one another, and if any part is out of correct position the machine does not work perfectly (Hugh, 1935).

Good posture is the attitude which, is assumed by Body parts to maintain stability and balance with minimum effort and least strain during supportive and non-supportive positions (Shimaa, 2012).

Good posture is much more than merely "standing straight"; it is the use of all parts of the body with proper balance, with ease and grace. This proper use of the body is called good body mechanics (Hugh, 1935). Body mechanics may be said to form the basis of all physical therapy, an irreducible minimum which must be satisfied if one

is to expect remedial measures to be most fully effective (Osgood, 1932).

For good posture to be maintained the following must be obtained:

- The ability to maintain 'the body upright in good and erect position with less energy.

- The ability to maintain balance in upright position via keeping the line of gravity near the center of the base of support (Shimaa, 2012).

- The spinal column is not deviated laterally and its normal lordotic and kyphotic anteroposterior curves are not exaggerated (Osgood, 1932).

When the body is in correct balance, all its parts, including the internal organs, are held in good position. The effects of good posture include:

1- Helps the muscles in the body to be unloaded and relaxed.

2- Improves respiratory and circulatory efficiency.

3- Prevents unnecessary strain and fatigue.

4- Decreases the incidence of diseases resulting from bad posture.

5- Improves the subject's state; mentally or psychologically (Shimaa, 2012).

Factors that influence Posture:

- Aging - body gradually loses its capacity to absorb and transfer forces however its not aging that influences posture as does,
- Inactivity/sedentary living/reluctance to exercise - leads to loss of natural movement flow,
- Poor postural habits - eventually becomes structural,
- Biomechanical compensation - muscle imbalance, adaptive shortening, muscle weakness and instability within the "core",
- Body composition – increases load, stresses on spinal structure, leads to spinal deviation,
- Workspace – ergonomics,
- Poor movement technique/execution/training ,
- Injury - leads to reduced loading capacity or elasticity,
- Others (McGill, 2007).

Poor posture is a position resulting from any deviation from ideally aligned erect posture (good posture) (Shimaa, 2012). Differences between good and poor posture are shown at the Figure 1.

Poor posture may cause one or more of the following dysfunctions:

1. Defects in:

- Joints: such as stiffness or immobilization.
- Bones: such as shortening or deformity.
- Muscles: such as weakness, paralysis or contracture.
- Vision or hearing.
- Both respiratory and circulatory efficiency

2. Bad habits: either from early childhood or from occupational positions.

3. Pain, fatigue or bad psychological state.

4. Secondary deformities and compensatory postural defects.

As a result the body functions are altered and this may lead to dysfunction and diseases (Shimaa, 2012).

Types of poor posture (from the lateral view):

- Kyphotic-lordotic Posture
- Flat-back Posture
- Sway-back Posture
- Lordosis Posture
- Kiphosis Posture

Types of poor posture (from the back view):

- Scoliosis (Shimaa, 2012).

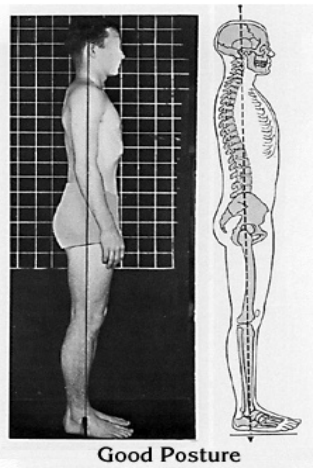
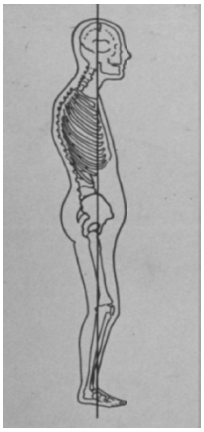
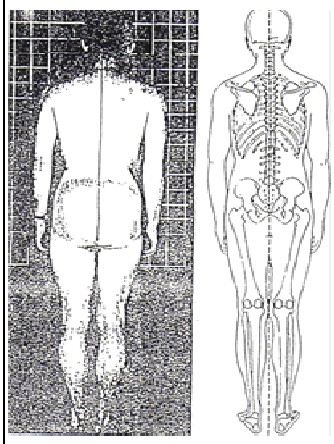
Correct Posture (Lateral)	Poor Posture (Lateral)	Correct Posture (Posterior)	Poor Posture (Posterior)
 Good Posture		 Good Posture	
Line is… • Through external auditory meatus (Ear) • Midway through shoulder • Through lumbar bodies • Slightly anterior to midline of knee • Slightly anterior to lateral malleolus		Line is… • In the center of head, neck, back and pelvis • Falls exactly in the mid-point between the two knees and ankles	

Figure 1 Differences between good and poor posture

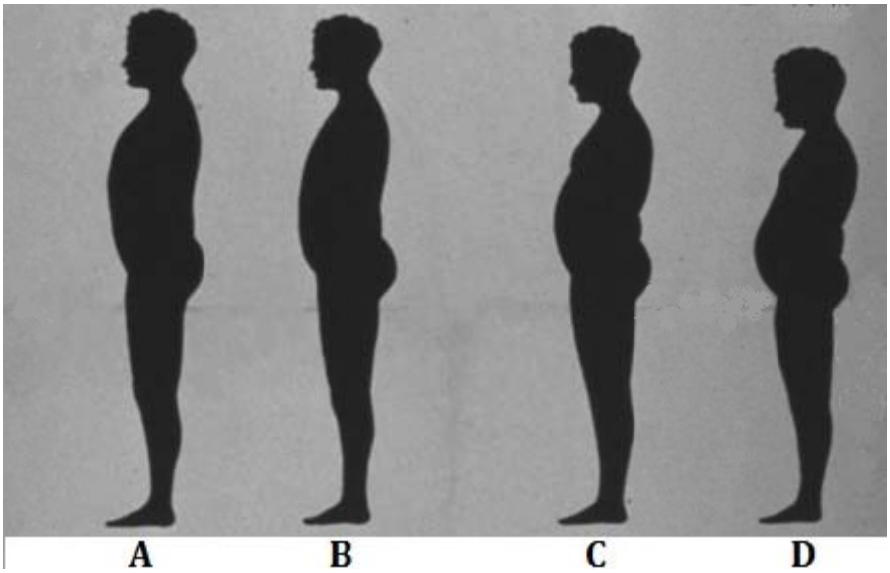


Figure 2. Posture standards (A, B, C and D) – lateral view.

There are also posture standards and according to Slanchev (1998) there are 4 types of posture, which are marked by the letters A (very good posture), B (good posture), C (middle posture), D (poor or bad posture). Posture C and D are spine deviation in the anterior-posterior or lateral direction (Figure 2).

The postural alignment starts its development from early period of life with development of the spine and its curvature. At first, at birth the spine has one "C"-shaped curve with one convexity and one concavity. Then, as the child is trying to raise his head 'from prone lying position cervical curve starts to develop and in the early phase of education of walking, another curve will be developed which is the lumbar curve (Shimaa, 2012).

The habit of holding the body in balance -in good posture - is learned gradually as the child learns to control his body. First, as a baby, he learns to sit up, then to creep, then to take a few steps, and finally to walk. Throughout these stages he is learning slowly how to hold his body in balance. All through childhood he continues to learn this lesson. How well he learns it depends largely on the strength of the muscles that hold the body erect, and these muscles should be gradually growing stronger as he grows older and as he uses them more and more actively (Hugh, 1935).

All-around development, which is gained by strengthening all the muscles of the body through active play-climbing, throwing balls, running, jumping, skipping, shouting-lays the foundation for good posture. But if the child is to learn the habit of good posture he must not only gain all-around development but must also strengthen the muscles that have the most to do with holding the body in good balance (The bad posture in children can result in problems with balance, coordination and upper body strength (Gencheva & Zaharieva , 2013). These are:

(1) the muscles of the abdomen - The lower abdominal muscles should pull in and flatten the lower part of the abdomen.

(2) the muscles of the buttocks – When the buttock muscles are well developed, they help to straighten the lower spine and keep the child's back from becoming too hollow.

(3) the muscles of the shoulders and of the upper trunk – The muscles of the shoulders and neck and those of the upper trunk help to hold the chest high and the chin in.

(4) certain leg muscles that hold the feet in good position (Hugh, 1935).

Man's core muscles - comprised of the abdominal and back muscles - act like that of a corset to hold everything in or support and stabilize your lumbar spine. The result is a slimmer shape, and more importantly, a spine that is supported against strain, pain and injury. The core "corset" also functions: to move the trunk in all directions - flexion (forward and laterally/sideways), extension and rotation/twisting (McGill, 2007).

Specific posture and muscle dysfunction work is limited to addressing strength and flexibility exercise and muscle re-education that will help offset poor postural habits both in sitting and while moving (McGill, 2007).

SEAS is an acronym for "Scientific Exercise Approach to Scoliosis". This includes: improving the patient's awareness of their deformity, autonomous correction by the patient (active self-correction), the use of exercises to stimulate a balance reaction. In the SEAS approach the two main treatment objectives are active self-correction as well as the improvement of spinal stability. The self-correction component can be defined as the search for the best possible alignment within three dimensional spatial planes, which are obtained autonomously by the patient (Bettany-Saltikov et al., 2012, Romano al., 2008).

The aim of this study was to establish the effect of 5-month physical therapy training program (based on SEAS) on posture in first and second grade children.

METHODS

The study was 5-months controlled trial. All assessments were done at baseline (first examination) and after the intervention (5 months) (second examination).

Study subjects were 30 children from 7 and 8 years old (of which 17 girls) with idiopathic posture impairments and idiopathic low-degree spine deformities (29 of 30 children were with scoliotic impairments).

At the beginning of the second semester of 2013-2014 was performed an examination of children from 68 SOU in Sofia for spinal deformities. Studied children were aged 7-8 years from first and second grade. After informed consent of the parents and initial research, the children were divided into two groups - experimental and control with corresponding posture and spine deviation, age and sex.

The experimental group (EG) included 15 children in mid age 7,5 years (7 girls and 8 boys). The 15 children in the experimental group were with posture deviation, 0 of them were with bad posture (posture D), 13 were with middle posture (posture C), 2 were with good posture (posture B) and 0 were

with very good posture (posture A) (Table 2). Children from this group had held two sessions physical therapy a week for 45 min for 5 months.

The control group (CG) included 15 children with mean age of 7,6 years (6 girls and 9 boys). The 15 children in the experimental group were with posture deviation, 0 of them were with bad posture (posture D), 11 were with middle posture (posture C), 4 were with good posture (posture B) and 0 were with very good posture (posture A) (Table 2). Children from this group were without treatment.

Two groups (EG and CG) had theirs physical education classes from school program which were led by general education teachers, rather than a physical education teacher, which reduced their effectiveness in terms of physical development.

Training program

The physical therapy training program was based on SEAS (there was no mirrors). Training frequency was two weekly sessions of 45 min for 5 months. Our physical therapy program included exercises for active self-correction on the three spatial planes (ask the patient to execute an active self-correction movement and to hold it for the entire duration of isometric contraction - at least 10 seconds of the chosen muscles); for spinal stability; for muscle strength (weight lifting – 1 kg, but it's done only if he/she is able to maintain the active self-correction while exercising); for static and dynamic trunk balance. All these exercises are designed to train the patient to maintain autocorrection even in unfavorable conditions of attention.

Sample of measuring instruments

To determine existence of posture and spine deviation and objectify the results of physical therapy the following methods were used: expert body/posture view/assessment (done by physical therapist in Frontal and Sagital Plane and documented with standardized photos) posture evaluation.

Static Postural Assessment: Standing on both feet: front, side and rear views / anterior, posterior and lateral view. To assess posture ideally, the subject asked to stand upright, and attention should be given to the following:

- No movement in the atlantoaxial or atlanto-occipital joint which results in protrusion of the jaw.
- Stands as straight as possible.
- Knees should be straight as much as possible.
- Head faces forward and arms beside the body.
- Almost all joints of the body must be in the neutral position.

The parts which were observe:

1 - Head alignment.

2 - Curvature of the spine; cervical, thoracic and lumbar.

3 - Shoulders and arms.

4 - Pelvic inclination.

5 - Hip, knee and ankle joints.

Posture evaluation: The posture was assessed in 4 degrees (types): very good (A), good (B), middle (C) and bad (D) (Slanchev, 1998).

Statistical procedures

For our statistical analyses we ordered posture evaluations: very good (A) - degree 1, good (B) - degree 2, middle (C) - degree 3 and bad (D) - degree 4. Non-parametric Mann-Whitney test was used to analyze differences between groups. Changes in posture were analyzed with Wilcoxon Signed Ranks Test. Analysis of data was performed using SPSS software.

RESULTS AND DISCUSSION

Table 1. Posture impairments findings.

Posture impairments	Experimental Group		Control Group	
	I Examination	II Examination	I Examination	II Examination
Normal	0 (0%)	5 (33%)	0 (0%)	0 (0%)
Lordosis	0 (0%)	1 (6.7%)	0 (0%)	0 (0%)
Scoliosis	3 (20.0%)	4 (26.7%)	4 (26.7%)	3 (20%)
Kyphotic-lordotic	0 (0%)	1 (6.7%)	0 (0%)	1 (6.7%)
Kyphotic-scoliotic	2 (13.3%)	1 (6.7%)	1 (6.6%)	2 (13.3%)
Lordotic-scoliotic	2 (13.3%)	1 (6.7%)	4 (26.7%)	3 (20%)
Kyphotic-lordotic-scoliotic	8 (53.4%)	2 (13.3%)	6 (40%)	6 (40%)

Table 2. Posture findings (types of posture by groups).

Posture type	Experimental Group		Control Group	
	I Examination	II Examination	I Examination	II Examination
1- Very good	0	0	0	0
2 - Good	2 (13.3 %)	9 (60.0%)	4 (26.7%)	3 (20.0%)
3 - Middle	13 (86.7%)	6 (40.0%)	11 (73.3%)	12 (80.0%)
4 - Bad	0	0	0	0

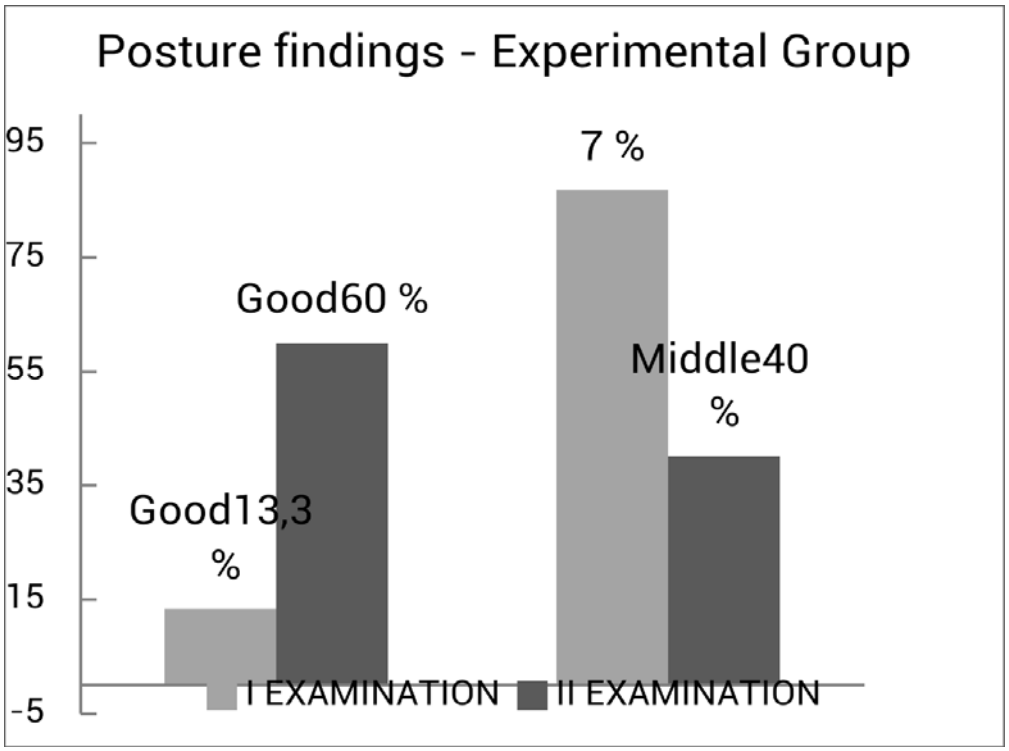


Fig1. Changes in Posture for Experimental Group on percentage during experiment.

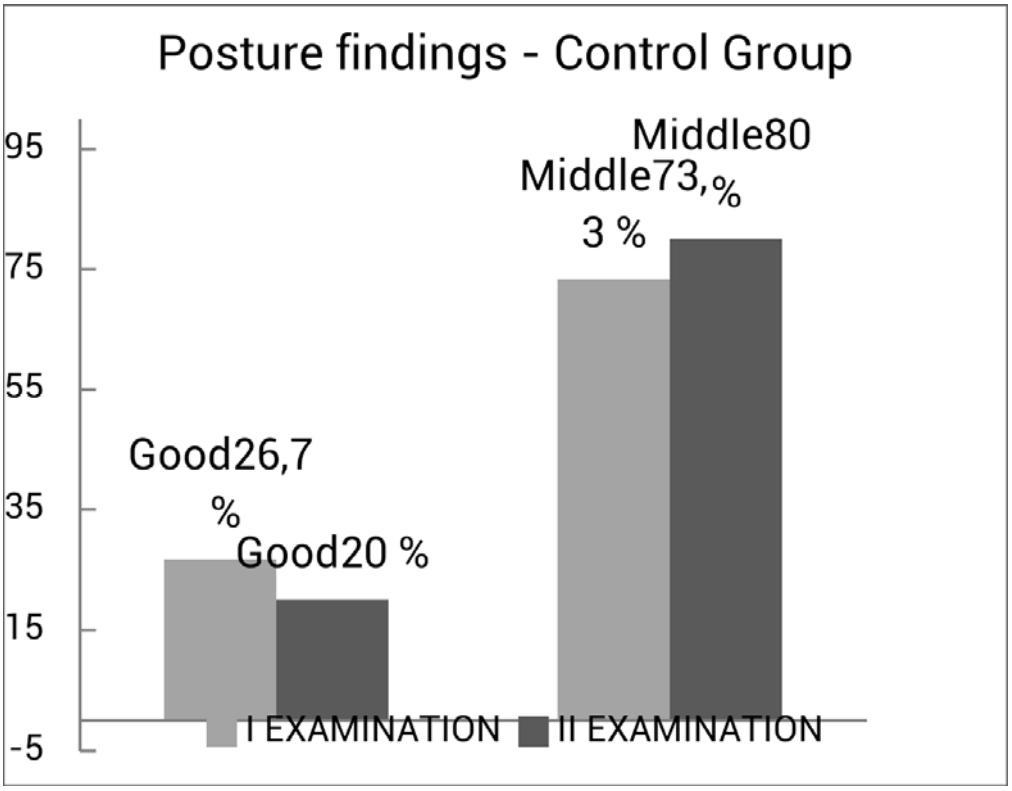


Fig.2. Changes in Posture for Control Group on percentage during experiment.

Table 3 represents statistical results for differences between groups and changes in posture.

At first examination (before experiment) there is not statistically significant difference between EG and CG. After physical therapy we found significant improvement (p = 0.008) in posture for the experimental group (Table 3). Fig 1 presents the improvement of children's posture type for the experimental group - by 13% "good" posture has become 60%.

In the same period in the control group shows the opposite trend - "good" posture by 40% at first examination occurred in 23% at second examination (Fig 2) but differences in control group are not significant (p = 0.317) (Table 3). Fig 2 presents the percentage of children's posture type for the CG. At second examination (after experiment) there is statistically significant difference between EG and CG (p = 0.028). Therefore the experimental physical therapy improved posture of the children.

Table 3. Statistic results for differences between groups and changes in posture.

Група	**n**	**I examination**		**II examination**		**Z**	**p**
		Mean Rank	Mean	Mean Rank	Mean		
Experimental Group	15	16.50	2.87	12.50	2.40	2.646	0.008**
Control Group	15	14.50	2.73	18.50	2.80	1.000	0.317
Z		0.898		2.198			
p		0.369		0.028*			

Notes.* *p<0.05, ** p<0.01. The lower value of posture result is better.*

CONCLUSION

Detailed study of the literature found that physical therapy is strongly reduced in the schools. There are removed classes in remedial gymnastics; there is no specific therapeutic method for preventing postural disorders in students.

As a result of the applied physical therapy (based on SEAS) the experimental group statistically significantly improved of posture. After experimental physical therapy 46,7% of children in EG improved their posture type (from C to B type) and no one worsen. Appropriate early 5-month physical therapy treatment of posture deviations was beneficial effect on posture in first and second grade children.

Learning how to stand in a better postural position takes effort. When you're corrected, you feel unnatural and exaggerated in your new position. You're suddenly aware of muscles you've never engaged before, and they start to fatigue after time practicing your new position. It's not an instant fix. It's a process, not an event. There's no magic trick or miracle cure.

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STUDY ON THE DIFFICULTIES OF THE PE TEACHERS IN THEIR COMMUNICATIONS WITH THE PRIMARY SCHOOL CHILDREN

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UDC 796,01

SUMMARY

Introduction: Effectiveness of the educational process in every school subject depends on the good interaction between the teachers and their pupils. Mutual understanding and co-operation in their contacts are wished by all of them but still unconscious for the little children.

Methods: The aim of this partial study is to define some of the problems that PE teachers meet in their communications and work with pupils from the primary school (I – IV class, 7 – 10-years-old). Subject of study are 30 PE teachers (27 female and 3 males) from Sofia (centre of the city and living complexes "Nadezda" and "Izgrev") who answered 11 questions gathered in a questionnaire. The greater number of females in our study proves the tendency that the work as a teacher last decades is taken more often by women. All examined teachers were graduates from higher pedagogical schools (24 or 80% graduated the National Sports Academy in Sofia), with different age (23 to 56-years-old), different pedagogical practice (2 to 35 years).

Results: We found that all PE teachers (100%) are aware about the importance of the primary school age for the adaptation of the little pupils not only to school life but to social life as well and try to support them in this attitude. Because of this 60% of the PE teachers (n = 18) pay special attention to the individual characteristics of the pupils.

Conclusion: Our study can be specified as a pilot with conclusions that will be in help mainly for the examined by us group of PE teachers. We think that all participants in the research were enough honest and responsible in their answers. We found also that not only pupils but PE teachers also have to be supported in their mutual relations.

INTRODUCTION

Effectiveness of the educational process in every school subject depends on the good interaction between the teachers and their pupils. Mutual understanding and co-operation in their contacts are wished by all of them but still unconscious for the little children. Though, interaction between teachers and pupils sometimes go along with obstacles and barriers that make contacts not so easy and natural.

Present-day views on the character of the communications between children and their parents and teachers stress on the *self-discipline* that has to be built along with the acquisition of skills for interactions and communications in the children. Doing this children will help parents and teachers in this process. Another important matter that has to be taken in mind is the ability of the elderly to follow closely the questions that excite or sometimes even worry children. Often this is accompanied with high extent of patience but success is to parents and teachers who manage to realize it steadily in practice.

World-famous in teaching of communication skills and conflict resolution methods to parents, teachers and leaders is the American clinical psychologist Thomas Gordon (1918 – 2002). He developed a model known as the Gordon Model or the Gordon Method that represents a complete and integrated system for building and maintaining effective relationships in community (http://en.wikipedia.org/wiki/Thomas_Gordon_(psychologist)#References). The skills for communications include *active listening* and No-Lose Conflict

Resolution. Followed different books of Thomas Gordon:

1970 – Parent Effectiveness Training (P.E.T.). The book is revised in 2000 and published in 33 languages, sold over five million copies in 45 countries around the world. The book gives access to the parents to a new philosophy in their contacts with the children.

1974 – Teacher Effectiveness Training (T.E.T.). This book gives a model for elimination ofauthoritarian teaching and punitive discipline in the classroom.

1950 – Leader Effectiveness Training (L.E.T.) is a new idea in the 50's but it became more popular in the 1970s with the increasing acceptance of management in the U.S.A. The worked out model is for democratic and collaborative leadership and contributes to the betterment of humanity.

Some details from the understandings and recommendations at the same time of Thomas Gordon about the communications among the generations we find in his article "How children really react to control". These recommendations are as follow:

> Be firm but fair. Insist that your children obey. Don't be afraid to express disapproval by spanking. There are times when you have to say 'no'. Discipline with love. Demonstrate your parental right to lead. The toddler should be taught to obey and yield to parental leadership.

Even now the interpretations of communication in the pedagogical circles are quite dual and sometimes contradictory. The great variety of opinions and approaches of the different authors hinders the attainment of a generalized definition of the real content of the communication. Usually every new theory is a reaction against another and the reason is the absolutism of one of the two main categories activity and communication.

Here we will mention only two definitions. The first one is to the eminent Russian psychologist A. A. Leontiev/А. А. Леонтьев (1936 – 2004) who defines communication as "a process or processes in a definite social community – a group, team, staff or the society as a whole, and this is a result of social necessities" (Леонтьев, 1997).

The second definition is to another famous Russian social psychologist, philosopher, sociologist and pedagogue named Борис Дмитриевич Парыгин (1930 – 2012). According to Парыгин/ Parigin the multiformity of the definition is a result of the different approaches to the phenomenon, so that the interpretation might be philosophical, psychological, sociological, pedagogical, etc. He continues that "communication is a complex and multilateral process of interaction between people and it can be an informative process, a process showing attitude among people, a process of mutual influence of one to another person, and a process of reciprocal comprehension"(Парыгин, 1999).

Our conclusion is that there are different tendencies in the definitions of this complex social phenomenon. Undoubtedly, there is not a country without scholars whose scientific findings are in the sphere of communications. As if to a certain extent theory anticipates practice. Furthermore the expectations from practice not always are predictable and examinations there have a concrete partial meaning that can be had in mind during other practical examinations.

METHODS

The aim of this partial study is to define some of the problems that PE teachers meet in their communications and work with pupils from the primary school (I – IV class, 7 – 10-years-old). Subject of study are 30 PE teachers (27 female and 3 males) from Sofia (centre of the city and living complexes "Nadezda" and "Izgrev") who answered 11 questions gathered in a questionnaire. The greater number of females in our study proves the tendency that the work as a teacher last decades is taken more often by women. All examined teachers were graduates from higher pedagogical schools (24 or 80% graduated the National Sports Academy in Sofia), with different age (23 to 56-years-old), different pedagogical practice (2 to 35 years). More than one answer was allowed to be given and because of this sometimes the sum total went beyond 100 percent.

RESULTS

We found that all PE teachers (100%) are aware about the importance of the primary school age for the adaptation of the little pupils not only to school life but to social life as well and try to support them in this attitude. Because of this 60% of the PE teachers (n = 18) pay special attention to the

individual characteristics of the pupils. All teachers realize that children need time to become aware of their new social position as pupils and this takes different time in the different children. 12 teachers or 40% insist very much on the preliminary personal contact with the parents to see how they understand the future of their children. 6 teachers or 20% rely only on the results of the psychological tests done in some of the schools before the first school day of the children. Also 6 teachers or 20% prefer the direct contact with the child and that means an embracement, smile or some warm and supporting words.

Love is the introduction to good education and this is understood by all teachers from our study. Scholars define love as a means of education but perfect balance between love and control is necessary. Love is the spiritual support of the little pupil in difficult moments. The expression "I am very exacting towards you because I love you so much" is a motto in the work of one of the PE teachers.

The research showed also that 80% (n = 24) of the teachers define their work as democratic, 13 % (n = 4) as liberal and only 7 % (n = 2) as authoritarian. Democratic style of communication is based on the principles of humanism and includes trust in children, encouragement, praises, freedom of opinions and in estimation, respect, defence and acceptance of the child's personality.

When 80 % of the PE teachers prefer the democratic style of communication it is supposed that the conflict situations in their work with the pupils will be less. The question from the questionnaire is "Are there conflict situations between you and the pupils?" with three proposed answers: often – 0%, sometimes 33 % (n = 10), and never 67 % (n = 20).

School for the little pupils is connected and identified mainly with their teachers. So the teacher is the person who has to build positive attitude to skills and knowledge in kids. The duties of the teachers in physical education are still more. From them is expected to maintain the natural love to movements in kids and for the purpose he/she has to have good contacts and communications with children. Communications must be rich in content and pregnant with meaning. Some information along these lines we get from the question "In what aspect prevail your communications with the pupils?"The answers are as follow:

- In connection with the educational content - 60 % (n = 18)
- In connection with the relationships among pupils – 50 % (n=15)
- About behavior at school – 33 % (n = 10)
- Incidents and experiences from the day – 60 % (n = 18)

The total sum went beyond 100 % as teachers could give more than one answer. Generalization concludes that pupils take an interest and pay greater attention in this what they study and what happens with them or around them during the day. Relationships and behavior interest them less. Though, commentary upon relationships with the classmates is necessary as this helps the mutual acquaintance of pupils in the class and the teachers have to support such a course of the conversations.

Following question was "What hinders you in your communications with the pupils?" The given answers are:

- Lack of a pedagogical tact by my side – 26,7 % (n = 8)
- Strong emotionality and inadequate reactions in some situations – 50 % (n = 15)
- Insufficient penetration and imagination – 26, 7 % (n = 8)

Another question was "Which pupils are more difficult for communication?" with answers:

- Pupils who have difficulties during communication – 3, 3 % (n = 1)
- Bad-mannered pupils – 40% (n = 12)
- Very ambitious and uncontrolled pupils – 6,7 % (n = 2)
- Pupils with poor vocabulary – 20 % (n = 6)
- Uncommunicative and timid pupils – 13,3 % (n = 4)
- Emotionally unstable pupils – 30 % (n = 9)

We explain the great diversity of the answers with the expected different individuality of the pupils. This defines the direction and the approaches of the teachers in seeking high effectiveness in communication with children.

The answers of question "Do you think that communication abilities are accustomed firstly in the family and then at school?" are totally "Yes". In this attitude here we will mention a part of the free answers of the PE teachers: "My behavior must not arouse fear but trust and calmness", "I try my behavior not to respect them but to inspire confidence and to predispose them to conversations", "Partnership in communications with the pupils is very important for me", "With my

behavior I show that I respect them, that I believe in them but though I insist on their correctitude during their duties", "I speak with the parents to receive a full concept for the pupil and then to find my individual approach to him/her", etc.

In their communications with pupils 93 % (n=28) of the PE teachers support the vision "Let us talk over the problem together". Also 93 % of the teachers hardly seek the help of the parents for solving the problems of the children when it is a question about their ability to communicate.

CONCLUSION

Our study can be specified as a pilot with conclusions that will be in help mainly for the examined by us group of PE teachers. We think that all participants in the research were enough honest and responsible in their answers. We found also that not only pupils but PE teachers also have to be supported in their mutual relations. Pedagogical competences of teachers need complementary knowledge on the personal and psychic characteristics of their pupils which the teachers from the examined group try to do.

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DISCRIMINATIVITY OF THE ENTRANCE-EXAM ENROLLMENT CRITERIA FOR THE PHYSICAL EDUCATION STUDY SELECTION OF FEMALE APPLICANTS

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SUMMARY

Introduction: Enroll exam criterion assume to unable the objectivity at the selection process of candidates, as well as to guarantee the success for the up-coming study. While applicants classify on the base of achieved results the enroll-exam includes competition elements as well. The research was done with aim to estimate how established criteria differentiate successful and unsuccessful applicants. Analysis includes the classical way of enroll- exam for the physical education study, which is the most common in praxis.

Methods: Sample of female candidates involved two groups: 1) successful; 2) unsuccessful - female applicants. For the evaluation of applicants was used following variables: A) General success in previous secondary education, and B) Specific part, which is significant for the physical education study.

Results: Research results have been analyzed using ANOVA and MANOVA, as well as the Kruskal-Wallis Range-Analysis of Variance, conducted within two models: 1-First, related to the evaluation of the Point list of applicants, and 2-Second, related to the evaluation of Original scores/Roh Werts.

Conclusion: Generally, it is possible to say that these methods of classification do not differentiate significantly successful and unsuccessful applicants on the entrance-exam in observed period.

Keywords: physical education, entrance-exam, enroll criteria, discriminativity

INTRODUCTION

The new system of students enrollment is based on the appropriate amendments to the Law on Higher Education, and in detail elaborated by document "Policy of enrollment for the school year 1980/81" (when he began to perform in all higher education organizations in the Republic of Serbia, outside Provinces). The main goal of the admission of students is contribution to a better approximation of the overall development and results of activities of higher education within a major social and personal needs and possibilities. The system of the students' enrollment, primarily has the function to enable in a fair way, and based on objective criteria the selection and admission of candidates which have, according to their knowledge and abilities, better prospects for successful education and tasks performance in future career. For realization of its core functions, the system of registration must include the following elements:

a) The statutory procedure of registration in terms of prior education; b) special conditions of entry in terms of specific abilities, aptitudes, talents, personality traits and certain biological, physiological or health characteristics of candidates; c) the criteria for selection of candidates should be based on the results that candidates have achieved in the previous education and special conditions, giving priority to those who, according to these criteria, are more likely to succeed in future study and profession.

The Law on Higher Education, after amendment, executed 1981st has put and closer determined the possibility of higher education organizations and their statutes to provide specific requirements for admission, which are of particular importance for the study, or future work in the profession.

Terms and method of entry and common criteria for the selection of candidates for the study of

physical education for the school year 1989/90, at the Faculty of Philosophy in Niš, are determining with the Statute of the higher education organization, as well as with a special program of qualifying examination for admission to the Department of Physical Education. Program of qualifying examination and selection of candidates for the study of physical education is very complex, due to the specificity of this study. In addition, it requires the candidate to possess skills necessary for any other study, required level of physical fitness, as well as the capacity for adoption of the specific motor skills of different sports and disciplines. In the selection of candidates for admission to study of physical education, one of the criteria is performing of classification physical fitness exam. It demands of the candidate to overcome certain norms by which is possible an insight into their physical abilities, as well as specific skills in terms of the execution efficiency of certain situational-motor tasks from different branches of sports, or disciplines within them.

In recent years in foreign and domestic literature, more attention is paid to the problems related to human resources in the field of physical education (PE). In function of the rationalization of the study process and achieve its maximum effectiveness, a series of research related to the study of the relationship between the factors that could affect the success in certain areas of human activity and the success of the studies. Based on the research results provided, it was found that academic achievement was studied partial or in relation to the overall success, it affects a number of factors, from those that determine the economic status and educational level of the parents, through morphological status, motor status, previous knowledge level, attitude towards learning and studies, to the motivation to learn and the study. Thus, many studies have confirmed the fact that prior academic achievement has a high predictive value in relation to success in further education. Selection of candidates for the study and the problems of studies success was dedicated a large number of researches, conducted on samples from the home country.

While investigating the problems of physical development and physical fitness of candidates for admission to the College of Physical Education in Belgrade, Stojanović et al. 1969 (after Radojević, 1976) suggested some corrections of norms in the standard entrance exam disciplines where there is a significantly high correlation coefficient between the parameters of physical development and physical skills. In the majority of established norms, occurs the need to reduce them.

On the sample of 135 students from Belgrade FPE, Radojević (1976) investigated the predictive value of the entrance exam test, in regard to the success in the artistic gymnastics and found that applied battery of measures have significance for the prediction of success, in general, as well as the success of the individual apparatus. Each of the criterion variables was negatively correlated with body weight and body mass. The same author (Radojević, 1976) has performed an analysis of battery of tests of the entrance examination, with extraction of three factors, which could be interpreted as: a) the ability of the movement structures, which overcome in gymnastics; b) the ability of the movement, which dominated in athletics; c) then the factor that defines the strength of the upper and lower extremities, with a simultaneous synchronization of movement of upper and lower extremities- climbing over the rope.

Agrež et al. 1981 (after Popović et al., 1998) investigated the validity of the entrance examination at the College of Physical Culture in Ljubljana, due to the transition from the first to the second year of study. It was concluded that the highest prediction to the common factor of the studies success has school grade in the final year of secondary school. Other variables from the predictor system (grades of the native language and motor skills tests) did not significantly contribute to the explanation of the variance of the criterion variable. It is evident that the statistical significance of the school success should be taken with certain skepticism, since a relatively high correlation may be caused by the same subjective variance of evaluation in high school, which appears in the appraisal studies.

Radojević, 1982 (after Popović et al., 1998) has implemented a comprehensive scientific research study in which has estimated significance of predictors for successful education and PE teacher position. This paper discusses the two complex issues: 1) the ability to predict success in studies at the Faculty of PE, and 2) the ability to predict success in certain aspects of the PE teacher. The sample consisted of 46 PE teachers, employees in 33 primary schools in Belgrade for common ground oriented secondary education, 1114 students-pupils for tests of motor skills and 1381 students for the knowledge test. Data for the study were collected within school year 1978/79 and 1979/80. For the

criterion variable "Success in studies at FPE" was selected 24 predictor variables, of which 18 are the subjects of the study at the FPE, three variables were selective for admission to study of PE, and the remaining three are related to the type and degree of involvement in previous sports activities. Analyzing the relationship between the stated criterion variables and the system of predictor variables it was found that this system provides a significant prediction of the study success. Assumptions have not been confirmed in regard to the positive correlation between success in study and indicators, which are taken as selective when enrolling the Faculty of PE, nor about the important connection between success in study with previous involvement in sports and level of achievements in sports.

Popović, R., Popović, D., Kostić, & Anastasijević (1987) conducted a study in order to determine how the evaluation criteria and scoring of all components of the entrance examination differentiate successful from unsuccessful candidates for the study of PE. The sample of respondents consisted of 84 male candidates, who participated in an entrance exam in school year 1981/82. Survey results were analyzed separately for successful sample (N=51) and unsuccessful (N=32) candidates, using ANOVA and MANOVA methods. Analysis of the results of the entrance examination has shown that the qualifying exam to check the specific requirements for entry (total points) most differentiates successful from unsuccessful candidates. The results suggest that the test of specific abilities, which refers to the assessment of hearing and sense of rhythm and movement of the respondents do not differentiate enough applicants. They point to the fact that the Seashore's test of musicality, as a whole, and in some segments, is not discriminative enough. The authors believe that it is necessary to conduct a detailed analysis of the specific part of the entrance exam, which is related to the evaluation of physical fitness and acquisition capabilities of sports techniques in a particular branch of sport and then corrected norms and procedure for passing this part of the entrance exam.

Popović, R., Stanković, Branković, & Popović, D. (1988) conducted a study in order to determine the extent to which the applied system of criteria for the entrance examination for physical education studies differentiate registered candidates (male), who were divided into three groups: successful and rejected candidates (home country, Yugoslav citizens) and candidates accepted (foreign country, Greece citizens). A total of 88 candidates were evaluated, who access the entrance exam in school year 1987/88. Results of the entrance examination were analyzed separately for each group. Variables for assessment criteria entrance examination system was defined like this: *General Criteria***;** *Specific criteria; Total Points Scored.* Survey results were analyzed with ANOVA and MANOV. The analysis of the results has been the ranking criteria that differentiate the most successful from unsuccessful candidates. Again was confirmed that the way to assess a sense of rhythm and movement do not significantly differentiate successful from unsuccessful candidates. Foreign citizens have achieved lower results compared to unsuccessful (rejected) home country candidates.

Opavsky, 1989 (after Popović et al., 1998) in his paper "Testing of the physical abilities of students of the Faculty of Physical Education" points that the claims of this study relate primarily to raise the issue of the entrance examination to the Physical Education, and of the particular part of the exam, which is related to the level of bio-motor abilities. The manner of their analysis is the same, almost, for four decades, although in professional circles emphasized the fact that the existing program entrance examination at the Faculty of PE, does not meet the requirements for which it was set. Basically, the entrance examination for professional school of physical education should include four elements: general medical examination; Intellectual-somatic connection; Success in secondary education (general and specific) and Level of physical fitness.

Popović, R., Dimova, Popović, D., & Damjanovska, 1989 (after Popović et al., 1998) conducted a study in order to compare the degree and direction of differences in morphological characteristics, motor skills and musicality, especially among selected PE students at the University of Skopje. The sample of respondents are 42 male, and 17 female students of the first year of study and research based on the results collected during entrance-exam in the 1986/97 study year. To assess the anthropomotoric status were applied 17 anthropometrical measures, and 10 motor tests. Musicality was estimated by the 6 tests for the assessment of general musical abilities (by Seashore's test of musical talent) and on the basis of results obtained in a separate part of the entrance examination of the Dances, expressed in points. Survey results were analyzed using ANOVA and MANOVA. The results indicate that the current group of respondents differ significantly in most

anthropometric measures applied, and in some motor skills, as was expected, but did not differ statistically significantly in musical ability, or in results obtained on a separate part of the entrance examination of the dances, which concerned assessing the sense of rhythm and movement of examined subjects.

The main objective of this study is the analysis of the entrance-exam enroll criteria, and attempt to determine whether the accepted system of criteria when selecting female candidates for the PE study, differentiated optimally admitted from rejected applicants.

METHODS

Sample of examinees

The sample was composed of all registered candidates (female) who joined the entrance-exam test in study year 1989/90. Entrance exam results were analyzed separately for the accepted-successful (n=15), and rejected (n=13) female candidates.

Sample of measuring instruments

1st system of criterion variables - qualification part of the entrance- examination:

OUPO-General candidate success in previous education (expressed numerically and can be achieved minimum 8 out of 20 points).

UGOP-The success of the group of certain subjects, which are of special importance for the study. As so were considered grades from Serbo-Croatian language and Biology (or Physics) in the final two classes of secondary education. Counted four grades that are described by the sum of the nominal values from 5, 4, 3 and 2, and are expressed as points (a total of minimum 8 out of 20 points).

UBRB-Total number of points from the previous education (provided by standards) excluding special conditions for registration and specific skills. According to this criterion, it is possible to achieve a minimum of 16, and a maximum of 40 points.

Success, which are candidates (female) achieved the qualification part of entrance-exam to study physical education is one of the important components of their ranking and admission to study physical education. This variable is also taken from the ranking list, made and approved after the entrance-exam and contains indicators which merge to form the overall success of previous education and grades earned in biology or physics and native language, in the final two years of high school (secondary education).

2nd system of criterion variables - classification part of the entrance examination:

Success, which has female candidates achieved in the qualifying part of the entrance examination, is one of the important components of their ranking and admission to study physical education. Recently, there is increasing concludes that the entrance exam, which is based on the indicators of success in individual sports disciplines, not say enough about the potential ability of candidates to study physical education. As has the method of the entrance examination, in ten-twenty years back, changed (without the detailed analysis of the former method of conducting entrance exams) with the aim of finding better indicators that will enable the assessment of real potential ability to study, it is useful to determine to what extent the present method for the evaluation of specific ability or "technique acquisition" was sufficiently selective in admissions to study physical education: Swimming - in the outdoor pool, 50 meters long, arbitrary style. It's possible to collect from 0-6 points; Handball - it is possible to collect up 0-4.5 points; Basketball - it is possible to collect up 0-4.5 points; Volleyball - it is possible to collect up 0-4.5 points; Rhythmic Gymnastics - it is possible to win collect up 0-4.5 points; Athletics - it is possible to collect up 0-6 points; Artistic gymnastics - it is possible to collect up 0-6 points; Rhythm - it is possible to collect up 0-4 points; SPEC - the total score on a specific part of the entrance examination, which refers to control certain physical abilities, as well as the ability to demonstrate some of the technical elements in different sports. Scoring is achieved on the basis of pre-determined criteria and prescribed norms. The ranking is conducted only for those candidates who collect minimum 11, out of 40 points; SCOR - total score, i.e. the sum of the points made by the predetermined criteria for overall success, the success of the group of subjects, and the success of a specific part of the entrance examination. To be entered into consideration when ranking, candidates must achieve a minimum 27 out of 80 points.

Statistical data processing

For the processing of the research results, the Univariate (ANOVA), and Multivariate Analysis of Variance (MANOVA), so as Kruskal-Wallis-test were applied. It should be emphasized that the interpretation of ANOVA only makes sense when "Willks-Lambda" is significant at least at the level of Q=.05.

RESULTS

The main objective of this study is to discuss ways of realization of entrance-exams from two different aspects. The first aspect is related to the evaluation of the entrance-exam results of the candidates for study of PE on the base of total points earned (on the qualification and classification part of an entrance-exam test), and the socond is related to the original results of the specific skills necessary to the PE study. In considering this issue, it was presumed that there exist statistically significant differences between group means of examinees in the entire system of selected variables.

If the results of the research confirm that there are significant differences between the groups of participants, should be to determine, which examined variables contribute the most to the samples of respondents differ significantly.

For data processing were applied appropriate statistical methods. Testing of mean differences of all variables applied to assess the results of the entrance exam success (ANOVA) between samples of candidates are estimated statistically significant differences. However, the interpretation of univariate analysis of variance only makes sense if, in general, there is a statistically significant difference in multidimensional space between groups of participants, or if the "Willk's Lambda" is significant at least at the level of Q=.05.

In the applied system of variables for estimating criteria of entrance-exam system, based on points earned, multivariate analysis (MANOVA) did not confirm the expected assumption that the two groups of participants significantly differ. The reason for this result is un-reasonable, perhaps, a small number of participants in the group studied, with a relatively large number of variables. Therefore, in solving these problems are using other analyzes, such as analysis of variance of ranks (Kruskal-Wallis test), which provides a better basis for the interpretation of results.

Summing up the results of the survey, and based on all the applied methods, it is possible to make the following statistical interpretation:

Assessing of Point System. To be based on a scoring system, got a one indication, all the results, which are candidates reached on the entrance-exam, were converted into points, on the basis of the principles of evaluation of both, better and weaker results than the norm, which was determined as a criterion for sufficiency results. However, it should be noted here that all the results that are weaker than the norm were evaluated with zero points, which could not be provided adequate evaluation of these results or better results than the norm. Scoring tests applied on the entrance-exam, has changed over the years, and have not been previously established, which is the best of them.

Table 1. Univariate significance of the between-group differences - Point-system

VARIABLES	GROUP- I	GROUP- II	t	p
OUPO	1751.73	1307.00	5.425	.000
UGOP	17.93	12.07	6.761	.000
OBRB	3545.06	2514.69	6.281	.000
PLIV	270.00	132.30	1.959	.061
RUKO	284.00	171.53	2.728	.011
KOSA	336.66	240.76	2.722	.011
ODBO	207.33	86.15	2.704	.012
ATLE	294.66	226.15	1.070	.291
RSGI	361.33	321.15	2.154	.047
SPGI	510.66	341.53	3.118	.008
RITP	290.00	169.23	3.378	.002
SPEC	2554.66	1688.84	3.957	.001
UREZ	6099.73	4079.69	7.894	.000

Table 2. Homogenity of Candidates belonging to certain groups

	Homogeneity of levels (n/m)	%
I – Group/Successful	12/15	80.000
II – Group/Unsuccessful	10/13	76.923

Table 3. Rank Analysis of variance (Kruskal-Wallis) for entrance-exam **Point-type** system

Variables	Hi	p
OUPO	13.4153	.0002
UGOP	17.3846	.0000
UBRB	15.1559	.0001
PLIV	3.0650	.0800
RUKO	5.0964	.0240
KOSA	5.4132	.0200
ODBO	4.8905	.0270
RSGI	4.9929	.0255
ATLE	1.0746	.2999
SPGI	5.9624	.0146
RITP	7.7692	.0053
SPEC	10.2527	.0014
UREZ	20.1779	.0000

DISCUSSION

Summing up the results of the survey, and based on all the applied methods, we can make the following statistical interpretation:

Among all applied variables to assess the success (using a point system) in the qualification part of the entrance examination (general criteria) to the samples differences most contribute the variables for the evaluation of the success of the group of subjects relevant to the study (UGOP), then the variable for the evaluation of the total number of points, collected on the base of criteria for assessing the success of previous education (UBRB) and at the end the variable for assessing the overall success of previous education (OUPO).

All of these variables for the evaluation of the success of previous education are numerically more pronounced in the group of successful female candidates.

Of the all examined variables applied for the assessment of the specific part of the entrance exam (classification part) that refers to the examination of specific motor abilities and preferences, as well as to the degree of adoption of certain sports techniques, to the differences of the sample of candidates contribute the most the following variables: SPEC - contains the ***total score*** on the entrance exam (Hi=10.25), followed by a variable RITP - assessing the ***sense of rhythm and movement*** (Hi=7.76), than SPGI, ***artistic gymnastics*** (Hi=5.96) at the level of (***p***=.005 to ***p***=.01), as well as variables KOSA, ***basketball*** (Hi=.41) RUKO, ***handball*** (Hi=5.09) RSGI, ***rhythmic gymnastics*** (Hi= 4.99), and variable ODBO, ***volleyball*** (Hi=4.89), all at the level of (***p***=.02). All of these variables to assess specific abilities were numerically more evident in the group of successful female candidates.

Variables to assess the success of the candidates in the test ATHLETICS (Hi=1.07) at the level of (***p***=.29), and SWIMMING (Hi=3.0) at the level of (***p***=.08), did not differ significantly these groups of examinees.

Candidates in the entrance-exam most differentiate the variable UREZ, ***total score*** (Hi=20:17) at the level of (***p***=.000). This was expected, since it contains points of all the items of the general criteria and specific part of the classification's exam. As such, it contains the most information about the psychosomatic status of candidates. According to standard criteria, candidates were able to achieve a minimum of 27, and a maximum of 80 points. Successful candidates are, on average, achieved 60.99 points, representing 76.24% percentage of the total possible points, while unsuccessful (rejected) candidates achieved 40.79 points, representing 50.99% percentage of the total possible points.

UGOP variable (the ***success of the group subjects*** of the special importance for the physical education study) is the second, most significant to

discrimination. It gives us an insight into the success of candidates who have achieved in previous education (the native language and physics or biology) in the last two years of high school (secondary education). According to this criterion, candidates were able to collect a minimum of 8, and a maximum of 20 points. Successful candidates are, on average, scored 17.93 points, representing 89.65% percentage of the possible points, while unsuccessful (rejected) candidates achieved 12.07 points, representing 60.35% percentage of the possible points.

UBRB variable is the third, most important for discrimination from the general criteria group. It is determined by ***general success***, which have candidates achieved in their previous education, as well as the success of the group of subjects relevant to the study. According to this criterion, it was possible to achieve a minimum of 16, and a maximum of 40 points. Successfull (admitted) candidates are, on average, collected 35.45 points, representing 88.62% percentage of the total possible points, while unsuccessful (rejected) candidates collected on average of 25.14 points, which is 62.85% percentage of the total possible points.

OUPO variable (***overall success*** in previous education) is the last, from the groups of common criteria for the importance of discrimination. It is determined by the overall success of the candidates achieved in their previous education in all grades of high school (secondary education). By this criterion, it is possible to achieve at least 8, and a maximum of 20 points. Successfull candidates are, on average, collected 17.51 points, making a total of 87.55% percentage of the possible points, while unsuccessful (rejected) candidates achieved 13.07 points, making a total of 65.35% percentage of the possible points.

The 1st (most discriminative) variable within the applied variables to assess specific skills on the entrance exam (***classification part***), except variable UREZ (results of all variables is RITP (Dances). Successful candidates are, on average, achieved 2.9 points out of 4, making a total of 72.5% percentage of points scored, while unsuccessful candidates achieved, on average, 1.69 points, making a total of 42.25% percentage of the possible points. The 2nd most discriminative variable is SPGI (Artistic Gymnastics). Successful candidates have achieved, on average, 5.1 points, out of 6, making a total of 85% percentage of achieved points, while the unsuccessful candidate (rejected) collected, on average, 3.41 points, that is, 56.83% percentage of the possible points.

The 3rd most discriminative variable is KOSA (Basketball). Successful candidates have achieved, on average, 3.36 points out of 4.5, for a total of 74.67% percentage of the possible points, while unsuccessful (rejected) candidates have achieved, on average, 2.4 points, making a total of 53.33% percentage of the possible points. The **4th** important variable for discrimination is RSGI (Rhythmic-Sports Gymnastics). Successful candidates are, on average, achieved 3.61 points, out of 4.5, for a total of 80.22% percentage of the possible points, while unsuccessful (rejected) candidates collected 3.21 points, making a total of 71.33% percentage of the possible points. The **5th** important variable for discrimination is RUKO (Handball). Successful candidates are, on average, scored 2.84 points out of 4.5, which is 63.11% percentage of the maximum points, while unsuccessful candidates (rejected), on average, achieved 1.71 points, which is 38% percentage of achieved points. The **6th** important variable for discrimination is ODBO (Volleyball). Successful candidates are, on average, scored 2.07 points out of 4.5, for a total of 46% of achieved points, while unsuccessful (rejected) candidate scored 0.86 points, making a total of 19.11% percentage of collected points.

Within the other variables applied to testing specific skills (in the *classification* part of the entrance examination) PLIV-Swimming and ATLE-Athletics is not sufficiently differentiate successful from unsuccessful candidate to study physical education.

On the Swimming skill test successful candidate achieved on average of 2.7 points out of 6, making a total of 45% percentage, while the unsuccessful candidate collected, on average, 1.32 points for a total of 22.% percentage of maximum.

On the test checks for specific skills in the athletic events, the successful candidate achieved on average 2.95 points out of 6, which is 49.17% percentage, while the unsuccessful candidates, on average, collected 2.03 points, for a total of 33.83% percentage of maximum.

Table 4. Univariate significance of the between groups differences (Points-system)

VARIABLES	F	p
OUPO	29.433	.000
UGOP	45.712	.000
OBRB	39.454	.000
PLIV	3.839	.061
RUKO	7.442	.011
KOSA	7.407	.011
ODBO	7.313	.012
RSGI	5.050	.033
ATLE	.778	.386
SPGI	10.857	.003
RITP	11.408	.002
SPEC	15.659	.001
UREZ	62.318	.000

Table 5. Multivariate Analysis of the between groups differences

	N	F	p
MANOVA	13	.000	1.000

Evaluation of the Original Scores. For this survey is important to note that is realized the parallel analysis of the original results as well, on the classification part of the entrance-exam, which allowed adequate comparison of the results achieved, as well as insight into the scores obtained on individual tests, or assignments (within a sports branch) which, depending on the way of testing some parts of the exam, it could be up 1-4. Analysis of the original results provided adequate indicators, in terms of the general assessment of achievements, with the successful and unsuccessful candidates, in some parts of the entrance examination, within particular variables to assess specific part of entrance-exam. However, applied MANOVA, again indicates that there are no statistically significant differences between accepted and rejected candidates (F= 1.368, ***p***=.352). The test applied in the frame of ANOVA (F-test and t-test), and Ranks analysis of variance (Kruskal-Wallis's test) indicated that among each specific discipline (to assess the extent of adoption of appropriate techniques), there are tests that do not sufficiently discriminate successful from unsuccessful candidates (RUK1; KOS3; ODB2; RSG2; ATL1, ATL2, ATL3; SPG2; RIT3). Analysis of the swimming test results (PLIV), in this way, suggests the fact that a better assessment of the objectivity has achieved by comparing the original results, but using the point system, which is similar in other disciplines as well. Hence the conclusion that it is necessary to find a different system for the evaluation of candidates, from so far-applied point-system, which does not differ significantly accepted from rejected applicants and does not provide sufficient guarantees of objectivity.

Table 6. ANOVA significance of difference between the levels of original Rohwert system

Variables	I-GROUP (MEAN)	II-GROUP (MEAN)	T-TEST	P
PLIV	591.66	776.53	2.251	.042
RUK1	19.13	15.46	1.718	.098
RUK2	8.53	4.00	3.512	.002
RUK3	4.46	2.92	2.507	.019
RUK4	4.33	2.76	2.598	.015
KOS1	11.33	8.07	2.953	.007
KOS2	7.80	4.84	2.946	.007
KOS3	14.53	11.15	1.589	.124
ODB1	9.86	4.00	3.156	.004
ODB2	5.06	2.53	1.932	.064
ODB3	6.40	2.07	2.324	.028
RSG1	32.66	28.46	2.116	.053
RSG2	39.60	35.76	1.607	.128
ATL1	155.80	158.61	.649	.522
ATL2	2024.33	2070.00	.298	.768
ATL3	733.73	682.92	1.255	.221
SPG1	25.46	17.38	2.621	.020
SPG2	25.60	20.23	1.649	.125
RIT1	8.00	4.46	2.682	.013
RIT2	13.66	6.69	2.779	.010
RIT3	7.33	5.76	1.072	.294

Table 7a. Univariate significance of differences within Basic-sports tests–scores

VARIABLES	F	p
ATL1 – Athletics (1)	.422	.522
ATL2– Athletics (2)	.089	.768
ATL3– Athletics (3)	1.574	.221
RSG1 – Rhythmic Gymnastics (1)	4.968	.035
RSG2 – Rhythmic Gymnastics (2)	2.803	.106
PLIV – Swimming	5.633	.025
SPG1 – Artistic Gymnastics (1)	7.597	.011
SPG2 – Artistic Gymnastics (2)	3.082	.091
RIT1 – Rhythm/Movement Sense (1)	7.192	.013
RIT2 – Rhythm/Movement Sense (2)	7.725	.010
RIT3 – Rhythm/Movement Sense (3)	1.149	.294

Table 7b. Univariate significance of differences within Specific Sports Game's tests–scores

VARIABLES	F	p
KOS1– Basketball (1)	8.718	**.007**
KOS2 – Basketball (2)	8.676	**.007**
KOS3 – Basketball (3)	2.524	.124
ODB1 – Volleyball (1)	9.960	**.004**
ODB2 – Volleyball (2)	3.731	.064
ODB3 – Volleyball (3)	5.401	**.028**
RUK1 – Handball (1)	2.952	.098
RUK2 – Handball (2)	12.333	**.002**
RUK3 – Handball (3)	6.284	**.019**
RUK4 – Handball (4)	6.748	**.015**

Table 8. MANOVA difference between the level of significance

	N	F	p
MANOVA	21	1.368	.352

Table 9. Rank Analysis of variance (Kruskal-Wallis's test)

Variables	Hi	p
PLIV	4.1093	.0426*
RUK1	2.6002	.1069
RUK2	8.5588	.0034 **
RUK3	4.9929	.0255*
RUK4	5.0964	.0240*
KOS1	5.3065	.0212*
KOS2	6.5381	.0106*
KOS3	2.0398	.1532
ODB1	8.1593	.0043**
ODB2	2.6750	.1019
ODB3	2.7509	.0972
RSG1	5.6297	.0177*
RSG2	1.5474	.2135
ATL1	.5434	.4610
ATL2	.1358	.7124
ATL3	1.0746	.2999
SPG1	4.8905	.0270*
SPG2	1.3802	.2401
RIT1	5.2009	.0226*
RIT2	6.3046	.0120*
RIT3	1.0273	.3108

CONCLUSIONS

- When assessing the ***Point System***, all the results, which are candidates reached on the entrance-exam, were converted into points, on the basis of the principles of evaluation of both, better and weaker results than the norm, which was determined as a criterion for sufficiency results.
- All the results that are weaker than the norm were evaluated with zero points, which could not be provided adequate evaluation of these results, or those results than are better of previously established norm.
- Testing of the mean differences of all variables (ANOVA) applied to assess the results of the entrance exam success between samples of examinees; statistically significant differences were established in some tests. However, the interpretation of this analysis only makes sense if, in general, there is a statistically significant difference in multidimensional space between sub-samples.
- In the applied system of variables for estimating criteria of entrance-exam system, based on points earned, multivariate analysis (MANOVA) did not confirm the expected assumption that the two groups of participants significantly differ.
- Among all applied variables to assess the success (using a point system) in the qualification part of the entrance examination (general criteria) to the samples differences most contribute the variables for the evaluation of the success of the group of subjects relevant to the study (UGOP), then the variable for the evaluation of the total number of points, collected on the base of criteria for assessing the success of previous education (UBRB) and at the end the variable for assessing the overall success of previous education (OUPO).
- Within the other variables applied to testing specific skills-SPEC (in the *classification* part of the entrance examination) PLIV-Swimming (p=.061), and ATLE-Field Athletics (p=.386) is not statistically significant differentiate successful from unsuccessful candidate to study physical education.
- Analysis of the ***Original scores*** provided adequate indicators, in terms of the general assessment of achievements, among the successful and unsuccessful candidates, in some parts of the entrance examination, within particular variables to assess specific part of entrance-exam.
- However, applied MANOVA, indicates that there are no statistically significant differences between accepted and rejected candidates (F=1.368, ***p***=.352).
- The tests applied in the frame of ANOVA (F-test and t-test), and Ranks analysis of variance (Kruskal-Wallis's test) indicated that among each specific discipline (to assess the extent of adoption of appropriate techniques), there are tests that do not sufficiently discriminate successful from unsuccessful candidates: RUK1 (p=.107); KOS3 (p=.153); ODB2 (p=.102); ODB3 (p=.097); RSG2 (p=.213); ATL1 (p=.461); ATL2 (p=.712); ATL3 (p=.299); SPG2 (p=.240); RIT3 (p=.311).
- Generally, it is possible to conclude that these two models of classification do not differentiate significantly successful and unsuccessful female applicants on the entrance-exam for the Physical Education study at University of Niš in Serbia, in the period last up 1970 to 1990.

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CRITICAL PERSPECTIVES OF THE OLYMPIC MOVEMENT IN MONTENEGRO

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SUMMARY

To be successful in determining route and range of the Montenegrin Olympic Movement, it is crucial to look beyond sport system itself and social aspects. It is clearly that through sport and social "frame", research would provide expected outcome in western hemisphere countries, but when it comes to society of Mediterranean influence (geographically), socialist principles (before) and market oriented concept of living (win no matter what), broader aspects should be taken into consideration, such as legal, political and economical.

Keywords: sport, Montenegrin Olympic movement, national strategy

SPORT AS A SUBSET OF SOCIETY: APPROPRIATE PARADIGM

Jan Boxill cites from Robert Simon a definition of sport that could be a good starting point for developing a paradigm for understanding how sport fits within the broader context of our society: (1) it is a freely chosen and voluntary activity; (2) it is governed by rules; (3) it is physically challenging; and (4) it involves a mutual challenge to achieve excellence.[1] So while this definition represents a good starting point for a deeper investigation, it is not sufficient as it does not consider other aspects which will be addressed in this paper. Later in the text, Jan Boxill quoted David Halbertsman:

"When most oarsmen talked about their perfect moments in a boat, they referred not so much to winning a race as to the feel of the boat, all eight oars in the water together, the synchronization almost perfect. In moments like that, the boat seemed to lift right out the water. Oarsmen called that the moment of swing…it allowed you to trust the other man in the boat. A boat did not have swing unless everyone was putting out in exact measure, and because of that, and only because of that, there was the possibility of true trust among oarsmen."[2]

Much earlier, in the "Republic", Plato emphasized that "there are two arts which I would say some god gave to mankind, music and gymnastic… not for soul and body incidentally, but for their harmonious adjustment."[3]

Remarks from above in some respect open a horizon to discuss about role of sports within a society. The question to follow is what values should be promoted by and through sport within sport institutions because these values should play a foundation of modern society?

CONSTELLATION OF OLYMPIC MOVEMENT IN YUGOSLAVIA AND POSITION OF MONTENEGRO WITHIN

After World War II, the development of sports in Yugoslavia was heavily supported and regulated by the state and this resulted in establishment of the country as a powerhouse in a number of team sports worldwide and school sport (education through sport from kindergarten to the university sport) in general terms. Yugoslav stakeholders at that time were fully aware of the situation in the global arena of international relations, which could be described by Orwell skepticism:

"I am always amazed when I hear people saying that sport creates goodwill between the nations, and

[1] Jan Boxill (2003). *The Moral Significance of Sport, Sport Ethics*. Malden: Blackwell Publishing Company, p. 1.

[2] David Halberstam (1985). *The Amateurs.* New York: William Morrow, p. 40.

[3] Plato, *The Republic*, book III, section 412.

that if only the common people of the world could meet one another at football or cricket, they would have no inclination to meet on the battlefield. Even if one didn't know from concrete examples (the 1936 Olympic Games, for instance), that international sporting contests lead to orgies of hatred, one could deduce it from general principles."[4]

Aron is probably more precise, stating that a football match is not simply an event pitting team against team; it is confrontation of nations through sports match (country).[5] Yugoslavia remained not aligned to either the US or USSR during the Cold War era, which allowed it to experiment with the best of both worlds in terms of sports development- the worker-athletes model (USSR) and the student-athlete model (USA).[6] The institutional support was granted to both models on all levels, including the educational system, the military, and public service). Back then, gender, racial, ethnicity, and religion was taken into account and inclusivity was sometimes excessive.[7] At the institutional level, the situation was slightly different as political background (commitments to the party) was a determining factor to be involved as a stakeholder in sports organization. Regardless of the high level of political involvement, Montenegro reaped the benefits of that development. In the spirit of Isocrates stated in Antidosis, the importance of training the minds as well (not only the body) of athletes in order to be prepared for completions:

"Are twin arts; parallel and complementary- by which their master prepare the mind to become more intelligent and the body become more serviceable, not separating sharply to kinds of education, but using similar methods of instruction, exercise, and other form of discipline. Watching over them and training them in this manner, both the teachers of gymnastic and the teachers of discourse are able to advance their pupils to a point where they are better men and where they are stronger in their thinking or in use of their bodies."[8]

A similar philosophical approach existed in former Yugoslavia at that time; participation in sports (physical education, professional and recreational) was well structured (organized from national to community level) and open to everyone with focus on educational, health and community development aspects.

Vulnerability of the Montenegrin Olympic Movement

During the 1991-2001, former Yugoslavia went through several transitions and civil wars and shortly speaking existence of large grey sector and black market, tycoons controlling big state companies, hyperinflation, state-controlled smuggling, over 25% of unemployment rate.[9] This had a devastating effect on the society as a whole, including the development of sports. The living standards plummeted with GDP growth went down 30% by 1993 and record low per capita 649.8$ in December same year.[10] Sport in Montenegro was a luxury not afforded to the majority of the population. The team sports (basketball, handball, volleyball, and waterpolo) continued to do well in various global competitions, though pervasive underinvestment and low economic development impacted both sports in the educational (drop certified coaches and physical education professors) and health sector (drop of psychologists and doctors of sports medicine).

Since 2006, Montenegro is an independent state experiencing a lack of institutional support for the growth of sports, including management, funding, personnel, and infrastructure.[11] Sport was seen only through the prism of professional sport and a results oriented philosophy. Internal political situation transmitted into sport, were stakeholders adjusted their focus on maximizing their private profit. State sport institutions (National Olympic Committee, Sports federations, and clubs) became property of

[4] George Orwell (1986). "The Sporting Spirit", in *I belong to the left: The Complete Works of George Orwell*, vol. XVII: 1945. Oxford, 1986, p. 441.

[5] Raymond Aron (2001). *Peace and War; A Theory of International Relations.* Zagreb: Golden Marketing.

[6] Well explained in Cristoph Bertling (2007). The Loss of Profit? "The Rise of Professionalism in the Olympic Movement and the Consequences for National Sport Systems". *Journal of Olympic History, 15*(2).

[7] Socialist principles introduced pragmatic plans to ensure equal representation of Yugoslav citizens no matter of religion, ethnical, class or any other differences,

[8] Isocrates, with an English translation done by George Nolin (1929*).* vol. 3. London and New York, vol. II, pp. 289, 291

[9] OSCE, (2005). *Policing the Economic Transition in Serbia,* Belgrade.

[10] http://www.tradingeconomics.com/serbia/gdp-per-capita

[11] http://www.upravazamladeisport.me/sports/biblioteka/nacionalni-program-razvoja-sporta

individuals who used state leverage to acquire power. By Gasset, the sportive instinct with joyous excess, rather than with labor: "Sportive activity seems to us the foremost and creative, the most exalted, serious, and important part of life, while labor ranks second as a derivative and precipitate. Nay more, life, properly speaking, resides in the first alone; the rest is relatively mechanic and a mere functioning."[12] Unfortunately, Montenegrin example of political and sports synthesis disable an opportunity to enjoy participating into sport (active or passive).

From utilitarianism philosophy to realism (neo-realism)

From professional sports, if it's possible to single out a certain sport (handball), the perception of general population is complemented by a sport stakeholder view and reflected in the Gasset's State and utility theory:

"The first house built by man is not a home for the family, still nonexistent, but a casino for a young man. Here they prepare for their expeditions and perform their rituals; here they indulge in chanting, drinking, and wild banquets. Whether we approve of it or not, the club is older than the family, the casino is older than the domestic hearth."[13]

Gasset argumentation carried out by utility theory is hardly sufficient to disclose Olympic movement in Montenegro and without welcoming broader clarifications would not provide an answer which could be a starting point to restore a sporting system or perception of it from 80s, having in mind overall socio-economical-political constellation in the country. The reality of the Olympic movement on the ground in Montenegro tends to be more in correlation with realism, but not one from medieval philosophy (such as Anselm of Canterbury), the one (political) still existing (evolving) from Thucydides through Machiavelli all the way to the structural perception of realism at Kenneth Waltz.[14] Realism, driven by self-interest, found a perfect soil (Montenegro), after crash of socialist country in period of transition (still ongoing process). Situation where you don't have a central authority, economic differences between citizens means fertile soil for entering private owners into state oriented sport institutions in order to increase their power (read influence) to the maximum.

Situation with no categorization of sports and no clear criteria for funding and overall support for sport, it's an open space for manipulation. One of the most obvious examples is constellation inside national sports federations. During socialist times, sports organization-clubs (founding members of national federations) were in the public ownership (not state). In the last decade, most of those clubs were privatized by individuals with little or no sport background. As an endgame, national sport federations nowadays are unity of individual clubs owners, very often neglecting basic legal obligation of sport statute's which is development of mass participation, promotion of education and healthy lifestyle through sport. Previously mentioned constellation within the Montenegrin Olympic Movement resulted in establishing NOC of Montenegro as union of all national sports federations working as central sports organization (umbrella) but without any instruments (commissions) to coordinate or to control legal obligations of federations.[15]

CONCLUSION

As the country was falling apart, bureaucratic institutions tended to remain as continuation of socialist rule with use of market oriented tool aspects in situation of transition in order to achieve power in a certain segments of society. Earnings, economic sanctions, wars, created insecure environment which had unforeseeable consequences on system of overall education (physical education). From organizational prospective (sports), type of privatization (non transparent one) used for turning sports organization from public to private ownership, put the whole sport system at danger of depending on individual good will for how sport was going to be run. Olympic movement is constantly under unsuccessful struggle to regain position from 80s, and to place sport as an important segment of education, health and community development.

[12] Jose Ortega y Gasset (1961). "The Sportive Origin of the State", in *History as a System: And Other Essays Toward a Philosophy of History*, translated by Helene Weyl, New York, pp. 18.

[13] *Ibid.,* p.29.

[14] For better understanding of the paragraph see also: Anselm of Canterbury, The Major Works, Oxford World Classics, edited by Brian Davies and Gill Evans, (1998), Thucydides, History of Peloponnesian War, Croatian Matica, Zagreb (2009). Machiavelli Niccolo, Il Principe, edited by L. Arthur Burd, Oxford (1891). Kenneth Waltz (1979). *Theory of International Politics*. Berkley: University of California.

[15] See Statute (only Montenegrin version) at: http://www.cokcg.org/onama/statut/;

Unsuccessfully, mainly because of athletes and sports stakeholders rushing into making profit without any significant strategic approach and the tardiness of state authorities to work on an overall national (country) strategy and position of the Olympic Movement within.

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OBJECTIVITY OF THE ASSESSMENT OF THE BASKETBALL ELEMENTS REALIZED IN CLASS OF SPORTS AND PHYSICAL EDUCATION – CASE STUDY

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SUMMARY

Increasing objectivity in sports and physical education can be achieved with the different organisation of evaluation, e.g. that colleague who also works in school attends evaluation. Another way of evaluation is to involve other students in evalution process, who are realising the required task at the highest level, i.e. in addition to teacher, to have two more students from that class or school, which would objectify the whole process. Of course it is necessary to previously develop assessment scales, which all the appreisers and students will be familiar with. Only so organised process can help to determine level of performed tehnique more realistically and giving the student more appropriate realistic grade. The aim of this work involves presenting a way of objectifying the assessment of basketball elements, realized in class of sports and physical education.

Keywords: physical education, basketball game, efficacy assessment

INTRODUCTION

In class of sports and physical education it is necessary to organise the assessment students work during the realization of curricula. The assessment is organised with intention of achieving insight into the individual as well as group progress of students. As the result of the assessment, a appropriate grade is given, which must be based on realistic grounds (Hadžikadunić & Mađarević, 2004; Cale & Harris, 2006). This work deals with one way of objectifying the assessment during the realization of motorical tasks (Cohen & Zach, 2013), because assessments must not represent the hindering factor for students development, which means that it should not be based on intuition or prejudices of pedagogues (Lux & McCullick, 2011). In order to eliminate the above, but also other hindering factors (Višnjić, Ilić, & Martinović, 2011), the assessment of the success during the tehnique performance of specific element should be standardized as much as possible. In order to achieve greater objectivity, levels of performing tehnique values could be pre-determined (Federal Ministry of Education, 1999) for students (specially for elementary school students, specially for high school students, specially for every sport) and based on this, the comparing with performed tehnique and grading will be done. Some recommendations for grading, which should unify the procedure of pedagogue, are already existing in form of principles during grading. That principles are synthesized according to the following (Najšteter, 1997): principle of systematicness (planned and ongoing during the school year), principle of individuality (there are certain anthropological differences among the students that need to be taken into account), principle of versatility (to include all contents realized in teaching process) and principle of reality (remove all prejudices and relationships with student from the assessment, and understand differences among students). The assessment of performed tehnique of the appropriate element is usually done by observing (Findak, 2001). To observation to be more objective, except pre-set scale for assessment, it is necessary to define aim and object of observation, the time in which some appearance will be observed, a way of organising the observation, a way of registration of data and methods with which we can eventually later analyze the obtained data. With this approach, the

observation can be objectified and the success assessment of students can be done in more realistic way (Jonsson & Svingby, 2007). Therefore, reasearch presented one of the possible ways to objectify the assessment of success, i.e. the assessment of the quality of performed tehnique, where examples of basketball elements were used. All students who were subjected to the assessment process, were familiar with criteria, determined by agreeing of three appraisers-judges coming from the field of sports and pyhsical education, to know what achievement they need to accomplish (Bowles, 2012). The independent appraiser – the judge, who also comes from teaching process of sports an physical education, was not familiar with the criteria and his assessment was made on basis of his own knowledge and experience gained in pratice (Sternfeld & Goldman-Rosas, 2012).

METHODS

Sample of examinees

The sample of examinees represents 100 male students, attending the first and second grade of vocational school (first and second grade) aged 15 and 16. There were no students with somatic damage. The subjects had an appropriate conditions for regular attendance in class of sports and physical and health education.

Samples of measuring instruments

Based on the above mentioned characteristics, as a sample of variables for the success assessment of performing basketball elements tehnique realized in class of sports and physical education of high school students, grades were taken from three appraisers – judges (judges: A, B, C) who were familiar with the criteria. Grades of independent appraiser – judge, who was directly realizing the curricula with all subjects (judge: I) were exluded as the variable whose reality was checked with this work.

Table 1. Description of basketball game elements

GAME	DESCRIPTION OF THE ELEMENT
BASKETBALL	Dribbling with running the lenght of at least 5 m, after which the student goes into two-step which ends jumping and shooting in manner taking the ball on or towards the hoop with hit.

During collecting data all of the students had the same working conditions, they regularly attended class of sports and physical educations and they attended classes when the testing tehniques were trained, which was determined in work book, under the attendance in class, which is led for all students. Hall in which the class was realized has dimensions 40m x 20m, temperature of the hall was continuously 20 degrees, and the brightness of the hall was also suitable for work. Students were dressed in equipment which enabled them to freely and without scrapel realize given tehniques of basketball elements. The student realized all the given elements with speed performance which personally fitted him (Horga, 2010) and the assessment of acquired tehniques made three appraisers – judges (judges: A, B, C) who made the criteria and were fully aware of the same (Black, Harrison, Lee, Marshall, & Wiliam, 2004), as from the independent appraiser – judge who directly realized class contents with all students (judge: I). Ranking of acquired knowledge of students is defined by scale of five grades (from 1 to 5). Grading is done exclusively with „full“ grades. Other grades were not allowed. Grade 5 is awarded for the highest and best level of performance, and grade 1 for the lowest, which is in consistent with differentiating of variables shown in Table 2. To homogenize the factors which affect the assessment of knowledge and acquisition of elements tehnique, judges: A, B and C have repeated the procedure, the process and criteria of grading before checking (Jarvis, 1999), while judge: I, graded

on basis of his own knowledge and experience gained in practice, i.e. he did not gave the grade based on criteria, but on basis of personal experience in teaching process and work with students (Schmidt & Wrisberg, 2000; Pease-Alvarez & Thompson, 2014). All of the appraisers – judges (A, B, C, I) have at least three years of working in teaching process as well as passed profesional exam for work in teaching process.

Table 2. Differentiation of variables (grades for basketball game elements)

GRADE	DESCRIPTION OF THE ELEMENT
Grade 1	Dropping the ball from hands during dribbling or any other phase of element realization, improper dribbling (double), improper two-step, too slow dribbling with the general impression of insecurity.
Grade 2	Too slow performance of the element (walking or improper running, „steps" – clumsiness between dribbling and movement) with stopping between running and two-step and, or, improper two-step (without longer then shorter step) regardless of eventually scoring.
Grade 3	Realization of element by jogging with proper transition from jogging to two-step with proper two-step, improperly performed laying or shoot performed in different way regardless of scoring with less insecurity during performance or eventually „dropping" the ball and continuing the realization of element after retaking the ball.
Grade 4	Realization of element by jogging with proper transition from jogging to two-step with properly performed two-step (longer then shorter step) with laying the ball towards or on the hoop, but without scoring with observing smal insecurity during the performing of element at any phase.
Grade 5	Realization of element by fast running or running at maximum speed, with proper transition from running to two-step with properly performed two-step with laying the ball on or towards the hoop with scoring, with present maximum security showed during the performance of element and complete control of the ball without any „insecurity" during the realization of whole element.

Statistical procedures

For data analysis were used: Decriptive statistical methods, Factor analysis, ANOVA.

RESULTS

During data analysis, insight in Table 3 and Figure 1 was primarily made, i.e. the distribution of grades that are rewarded to students from all judges (judges: A, B, C, I).

Table 3. Distribution of judges grades

GRADE	**Judge A** Frequency	**Judge B** Frequency	**Judge C** Frequency	**Judge I** Frequency
1	10	11	11	/
2	16	23	21	/
3	34	28	37	15
4	22	19	22	47
5	18	19	9	38
Total	**100**	**100**	**100**	**100**

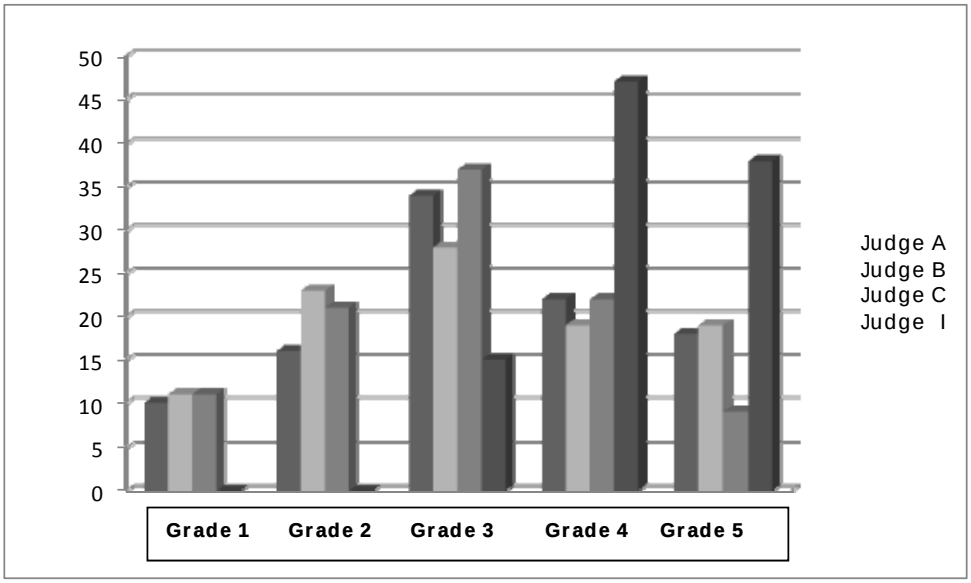

Figure 1. Distribution of judges grades

Looking at the distribution of grade from F to A, it can be concluded that all three appraisers – judges correctly applied grading scale from 1 to 5, considering that there is no wrong registrated formulated grade (e.g. above 5, or grades with a decimal number etc.). However, the structure of judge I grades, who independently graded students, obviously does not contain all grades of the scale (grade 1 or 2). Among the appraisers who made and applied criteria, the highest grades for performing the tehnique gave judges A and B, considering the number of grades ranked with mark A. Judge C gave most of the grades with mark 3 and 4. Summarizing the grades of judge I, we can say that no students was given a grade ranked with worst performance (1 or 2), for which there may be an indication that he did not evaluated as other judges (A, B, C) a way of movement, posture, hand coordination, leg coordination, general coordination, precision and leaving the impression of security when handling the ball (Honeyburne, 2006). In further work factor analysis was applied, to statistically determine whether there is a connection between the evaluation of judges who made the criteria and applied it and evaluation of the independent appraiser – judge. In that context Bartlett's Test was applied that checks the justification of the factor analysis.

Table 4. Factor analysis: KMO and Bartlett's Test

Kaiser -Meyer -Olkin Measure of Sampling Adequacy.	,695
Approx. Chi-Square	162,997
df	6
Sig.	,000

After Bartlett's Test showed the justification of factor analysis on level ,000 we approached analysis and extraction of the component that will represent an imaginary appraiser – judge, formed from the grades that are given by all appraisers – judges (A, B, C, I).

Table 5. Factor analysis: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,43	60,95	60,95	2,438	60,95	60,95

Explaining the variance can be done after separation of only one significant function, which was expected. Next table (Table 6) shows us the extraction of communality and the correlation of grades between all who participated in evaluation process. The correlation is observed by comparing to the imaginary judge who has been formed on basis of all grades. From the obtained results we can see clearly that the independent appraiser – judge I, who has not participated in agreeing of criteria, differed from the most isolated main component.

Table 6. Factor analysis: Communalities and Component Matrix

		Maks.	Extraction	Component
Judge	A	1,00	,786	,887
Judge	B	1,00	,864	,930
Judge	C	1,00	,692	,832
Judge	I	1,00	,096	,311

To check whether the obtained high correlations with isolated first main component match with correlations of grades between the appraisers – judges A, B, C and the independent appraiser – judge I, insight in obtained mutual correlation of grades is done (Cross-Correlation in Table 7). Data obtained in this way were not at a satisfactory level, considering that the highest level of correlation between judges is ,755 and the coefficients of mutual correlation which were expected are on level ,800. Regardless of this phenomenon, it is clearly visible that the grades of the independent judge I are not significantly correlated with the grades of others.

Table 7. Factor analysis: Cross-Correlation Matrix

Correlation		Judge A	Judge B	Judge C
Judge	A	1,000	1,000	1,000
Judge	B	,775		
Judge	C	,581	,707	
Judge	I	,228	,197	,074

Therefore, it should be approached to further appropriate evaluation, to confirm that the appraisers had adequate knowledge of characteristics that they judged, and did the procees of evaluation and setting of criteria for evaluation had an appropriate purpose. All new requests for verification were created as the result of suspicion caused by the relatively lower coefficients of connectivity in matrix of grade correlation. In further process, ANOVA analysis was applied for mutual evaluation of grades that judges A, B, C gave, as well as the assessment of significance of matching their grades with grades of the independent appraiser – judge (Tables 8 and 9).

After ANOVA analysis, looking at the significance which in this case, shows whether grades of competent judges are statistically significantly different, we can conclude that, analayzing the coefficient of significance for all judges, the significance difference between grades is not statistically determined, and it can be accepted that the judes had agreed criteria on appropriate level. In

order to perform an inspection of the assessment of judges (A, B, C) criteria separately and of independent judge (I), ANOVA analysis is also applied (Table 9).

Considering that in this case the significance of the differences between the grades is statistically significant and on the highest level with ,000, we can conclude that the evaluation performed by competent judges (A, B, C) was different from evaluation performed by an independent competent – judge I, who was not familiar with assessment criteria.

Table 8. ANOVA: Analysis of uniformity of judges grades A/B, A/C, B/C

Judges A/B	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1,500	1	,500	,324	,570
Within Groups	305,720	198	1,544		
Total	306,220	199			
Judges A/C					
Between Groups	3,125	1	3,125	2,308	,130
Within Groups	268,070	198	1,354		
Total	271,195	199			
Judges B/C					
Between Groups	1,125	1	1,125	,786	,376
Within Groups	283,470	198	1,432		
Total	284,595	199			

Table 9. ANOVA: Analysis of uniformity of grades A/I, B/I, C/I

Judges A/I	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	51,005	1	51,005	52,362	,000
Within Groups	192,870	198	,974		
Total	243,875	199			
Judges B/I					
Between Groups	61,605	1	61,605	58,567	,000
Within Groups	208,270	198	1,052		
Total	269,875	199			
Judges C/I					
Between Groups	79,380	1	79,380	92,118	,000
Within Groups	170,620	198	,862		
Total	250,000	199			

DISCUSSION

Considering that the process of assessing motorical knowledge, which is realized in class of sports and physical education, is exposed to certain criticisms and sometimes followed by dissatisfaction of the assessed (Magill & Anderson, 2007), a model, or way to objectify the same is presented in this work. The whole process is organized so that three competent appraisers – judges (A, B, C) made criteria for the assessment of certain elements of basketball game (Lund, 1992). With those assessment criteria the independent appraiser – judge (I) was not familiar, who works in teaching process of students used as sample objects and who also made the assessment. Students are also familiar with the

assessment criteria and grading (Nyberg & Larsson, 2014) because of the psychological preparation for tasks realization. Specifiying the discussion by insight into the results, we can conclude that the deviation in evaluation of students could be seen immediately when analyzing the distrubution of grades (Table 3 and Figure 1). More specifically, the appraiser – the judge I did not recorded any assessment for realization of treated elements with the lowest grades (marked with F or D), but his lowest grades were starting from D. In further process of the analysis, to determine specific statistical indicators, i.e. statistical significance of difference in the assessment, the grades of all appraisers – judges (A, B, C, I) were subjeted to factor analysis (Wolf & Rađo, 1998). KMO and Bartlett Test are also previously done. Because this test had significance level .000, good introduction for continuation of factor analysis was made. In futher process, first (in this research the only one) main component is isolated with characteristic root of 2.43 and explanation of variance from 60,95%. Considering the specificity of the research i.e. the factorization of grades for only one tehnique, it was expected to allocate only one significant function. It can be stated that the level of explanation of variance is highly above 60%, considering that the criteria of the judges before the evaluation was agreed. Further analyzing the relations of grades of the appraisers – judges (A, B, C, I) in relation to isolated main component, we can still see a positive result of agreeing because the grades from all three judges who participated in agreement of criteria (A, B, C) with high projections of extracted components which are related with the main component (Table 6), and it can be said that each of them knew what they were evaluating, i.e. what characteristic movements of students they should track (Camiré, Trudel, & Forneris, 2014). If judges were not familiar with criteria and grading, isolated coefficients of significance would have been significantly lower level, which can be assumed based on grades of the independent appraiser – judge who evaluated students based on his experience and in a way he usually does it (Noonan & Duncan, 2005). We must point put here that the judge B with the highest coefficients is related to the main component and it can be considered that it was the most clearly for him how to „apply the criteria“. To check the level of mutual uniformity of judges A, B, C evaluation, the cross-correlation was done. Coefficients obtained like this were on the level ,581 to ,775. Check of the uniformity of grades of the independent judge I (also in cross-correlation matrix) with grades of judges A, B, and C showed that the correlation coefficients were on very low cross-correlation level with grades of others (In Table 7: ,228 ,197 and ,074) so in the opinion of the author, there should be another check of uniformity of grades of all who participated in the process. The same is done using ANOVA analysis, and results show the indicator that the performance grades of the appraisers – judges A, B, and C are not statistically different, so we can accept that the judges knew and used already agreed criteria. The verification of agreement in the assessment and grades was performed (with the same ANOVA analysis in Table 9.) for each of the judges individually with the independent appraiser – judge I, which showed statistically significant difference between the assessment.

Based on the above it can be concluded that the judge I, not knowing the criteria, gave grades different from the other appraisers – judges grades. In the conclusion of the discussion we can conclude that in the previous consultations, i.e. training the quality levels of performing the tehnique, for which the appropriate grade should be given, had a positive impact on agreeing the criteria. Listed above positively affected on the final assessment and evaluation of judges, and the grade of the independent pedagogue, because he was not familiar with the criteria, does not match the performance of students, i.e. not realistic. We must emphasize here that the process of motorical learning usually involves learning based on large number of repetition and some sources say that it takes between 10000 and 15000 of repetitions to adopt one motorical skill (Schmidt & Wrisberg, 2000), for which is not suprising the presence of uniquenesses , i.e. certain percentage of unexplained variance which is in this case of research about 40%. This percentage of unexplained variance can be explained with hindering factor or requests for modification of the movement (Gentile, 2000), which is hard to explain on different way other than it is about specific adjustment of tehniques to the exerciser, but also the dose of subjectivity present in judges, regardless of the already agreed criteria. They also (Wersch, Trew, & Turner, 1992) concluded that the motivation of student for realization of curricula is inversely proportional to age, i.e. older children are not interested for class of sports and physical education as younger children, so this part can be interpreted as part of unexplained variance.

Summarizing all of the above, it can be concluded that the aim of work is accomplished, and the way of objectifying the assessment of basketball game elements is presented, realized in class of sports and physical education, and that achievement of appropriate positive results, (through grades of the judges who paritipated in making and applying the criteria) of that model applied in pratice, is determined. Organization and application of this way of work can be recommended for practical work in teaching process, which will help to objectify the assessment of students perfomances.

CONCLUSIONS

In class of sports and physical education, which is organized in schools, it is necessary to continuously mantain, systematic monitoring the work of students during the realization of curricula. Monitoring is organized with the intention of achieving a permanent insight in work of students, control of indvidual progress, and assign of specific grade for the performance.

In case of this research, the grade is needed to become a real feedback based on performed task, which student recieves, which significantly facilitates the development of motorical skills or helps the quality of performance or assessment.

This research presents a case study in which is checked and presented one of the ways to objectify the assessment of success. Other researchers have tried conducting an appropriate survey to determine feedback of students interest for class of sporsts and physical education, and objectifying the process like in this research would certainly have positive effects on students attitudes about class.

Although in this work, as an example, were used the elements of basketball game, for other curricula in class of sports and physical education it is posibble to establish the same model (if not for everything that contains curriculum, at least for the contents in class that will be realized in that school year). All of this of course requires a change in teachers approach to the organization of entire teaching process.

It is important that the appraisers as well as students, before the evaluation, inform about criteria for evalution, because it directly affects the quality of their assessment, although in the context, for realization of the given content, the age and interest of students must be taken into account.

Results of the uniformity of criteria are checked and confirmed with the descriptive analysis of the grades as well as the use of factor analysis in which the significance of KMO and Bartlett test on level .000, showed the justification of use. Later, positive relation of isolated main component with grades of appraisers A, B, and C is showed, in contrast to the non-existing relation with grades of the independent appraiser who judged based on his own personal knowledge and experience in teaching process.

Smaller dilemma about quality of uniformity of criteria was brought by cross-correlation matrix of grades of all judes, considering that non of the uniformity coefficients, it is meant on coefficients of judges who participated in making the assessment criteria, was not above ,800. Low coefficients in table of cross-correlation for the independent appraiser – judge I were expected.

In order to remove the appropriate uncertainties, the ANOVA analysis was used for judges A, B and C grades, as well for checking the relations of these three judges grades, individually, with grades of the independent judge I who did not know the criteria, but he made an assessment based on his experience from teaching process.

Obtained indicators confirmed mutual agreement of judges A, B and C grades (they participated in making of criteria and were familiar with the way of their use) as well as the disagreement of the independent appraiser – judge I grades with the grades of others, and also the performance of students.

So it can be concluded that the previous consultations had positive impact on agreement and use of criteria, and it is also important to conclude that the studenst were familiar with those criteria, which could mean to them that they will get an appropriate – more realistic evaluation and grade for the performance.

With this, the main goal of the research is achieved, and it has presented the way of objectifying the assessment of basketball game elements, realized in class of sports and physical education. The achieving of an appropriate positive results is determined in this model of work, i.e. an appropriate statistical agreement of judges grades who participated in making and applying the assessment criteria.

Recommendation of the work is that organization and use of this way of the assessment can be organized and applied during practical work in

teaching process, which will help objectifying the assessment of student performance.

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EFFECTS OF THE APLIED KINESIOLOGY TREATMENTS ON MOTORIC ABILITIES IN PRESCHOOL BOYS

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SUMMARY

Introduction: he aim of this research was to determine the effects of kinesiology activity application on motoric abilities of preschool boys during a school year.

Methods: Experimental group (45 boys, age 5.45±0.70 of decimal years) consisted of children that voluntarily participated in this experiment. The control group consisted of 42 boys (age 5.60±0.54) enrolled in preschool "Petar Pan" in Novi Sad. Experimental treatment, in a means of curriculum implementation of kinesiology activity in the experimental group of children (Sports School) was conducted twice a week for 60 minutes during the school year. Effects of applied treatments were analyzed in a final measurement using the multivariate and univariate analyzes of covariance.

Results: Applied treatment in the experimental group gave the best effects in tests within which in motor tasks dominated the manifestation of explosive power and flexibility of the lower extremities. In all examined variables were noticed differences in favor of experimental group, whereas the most pronounced differences occurred in the previously mentioned variables.

Conclusion: The obtained results indicate that there is a tendency of improvement in motoric functioning of children. Probably these improvements would have been even more pronounced if the kinesiology experimental treatment activity lasted longer. This all suggests the need for children to be involved in kinesiology activities and regular physical exercise during early childhood, but under the expert guidance of kinesiology experts in kindergartens, schools, sports clubs, as well as within the family.

Keywords: Sports School, basic elementary games, kindergarten

INTRODUCTION

In preschool age, one can influence a great deal on the establishment of motoric behavior in children. This is a baseline for further formation and development of motoric abilities and skills, for an active participation in sports activities and sports recreation, or simply to create an adequate capacity for various activities in older age (Bala, 2004).

The impact of motoric development is of crucial importance for overall development of preschool children. The most important, primary aspect for implementation of quality and well-organized physical activity programs for children must be its positive influence on their entire physical and mental health.

Research shows that participation in kinesiology activity contributes to better mental health, an increase in self-confidence, concentration, reducing the symptoms of depression, and possible stress and anxiety (Hutchinson, & Merger, 2004). One of the important tasks is to develop the awareness of the need for physical exercise. Some research showed that when children are included in the sports they love in early childhood, they become motorically active as young people and as adults (Weiss & Ebbeck, 1996).

Based on previous practical experience information in working with preschool children suggested that their motor skills can be better treated because they are qualitatively different than in school, and especially than in groups of older age children. Unfortunately, the problem of motor space regulation in preschool age has not been satisfactorily resolved yet (Bala, 2002).

The aim of this research was to determine the effects of kinesiology activity application on motoric abilities of preschool boys during a school year.

METHODS

Experimental treatment, in a means of curriculum implementation of kinesiology activity in the experimental group of children (Sports School) was conducted twice a week for 60 minutes during the school year. Applied kinesiology activities included: free form of exercise with and without the use of a variety equipment, preventive and corrective exercises to control body posture, basic apparatus exercises, specific exercises for the development of motor skills (especially coordination, balance, accuracy, all kinds of speed, agility, flexibility, as well as all kinds of strength and endurance), athletic events, sports games elements (football, handball, basketball, volleyball), tennis, martial arts elements (karate and wrestling), basic games (capture, group games, etc..), outdoors activities, stretching and aerobics.

Control treatment included a formal preschool curriculum (Kamenov & Slavković, 1997).

Subject sample

Experimental group (45 boys, age 5.45±0.70 of decimal years) consisted of children that voluntarily participated in this experiment. The control group consisted of 42 boys (age 5.60±0.54) enrolled in preschool "Petar Pan" in Novi Sad, that was randomly drawn from the group of preschools from Novi Sad territory. Parents gave their written consent for child's participation in experiment and measuring procedures. The experiment and appropriate measurements were approved by the Ministry of Education, Science and Technological Development of Republic of Serbia, Academic Council of the Faculty of Sport and Physical Education, University of Novi Sad and Preschool institution "Radosno detinjstvo" in Novi Sad.

Sample of measuring instruments

Chosen sample of motoric measuring instruments was the one that can provide optimal information regarding the structure of motoric abilities and motoric behavior of children (Bala, Stojanović, & Stojanović, 2007).

Statistical procedures

Results of motoric measurements were analyzed separately for each group of boys by calculating the basic statistics (mean and standard deviation) for each variable. Furthermore, quantitative differences between groups in relation to the experimental treatment were defined on the initial and final measurement using multivariate analysis of variance for the entire variables set, and univariate analysis of variance for each single variable.

Effects of applied treatments were analyzed in a final measurement using the multivariate and univariate analyzes of covariance. Covariates were motoric variables at the initial measurement, which served to neutralize the impact of differences between groups of boys in the initial measurement on the differences (treatment effect) at the final measurement. Homogeneity of variance and covariance matrix was analyzed with Box's test whereas for individual variables was analyzed by Levene's test.

Quantitative changes at the end of the experimental treatment were tested for each group separately using the *t*-test for dependent samples. Effect size analysis of variance and covariance is estimated by calculating the Eta square coefficient ($\eta 2$), using the following criteria: a negligible effect to 0.01; 0.01 - 0.06 is considered as small effect; 0.06 - 0.14 as medium effect, and over 0.14 as large effect (Cohen, 1988). To estimate the effect of changes in the *t*-test for paired samples Cohen's d coefficient was used, and the following evaluation scale is applied: a negligible effect to 0.20; 0.20 - 0.50 is considered as small effects; 0.50 - 0.80 as medium effect, and over 0.80 is considered as large effect.

RESULTS

At the initial measurement with Box's test of variance and covariance homogeneity matrix suggested that the assumption of homogeneity of the matrix is violated ($p = 0.000$). Therefore, it was concluded that variability is different in the motoric variables set for the experimental and control group of boys. Levene's test of equality of variance for each single variable indicated that this occurred mainly due to significant different variability in Standing on one foot and Arm movement speed variables.

In most observed variables subjects of the experimental group achieved better results than the control group (Table 1). These differences were not

large but they were systematically in favor of the experimental group, which led to the fact of small individual effects of differences between the groups, but the overall differences effects to be statistically significant. Applied variables set explained 21.1% of the differences between the analyzed groups. Separately, only with Standing on one foot variable appeared statistically significant differences between the analyzed groups.

Table 1. Differences in motoric variables in initial measurement for boys

VARIABLE	E (N=45)		C (N=42)		f	p	η^2
	M	SD	M	SD			
Running 20m (0.1 s)	52.82	6.41	55.48	6.40	3.73	0.06	0.04
Polygon backwards (0.1 s)	267.62	85.63	271.55	93.41	0.04	0.84	0.00
Hand taping (freq.)	17.38	4.34	15.97	4.36	2.26	0.14	0.03
Seated bend (cm)	35.73	6.34	34.44	6.92	0.83	0.36	0.01
Standing long jump (cm)	115.22	20.97	113.14	18.62	0.24	0.63	0.01
Pull-up endurance (0.1 s)	120.44	99.88	100.71	95.81	0.88	0.35	0.01
Trunk sit-ups (freq.)	21.22	8.29	23.10	13.61	0.62	0.43	0.01
Dart (point)	10.09	7.41	11.15	7.03	0.46	0.49	0.01
Standing on one foot (0.1 s)	190.09	154.91	313.81	383.88	3.98	**0.05**	0.05
Arm movement speed (0.001 s)	700.07	135.79	677.46	81.81	0.86	0.35	0.01
	F = 2.035 P = 0.041 H^2 = 0.211						

Legend: E- Experimental group, **C –** control group; **M** – Mean; **SD** - Standard Deviation; **F** – F-Distribution (for variable set); **p** – the level of significance for F; **f** – F-Distribution (for single variable); **p** – the level of significance for f; **H^2** –variable set effect on group discrimination; **η^2** –single variable effect on group discrimination.

At the final measurement (Table 2) results showed that there is statistically significant difference between the experimental and control group. Analyzed motoric variable set explained 30% of the difference between these groups, which is presumed as high impact of the obtained difference according to the Cohen criteria (Cohen, 1988). Greatest contribution to the established differences gave *Standing long jump, Seated bend* and *Running 20m* variables. The effect of changes is moderately high for all three variables; however, statistically significant difference is determined in favor of experimental group. It is noticeable appearance of differences in mean values for other variables in favor of experimental group, but these differences and effects are not statistically significant.

Analysis of differences between experimental and control group was done in the final measurement with neutralizing differences from the initial measurement (Table 3) in order to determine effects of changes after applied kinesiology treatment. After differences partialisation between groups in the initial measurement, final measurements showed statistically significant difference with overall effect of 29.4%. The largest changes occurred in *Running 20m, Seated bend* and *Standing long jump*.

Applied kinesiology treatment gave the best effects in variables mentioned above for experimental group. These tests of motoric tasks are dominated by the manifestation of explosive power and flexibility of the lower extremities. Differences were found in all variables tested in favor of experimental group; however, most pronounced differences occurred in previously mentioned variables.

Table 2. Differences in motoric variables in final measurement for boys

VARIABLE	E (N=45)		C (N=42)		f	p	η^2
	M	SD	M	SD			
Running 20m (0.1 s)	50.02	4.96	55.05	7.20	14.54	**0.00**	0.15
Polygon backwards (0.1 s)	227.36	75.84	245.81	74.61	1.31	0.26	0.02
Hand taping (freq.)	18.07	3.88	17.86	3.08	0.08	0.78	0.00
Seated bend (cm)	39.24	6.74	33.79	8.16	11.64	**0.00**	0.12
Standing long jump (cm)	129.56	25.84	114.24	18.46	10.00	**0.00**	0.11
Pull-up endurance (0.1 s)	132.93	150.89	99.64	79.54	1.62	0.21	0.02
Trunk sit-ups (freq.)	21.98	10.02	22.17	9.59	0.01	0.93	0.00
Dart (point)	12.50	9.79	11.55	6.73	0.27	0.60	0.00
Standing on one foot (0.1 s)	838.60	748.19	784.83	607.87	0.13	0.72	0.00
Arm movement speed (0.001 s)	602.22	66.34	607.34	53.58	0.16	0.69	0.00
	F = 3.296 P = **0.001** H^2 = 0.303						

Legend: E- Experimental group, **C –** control group; **M** – Mean; **SD** - Standard Deviation; **F** – F-Distribution (for variable set); **p** – the level of significance for F; **f** – F-Distribution (for single variable); **p** – the level of significance for f; **H^2** –variable set effect on group discrimination; **η^2** –single variable effect on group discrimination.

Table 3. Effects of kinesiology treatment on motoric abilities in boys

VARIABLE	E		C		f	p	η^2
	M*	SD	M*	SD			
Running 20m (0.1 s)	50.02	4.95	55.05	7.20	8.95	**0.00**	0.11
Polygon backwards (0.1 s)	227.36	75.84	245.81	74.61	0.00	0.95	0.00
Hand taping (freq.)	18.07	3.87	17.86	3.08	1.60	0.21	0.02
Seated bend (cm)	39.24	6.74	33.79	8.16	9.39	**0.00**	0.11
Standing long jump (cm)	129.56	25.84	114.24	18.46	11.01	**0.00**	0.13
Pull-up endurance (0.1 s)	132.93	150.89	99.64	79.54	2.30	0.13	0.03
Trunk sit-ups (freq.)	21.98	10.02	22.17	9.59	0.00	0.99	0.00
Dart (point)	12.50	9.79	11.55	6.73	0.15	0.70	0.00
Standing on one foot (0.1 s)	838.60	748.19	784.83	607.87	0.01	0.92	0.00
Arm movement speed (0.001 s)	602.22	66.34	684.96	66.29	0.10	0.75	0.00
	F = 2.743 P = **0.007** H^2 = 0.294						

Legend: E- Experimental group, **C –** control group; **M*** – adjusted Mean (after covariates partialisation); **SD** - Standard Deviation; **F** – F-Distribution (for variable set); **p** – the level of significance for F; **f** – F-Distribution (for single variable); **p** – the level of significance for f; **H^2** –variable set effect on group discrimination; **η^2** –single variable effect on group discrimination.

In addition to statistically significant differences that were determined in favor of the experimental group after applied kinesiology treatment, quantitative changes that have occurred within each of the analyzed group of boys were tested using the *t*-test for paired samples.

In almost all tested variables changes were statistically different in favor of final measurement for the experimental group. Only within following variables (*Hand taping, Pull-up endurance, Trunk sit-ups and Dart*) during applied treatment did not cause statistically significant changes, although changes that occurred were with positive direction. Large effect of changes were found in variables *Standing on one foot* and *Arm movement speed*, whereas in variables *Standing long jump, Seated bend, Polygon backwards* and *Running 20m* changes have shown medium high effect. For other variables the effects of changes were minor.

DISCUSSION

Effects of the experimental treatment were determined based on the results of multivariate and univariate analysis of covariance, which showed the level of significance for improving motoric functioning in children. This improvement was determined based on the final measurement with neutralizing the impact of differences recorded between the groups on initial testing. This was done for both in overall variables set as well as in every single variable in relation to both groups of children.

Results indicate that there has been a statistically significant improving effect in the overall system of

variables, where values of all variables in experimental group have contributed. At the individual level, the largest changes were obtained in the variables *Running 20m*, *Seated bend* and *Standing long jump*. Applied kinesiology treatment gave the best effects in variables mentioned above for experimental group. These tests of motoric tasks are dominated by the manifestation of explosive power and flexibility of the lower extremities. Differences in favor of experimental group were determined in all variables.

The value of practicing kinesiology activity and physical exercise in childhood, especially in preschools, contributes to children's better readiness for school. Bala, Krneta and Katić (2010) investigated the effects of kindergarten time attending on readiness for school and motor skills of preschool children in Novi Sad. Research has shown that the overall education and motor activity in preschool significantly contributes to school readiness and improve motor skills in children. The best results have been observed in children who had attended preschool longest, and weakest results were found in those children who attended preschool only one year before starting school.

CONCLUSION

The obtained results indicate that there is a tendency of improvement in motoric functioning of children. Probably these improvements would have been even more pronounced if the kinesiology experimental treatment activity lasted longer. This all suggests the need for children to be involved in kinesiology activities and regular physical exercise during early childhood, but under the expert guidance of kinesiology experts in kindergartens, schools, sports clubs, as well as within the family.

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INFLUENCE OF GYMNASTIC EXERCISE ON THE DEVELOPMENT OF SPEED IN YOUNG SCHOOL GIRLS

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SUMMARY

Introduction: By different moving activities, learning about their body and its motor skills, a child develops its motor skills, acquires different motor skills and habits and develops motor activities. In this work, the subject of the research is just one segment of the anthropological area which refers to the appearance of appropriate motor abilities-speed. The research involved a total sample of 212 girls from the third and fourth grade of elementary school.

Methods: The subjects were classified in three experimental and one control groups. The experimental groups were practicing according to planning instruction where the artistic, rhythmic and developmental gymnastics had the primary part. The control group of 48 students was practising according to official instructional plan and program for P.E. of the Republic of Serbia. At the beginning of the academic year, initial (first) measurement was performed, followed by experimental final (second) measurement at the end of experiment. Research data was processed using SPSS standard statistics procedure. The multi-variant procedures were used in this research ant those were: the multi-variant analysis of the variable MANCOVA I MANOVA. Also, the mono-variant procedures were used and those were: the variable analysis ANCOVA, ANOVA and the interval of entrust.

Results: During the procedure of analysing the final state, by the application of multivariate analysis (MANCOVA), it is determined that the analysed groups of female pupils (three experimental and one control group) mutually statistically significantly differ in speed ablilities and that there is a clearly defined line among the experimental and the control groups of the examinees. It means that even after the neutralization of the differences in the initial measuring, among the analysed groups, in the final measuring, there is a significant difference, i.e. there is a significant difference in the efficacy of the experimental programs on the transformation of the examined motor space of speed.

Conclusion: Considering the difference of the influence of treatments, it can be pointed out that the experimental programs, with all its characteristics, widely contributed to all its segments to the improvement of speed.

Keywords: Gymnastics Training Process, Speed Developing, Young School Girls

INTRODUCTION

It is extremely significant to emphasize that physical education should be considered a mean by which we want to form a child`s personality. Without our knowledge about the influence of means of physical education on pupils, we cannot know how much we have achieved given goals. Also, it is necessary to know the value of means which are required for the achievement of a given goal so to choose those which are the most appropriate and the most efficient for the realization of the results, which we define as formation of psychophysically healthy, capable and happy child.

Previous experience shows and confirms that school physical education does not achieve the level which coresponds abilities, wishes and abilities of pupils, so it is asserted that school physical education insufficiently influences physical abilities of pupils and that results they achieve are not satisfactory (Milenkovic, 2002).

If it is wanted to more signifficantly influence the anthropologic status of young school children, it is necessary to choose the means for physical exercise of general character and to use them with

signifficantly higher intensity than usually. In other words, most of the principles and methods of sports training should be built in physical education and adapt them to young school childen, influencing their developmental motorics, i.e. their motoric behaviour, and thus, other anthropologic dimensions (Bala, 1981).

Such beliefs have been the basis for this research, which intention has been to signifficantly intensify the influence on the anthropologic status by enrichening the lessons with elements of rhythmic, artistic and developmental gymnastics as means in teaching of physical education on regular physical education lessons with female pupils of third and fourth grade of elementary school.

In the system of physical education, under the term gymnastics, we consider an aspect of body exercise which is directed towards the solution of the basic biological and helath and hygiene assignments, in order to make bases which are necessary to a human being for everyday life and other activities. According to the psychological classification of Kodym (Kodym, 1978), the following are considered the sports of aesthetic-coordination character: rhythmic gymnastics, artistic gymnastics, figure skating, highboard diving, synchronized swimming, sport dance, ballet on snow (free styling), aerobic gymnastics, acrobatic rock-n-roll, jumps on the elastic table, culturistics, fitness, artistic acrobatics etc.

Developmental gymnaatics is based on studying and development of fundamental motor skills, i.e. motor behaviour, through studying the basic gymnastic positions, elements and skills through natural forms of movement and game in the athmosphere which is not competitive. By various moving activities, getting to know their body and its motor skills, a child develops and improves its motor skills, aquires different motor skills and habits and develops motor abilities (Aleksic, 2010).

Artistic gymnastics is complex and extremely demanding discipline, because it consists of four different competitive disciplines: overshoot, assymetric bars, beam and ground. Because of the numerous different elements of the technique which gymnasts have to master in order to satisfy the demands which are prescribed by the International Federaion of Gymnastics (FIG), gymnasts have to dispose of great physical strength. The essence of the gymnastic exercises is the efficient body manipulation on the equipment for physical trainig (Vranekovic et al., 2003), so the physical preparation of extreme quality is necessary.

Rhythmic gymnastics also represents a form of basic gymnastics. Natural forms of movement are the basic starting point in all moving activities within rhytmic gymnastics. The goals of rhythmic gymnastics are exercising the hearing, sensitivity on sounds and tones, rhythm and melody changes, exercises oriented towards the development of concentration, memory and attention, exercises of inhibition, in terms of constant caution and readiness of the reaction on an impulse, exercises of coordination, improvisation and music-rhythmic exercises (rhythm, tempo, dynamics, tact, expression).

The significance of the internal and external factors is different even in the development of motor abilities. Some motor abilities, more or less, depend on genetic predispositions. The inheritance is important for the expression of the latent time of motor reaction, then the speed of certain movements, where that influence is equally dependent on the internal and external factors and frequences of movement, which is strictly dependent on external factors.

In phenomenologic competition of the motor space structure, almost in the whole world, researchers defined certain factors of action type – strength, speed, flexibility, balance and precision.

The factor of speed, as a physical characteristic, according to Zaciorski (1975) represents an ability of a human being to make movements for as short time as possible under the given conditions.

The conduction of exercises in artistic and rhythmic gymnastics, when we speak about motor skills, has its specificities. The experimental treatment considered the application of general and specific elements of artistic, rhythmic and developmental gymnastics. It means that the accent has been put on the improvement of almost all the motor characteristics, and especially coordination, flexibility and all kinds of strength, with the accent on the explosive strength, because of the specific demands which these kinds of sport have. From that reason, it will be shortly explained which these specificities connected to motor abilities in conduting exercises in artistic and rhythmic gymnastics are. In artistic gymnastics, what is more desirable is the speed of the unique movement and the speed of the latent neural muscular reaction, while the speed of frequency of movement in some extremities is less desirable. Motor abilities,

especially in the phase of the biological development in which the examinees from this research are, can be influenced although the coefficients of inheritance in certain activities are very high. And speed is the motor ability with the greatest coefficient of inheritance 0.95. All motor abilities with high coefficient of inheritance are necessary to be developed at an early age, so the examinees from this research are compatible for the age when there is the best opportunity to influence the development of certain motor abilities.

Aleksic, Lilic, Karalejic, Stankovic and Mekic (2011) conducted a research on a sample of 99 young school boys about the influence of experimetal program of basketball on transformation of motor space of speed. The research has lasted for 36 weeks, the results have been processed by the statistical program SPSS and they have showed that there are significant changes in improvement of speed in experimental group in relation to the control group.

Aleksic, Stankovic, Milenkovic and Lilic (2013), for the needs of this research, examined totally 99 third and fourth grade female pupils from two elementary schools in Nis. The female pupils from the experimental group (51) have realized the teaching program with the application of elements of rhythmic gymnastics in the teaching of physical education. The female pupils from the control group (48) have realized the actual teaching program for physical education of the Republik of Serbia. At the beginnig of the school year, the initial (first) measuring was conducted, and at the end of the experiment, the final (second) measuring was conducted, and after that, the basic statistic data were processed. In this research, multivariant procedures MANCOVA and MANOVA have been used, and from univariant procedures ANCOVA, ANOVA and the interval of trust on the difference of corrected means have been applied. Bearing in mind the influence of the experimental treatment, it can be emphasized that the experimental program, with all its characteristics, conributed to the improvement of speed very much.

The subject of this research is studying the effects of the suggested experimental teaching program for physical education, in duration of one school year, in which the elements of artistic, rhythmic and developmental gymnastics, as means of physical education teaching, have primary role in transformation of one of the segments of anthropologic space which relates to the expression of certain motor abilities, i.e. speed of young female pupils of elementary schools in Nis. The search for adequate contents for physical education teaching which will make possible higher efficacy of school physical education, i.e. optimalization of work in this educational area is the basic problem of this research.

When determining the general subject of the research (What to explore?), it is necessary to approach the goal of a research. In that sense, we have defined the goal of the research in the following way:

To determine the efficacy of the specially programed physical education teaching (with the accent on artistic, rhythmic and developmental gymnastics) on the transformation of some anthropologic characteristics (motor abilities - brone) of young female pupils during the period of one school year.

METHOD

Sample of examine

The population from which the sample of examinees for the research has been taken is defined as the population of young school female pupils, 9-10 years of age.

According to the goal of the research, the sample of minimal 212 examinees has been suggested, divided into four subsamples (three experimental and one control group), and which is relatively optimal for the planned research to be acceptable.

The research has been conducted with female pupils of the third and fourth grade of elementary schools in Nis, „Bubanjski heroji“, „Vozd Karadjordje“ and „Radoje Domanovic“.

The examinees who form the sample have to fulfill the following condition:

- tor regularly attend physical education lessons.

Sample of variables

The evaluation of motor abilities, i.e. speed, significant for this measuring program, has been conducted by the following measuring instruments:

1. Taping by hand - MTAR
2. Taping by foot - MTAN
3. Bend-rotation-touch - MPZD

Strating with the results from the previous research from the area of motor abilities, which have been gained by: Kurelic, Stojanovic, Hosek, Momirovic, Gredelj, Metikoc, Sturm and others, a block of parametres has been chosen to which a

special procedure for evaluation of their metric characteristics would not be applied. The mentioned authors evaluated metric characteristics in most of the applied parametres by experimental procedures and it has been done on samples of examinees from Yugoslav population.

Strating with the assumption that modern physical education teaching does not contribute enough to the adequate transformation of anthropologic dimensions of female pupils, a research of longitudinal character and of duration of 36 weeks (one school year) has been conducted and according to which, exercising twice a week for 45 minutes has been conducted. That is, two thirds of the estimated number of lessons for the conduction of physical education teaching, according to the current Teaching plan and program for elementary school education, which has been enriched by implementing the elements of artistic gymnastics, rhythmic gymnastics and developmental gymnastics, so that those lessons look like sports trainings.

The first experimental group has been made of female pupils of elementay school „Bubanjski heroji“ in Nis, with the experimental program in physical education teaching implenented with with elements of artistic gymnastics.

The second experimental group has been made of female pupils of elementay school „Vozd Karadjordje“ in Nis, with the experimental program in physical education teaching implenented with with elements of rhythmic gymnastics.

The third experimental group has been made of female pupils of elementay school „Radoje Domanovic“ in Nis, with the experimental program in physical education teaching implenented with with elements of developmental gymnastics.

The fourth experimental group, made of female pupils of elementay school „Bubanjski heroji“ in Nis (five classes of the third and fourth grade), represent the control group, i.e. they do not have experimental program but attend regular physical education teaching lessons according to the program of the Republic of Serbia.

Before the beginning of the experiment, the initial measuring of certain segments of anthropologic space has been conducted, and they have been monitored during the experiment in all the subjects of the experimental and the control group. The final measuring of the relevant segments of anthropologic space has been conducted at the end of the school year, after the experimental treatment.

The teaching contents of the experimental program includes elements of movment and physical activity which have basically been included by the Teaching plan and program for the third and fourth grade of elementary schools with the special accent on the general and specific elements of artistic, rhythmic and developmental gymnastics, and on the higher intensity during the activity, which has been more like a sports training than classic physical education lesson.

During the experiment (for all the three experimental groups) activities of general physical preparation have been applied, and they include:

-exercises of speed, strength, coordination, flexibility, stamina and balance

-of the equipment for artistic gymnastics, skip, assymetric bars, beam and parter have been used, and of requisites, skipping rope and ball have been used for rhythmic gymnastics and sticks and hoops for developmental gymnastics.

Data processing

For all the variables which have been the subject of the research, basic descriptive statistic parametres have been established:

- arithmetic mean (SR. VR.);
- standard deviation (ST. DEV);
- coefficient of variation (KO. VAR.%) and interval of trust;
- limits of scope within which there are the values of minimum (MIN) and maximum (MAX) results;
- Skjunis, Kurtosis;
- and Kolmogorov-Smirnoff test of normal division.

In this research, multivariant procedures MANOVA and MANOCOVA have been applied, and of univariant procedures ANOVA and ANOCOVA and interval of trust on the difference of the corrected means.

RESULTS

Table 1 Central and disperse parameters and normality of distribution of motoric variables speed

	$\overline{X}$	SD	MIN	MAX	KV %	SKEW	KURT	p
MTAR/ I group	23.49	2.53	16.00	28.00	10.76	-.44	.23	.996
MTAN/ I group	28.97	3.53	18.10	36.00	12.18	-.78	1.34	.844
MPZD/ I group	14.80	1.87	10.00	19.00	12.66	.01	.23	.394
MTAR/ II group	22.61	3.24	14.00	28.00	14.32	-.66	.30	.746
MTAN/ II group	29.08	3.07	19.00	34.00	10.56	-1.03	1.30	.513
MPZD/ II group	14.41	1.43	12.00	18.00	9.93	.28	-.21	1.00
MTAR/ III group	21.83	4.11	16.00	31.00	18.83	.50	-.76	.973
MTAN/ III group	28.06	3.95	21.00	35.00	14.08	.01	-.91	.999
MPZD/ III group	13.61	2.48	10.00	19.00	18.19	.63	-.54	.791
MTAR/ control	21.54	3.38	16.00	29.00	15.68	.15	-1.00	.861
MTAN/ control	27.54	3.78	21.00	35.00	13.71	.26	-.67	.994
MPZD/ control	14.02	2.39	10.00	19.00	17.06	.38	-.63	.888

Table 2 Significance of differences among all the groups of examinees in relation to the initial measuring of motor abilities of speed

	n	F	p
MANOVA	3	4.795	.000

During the procedure of analysing the initial state, by the application of multivariant analysis of variance (MANOVA), it is determined that the analyzed groups of examinees (three experimental and one control group) mutually statistically significantly differ in motor ablilities and that there is a clearly defined line among the examinees.

Table 3 Significance of differences among all the groups of examinees in relation to the single variables of motor space of speed in the initial measuring

ANOVA	F	p
mtar	9.982	.000
mtan	7.701	.000
mpzd	2.770	.042

According to the analysis ANOVA (table 2), it can be seen that there are statistically significant differences in two of three variables of motor space of speed, by which the existance of differences among the examined groups before the start of the experimental program is confirmed.

Table 4. Significance of differences among all the groups of examinees in relation to the final measuring of speed

	n	F	p
MANCOVA	3	4.571	.000

During the procedure of analysing the final state, by the application of multivariant analysis (MANCOVA), it is determined that the analysed groups of female pupils (three experimental and one control group) mutually statistically significantly differ in speed ablilities and that there is a clearly defined line among the experimental and the control groups of the examinees. It means that even after the neutralization of the differences in the initial measuring, among the analysed groups, in the final measuring, there is a significant difference, i.e. there is a significant difference in the efficacy of the experimental programes on the transformation of the examined motor space of speed.

Table 5. Significance of differences among all the groups of examinees in relation to the single variables of speed space in the final measuring

ANCOVA	F	p
MTAR	4.258	.006
MTAN	6.573	.000
MPZD	3.385	.019

According to the analysis of the covariance (ANCOVA), a statistically significant difference among the examinees of the experimental and control groups in all the variables for the evaluation of speed is cofirmed.

Table 6. Significance of the difference among the experimental groups and the control group in relation to the interval of trust of corrected means of the examinees in speed measuring – final

groups		variable	corrected means		interval of trust	
I experim.	control	MTAR	22.18	21.99	-.49	.86
I experim.	control	MTAN	27.80	28.14	-1.07	.39
I experim.	control	MPZD	14.27	14.15	.00	.24
II experim	control	MTAR	22.44	21.99	-.23	1.11
II experim	control	MTAN	28.73	28.14	-.15	1.32
II experim	control	MPZD	14.33	14.15	.06	.30
III experi	control	MTAR	23.02	21.99	.37	1.69
III experi	control	MTAN	29.12	28.14	.25	1.69
III experi	control	MPZD	14.16	14.15	-.11	.13

By the insight into the Table 6, according to the interval of trust and comparation of corrected means of the results of the experimental and control groups, it can be concluded that experimental programs are the efficient tool for the transformation of the motor ability of speed.

Experimental program with elements of artistic gymnastics is efficient as a tool by which the transformation of one of the three variables of the motor space of speed can be influenced. In artistic gymnastics, the speed of a single movement and the speed of neural muscular reaction are more desirable, and the frequency speed of extremity movements is less desirable. According to the results, we can conclude that adequate exercises which enhanced the development of speed in the examinees of the experimental group have been applied.

Experimental program with elements of rhythmic gymnastics is efficient as a tool by which the transformation of one of the three variables of the motor space of speed can be influenced. We have already mentioned that for the conduction of certaine movements in rhythmic gymnastics, beside the adequate flexibility and explosive strength, certain speed of a single movement is also needed. It

should be mentioned that physical exercise can enhance genetic predispositions, which are great in speed, so it can be concluded that it has been achieved with the examinees of the second experimental group by the adequate choice of exercises.

Experimental program with elements of developmental gymnastics is efficient as a tool by which the transformation of two of the three variables of the motor space of speed can be influenced. Speed is a motor ability with the greatest coefficient of inheritance .95. All the motor abilities with high coefficient of inheritance are recommended to be developed at an early age, so the examinees from this research are appropriate to the age when it is the best to start with the development of the mentioned motor ability. Adequate physical exercises, applied within the polygone, enhanced the development of speed in the examinees of the third experimental group.

DISCUSSION

Tha gained results lead us to the conclusion that, for the significant changes, i.e. for the improvement of speed in the examinees of the experimental groups, beside the genetic predispositions, the experimental factor is also responsible.

That it is possible to influence the development of motor abilities with high coefficient of inheritance was also proved by Menez, Dantes and Filho (2009) who conducted a research on an experimental sample of 20 girls, divided into three groups, 9 to 15 years of age, in the space of motor abilities. The goal of the research was to compare the results of motor ablities of girls who do rhythmic gymnastics with those of the same age who do not do sports. The comparation was done on the motor abilities of the whole body coordination, dynamic balance, static balance, speed and coordination »eye-arm«, as well as perceptive abilities for the prediction of coincidences and sense for space. The conclusions show that there is a presence of systematic differences among active athletes and inactive athletes in motor abilities, and that better results are connected to experience in this sport.

In gymnastics, the speed of a single movement and the speed of latent neural muscular reaction are more desirable, and the frequency speed of some extremity movements is less desirable. For the conduction of different jumps with the appropriate walking or running, it is necessary to bring muscles in the regime of isometric contraction, have great explosive strength of lower extremity muscles, at the same time, it is necessary to have great flexibility of hamstrings of a thigh, speed, and finally, to conduct the reactive transmission of the impuls to other systems of levers, and for stopping movement, to keep a balanced position at the end of a jump. And speed is a motor ability with the highest coefficient of inheritance 0.95. All the motor abilities with high coefficients of inheritance are necessary to be developed at an early age, so the examinees from this research are appropriate to the age when it is the best to influence the development of certain motor abilities.

CONCLUSION

Previous experience and results of research have unquestionably showed that more efficient modernization and intensification of ohysical education, and more real planning and programing these activities can be achieved only if there is enough objective expert information according to which the current state can be diagnosed and procedures for further work can be determined. Of course, this research should initiate not only experts from the area of physical education, but also other experts to further more complex and far wider research on greater population and wider space areas which would lead to more efficient improvements of psychosomatic status, motor abilities, etc. Rhythmic gymnastics, as a young Olimpic sport, is a subject of interest of more and more young people. However, artistic gymnatsics belongs to the oldest Olimpic sports, and as such, it found its place in programes of physical education teaching for elementary and high schools from the beginning of the organized physical education teaching. Developmental gymnastics is a new sports discipline, originated from the International Federation of Gymnastics (FIG) with the slogan „a sport for everyone“. However, although (all the three sports) appear and practise, it is unfortunately, with not enough intensity, so they do not significantly contribute to the changes of anthropologic status of children. The results gained by this research exactly show that the efficacy of different programe contents of the physical education teaching was different. That is to say, the experimental teaching with the accent on the artistic, rhythmic and developmental gymnastics contributed significantly more to the transformation of motor ability of speed in female

pupils of younger grades, than the existing programe contants.

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INFLUENCE OF PHYSICAL ACTIVITY ON THE DEGREE OF NUTRITION OF CHILDREN OF YOUNG SCHOOL AGE

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SUMMARY

Introduction: The minimum physical activity, sedentary lifestyle, unhealthy habits can be the cause of excessive body weight in youth. The aim of the review study was to determine the effect of physical activity on the degree of nutrition of children of young school age based on collected and analyzed works in the period 1990-2012.

Methods: descriptive methods and theoretical analysis were used to collect the results. The collection of works was done with the help of PubMed, Kobson, DOAJ and Google Scholar. From a total of 429 works, 28 works analyzed met all the criteria. All works that were taken into consideration were related to children aged 7-12 years, who had no other problems except that they were obese. The studies included physical activity, and were of the longitudinal character.

Results: Out of 28 analyzed works whose time experimental treatments ranged 4-24 weeks, and the number of respondents 11-1627, the best treatment in prevention and reduction of body weight showed to be aerobic programs four or more times a week.

Conclusion: The lack of physical activity and overweight children is a disease of the 21st century. If it is necessary to increase the physical capacity or work on weight loss, physical activity should be more frequent with moderate or high intensity.

Keywords: health, sports, nutrition, training

INTRODUCTION

The increase in the number of obese children has doubled in the countries of Europe, in the period from 1980 until today (Branca, Nikogosian, & Lobstein, 2007) and in the USA (Wang & Dietz, 2002). Minimal physical activity, sedentary lifestyle, unhealthy living habits, etc. may be the cause of overweight in youth (Hills, King, Armstrong, 2007; Lavizzo-Mourey, 2007). Research conducted in 2010 showed that about 43 million children under the age of 5 are obese and do not meet the recommended daily dose of physical activity (Onis, Blo, & Borghi, 2010). Reducing unhealthy habits and increasing levels of physical activity has many advantages in maintaining the health of children and in the prevention of obesity. Still, a large percentage of children do not meet the recommended optimal levels of regular physical activity (Pate et al., 2002).

Physical exercise can be defined as any startup of the body using skeletal muscles which results in energy expenditure (Caspersen, Powell & Christenson, 1985). Physical activity of children is smaller and in the future aspires to further reduce (Stark & Boris, 2007), which will further increase the risk of various diseases (Boreham & Riddoch, 2001). Regular physical activity of children is an extremely important factor in the development, maintenance and enhancement of the level of physical fitness as well as acquiring the habit of lifelong sports (Strong et al., 2005). Numerous studies have shown that sporting activities increase the flow of blood and oxygen, which causes changes in neurotransmitters, increases the level of endorphin which reduces stress and improves mood (Taras, 2005).

Parents have a large degree of influence on the physical activity of their children based on genetic potential (Bouchard & Malina, 1983) and the environments in which they live (Heitzler, Martin,

Duke, & Huhman, 2006; Sallis et al., 1992). Sports and parental support help the children in socialization (Gustafson & Rhodes, 2006; Baranowski, 1997). Also, numerous studies have shown that parents with their active involvement in sports greatly influence the formation of habits of physical activity with their children. Results of American research suggest that children of fathers who are physically active are three to five times more active than children whose fathers are not physically active (Kalish, 2000). Children whose both parents are physically active are six times more active as compared to their peers whose parents are not physically active. Physically active parents are more involved in their children's sports activities compared to the inactive parents.

The aim of this study was to determine the effect of the level of physical activity on the nutritional status of children of young school age based on collected and analyzed works published from 1990 to 2012.

METHODS

Searching the literature

A literature search was performed with the help of search engines: PubMed, Google Scholar, DOAJ and Kobson. In order for the search to be more specific the following keywords were used: effect, prevalence, obesity, physical activity, overweight, children, childhood. Works that were published in the period from 1990 to 2012 were considered. In order for the exploring to be more fully, references of studies that explored the same or a similar field were also reviewed.

Selection of works and data collection

The selection of works was carried out on the basis of: weight reduction, the fact that subjects were not suffering from any kind of disease except that they were obese, that selected studies include physical activity and exercise combined with proper and reduced nutrition, that the studies were of longitudinal and transversal character, surveys, that the respondents were boys and girls of young school age from 7-12 years.

Theoretical consideration of the problem

In order to collect and analyze the collected works a descriptive method and theoretical analysis were used. The study included 28 works closely related to the impact of physical exercise on the level of nutrition of children of young school age. The works also satisfied all the criteria on which the selection was made. Researches that have been collected and analyzed are shown in Table 1. Every research shown in the table includes: research that includes the name of the first author and year of publication, sample of the respondents, which includes the number, the age, the sex, the country and testing, and experimental treatment that includes the duration of the program, the number of groups, exercise program. The sample has quite varied, the smallest number of respondents in research was 11 (Danforth, Allen, Fitterling, Danforth & Farra at all., 1990) and the greatest 1627 respondents in research (Donnelly, Greene, Gibson, Smith, Washburn et al.,2009).

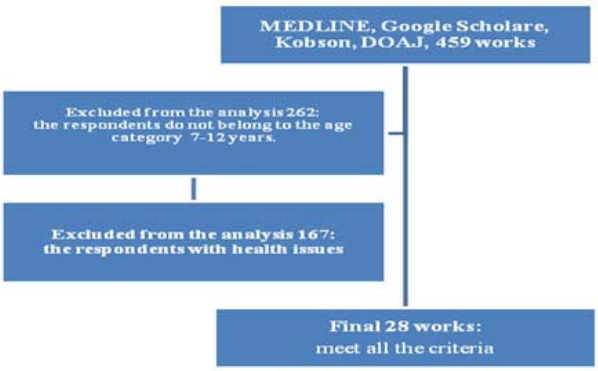

Chart 1. The selection of works on the basis of criteri

Most of the researches (21 studies) were related to physical activity and obesity while 7 researches observed, besides the level of nutritional status, the relationship of cholesterol level in the blood, cardiovascular system, and physical exercise. The sample was predominantly made up of boys and girls, but there are researches that were made up of girls only (4 researches) and they are (Nassis et al., 2005; Treuth et al., 1998; Jago et al., 2006 McKay et al., 2000) and one research that included only boys (Stergioulas, Tripolitsioti, Messinis, Bouloukos & Nounopoulos, 1998). The subjects were children of young school age who, except that of obesity, had no other problems.

Table 1. Influence of physical activity on the degree of nutrition of children of young school age

Research first author, year	Respondents sample					Experimental treatment		
	Number	Age	Gender	Country	Examination	Program duration	Number of groups	Exercise program
Hardin **et al. 1997.**	36	9-12	Both	USA	Level of cholesterol and physical activity	6 weeks	a) control group b) nutrition c) exercise-aerobic	3x week for 60min. 60-70% HRmax.
Stergioulas **et al. 1998.**	28	10-14	Boys	Greece	Level of cholesterol, obesity and physical activity	4 weks	a) control group b) bicycle ride ergometric-aerobic	4x week 75% VO_2max
Ferguson **et al. 1999.**	79	7-11	Both	USA	Obesity	20 weeks	a) control b) aerobic	5x week HR >150 bpm
Meyer **et al. 2006.**	102	11-16	Both	Germany	Obesity, cardio-respiratory system	24 weeks	a) control group b)swimming c) sports games and walking	3x week 60-90min.
Lau **et al. 2004.**	37	10-17	Both	China	resistance-endurance and obesity	6 weeks	a) control group b)exercising at a gym with a load	3x week for 60 min. 70-85% 1RM, 3 series 10 exercises
Danforth **et al. 1990.**	11	8-12	Both	USA	Obesity, blood pressure and physical activity	12 weeks	a) control group b) aerobic	3x week for 30 min. 67-80% HR max
Nassis **et al. 2005.**	19	13	Girls	Greece	overweight	12 weeks	a) control group b) aerobic	3x week for 40 min. HR >150 bpm
Kelly **et al. 2007.**	19	10	Both	USA	overweight	8 weeks	a) control group b) aerobic exercise	4x week for 30-50min. 50-80% VO_2max
Treuth **et al. 1998.**	22	7-10	Girls	USA	obesity	22 weeks	a) control b) low intesity of strenght training at a gym	3x week for 20min. 50-70% 1RM 7 exercises 2series, 12-15 repetings
Carrel **et al. 2005.**	55	12	Both	USA	Overweight	40 weeks	a) control group b) fitness program	5x week for 45 min. HR >170 bpm
Owens **et al. 1999.**	74	7-11	Both	USA	Obesity	18 weeks	a) control group b) aerobic	5x week for 40 min. 70-75% HR max
Lazaar **et al. 2007.**	425	6-10	Both	France	Overweight and obesity	26 weeks	a) five schools as control groups b) activities content in physical education class	2x week for 60 min. 70% HR max

Jago **et al. 2006.**	30	10-12	Girls	/	Obesity	4 weeks	a) control group b) Pilates training	5x week for 60 min. 60-70% HR max
McKay **et al. 2000.**	144	6-10	Girls	Canada	Bone density and obesity	32 weeks	a) control group b) jumping program	3x week for 30 min.
Aya **et al. 2012.**	227	11-12	Both	Japan	Obesity and overweight	4 weeks	a) urban environment b) rural environment	Physical activity measurement with accelerometer 5 days a week 24hours a day
Erik **et al. 2012.**	176	6-9	Both	Czech Republic	Obesity and overweight	24 months	a) two schools as a control group b) two school as an experimental group	Pedometer and accelerometer 5 days a week
Ahamed **et al. 2007.**	280	9-11	Both	Canada	Level of physical activity	16 months	a) control b) jumping program, dancing, sports games	accelerometer questionnaire
Donnelly et al. 2009.	1627	7-10	Both	USA	Overweight and level of physical activity	36 months	a) control group b) jumping, dancing, sports games	2x week for 60 min. Moderate to high intesity
Henaghan **et al. 2008.**	46	10-11	Both	England	Overweight and cardio-vascular system	9 weeks	a) control group b) regular sports activities in class	2x week for 60 min. High intensity
Kriemler **et al. 2010.**	502	6-11	Both	Switzerland	Obesity	9 months	a) control group b) athletic activities	2x week for 45 min. High intensity
Martinez **et al. 2008.**	1409	7-10	Both	Spain	Obesity, school activities	24 weeks	a) control group b) sports games, dancing, athletic activities	3x week for 90 min. Moderate intensity
McManus **et al. 2008.**	122	9-11	Both	China	Level of physical activity	6 months	a) control group b) organized physical activity c)non-organized activity	Pulse measured during the activity
Thivel **et al. 2011.**	457	6-10	Both	France	Obesity, physical activity	6 months	a) control group b) endurance, sports games, recreational activity	2x week for 60 min. Moderate intensity
Verstraete **et al. 2007.**	764	9-11	Both	Belgium	Physical activity	2 years	a) control group b) accelerometer, eurofit test	5x week for 45 min. Moerate and high intensity
Walther **et al. 2009.**	181	11-12	Both	Germany	Physical activity	12 months	a) control group b) accelerometer, athletic activities, endurance	5x week for 45 min. Moderate and high intensity
Nordine **et al. 2007.**	425	6-10	Both	France	Obesity and physical activity	6 months	a) five control groups b) sports games, dancing, athletic activities	2x week for 60 min. Moderate and high intensity
Atlantis **et al. 2006.**	48	8-16	Both	Australia	Obesity and physical activity	16±7 weeks	a) control group b) aerobic and strenght training, aerobic, strenght training	2-5x week 10-60 min. aerobic 60%–80% VO_2 max strenght training 50%-100%
McGovern **et al. 2008.**	791	5-18	Both	Washington	Obesity	6-104 weeks	a) control group b) aerobic, strenght training, aerobic and strenght training	1-7x week 30-75 min

The duration of the research was moving in a different period. The shortest program lasted for four weeks in three researches (Stergioulas, Tripolitsioti, Messinis, Bouloukos & Nounopoulos, 1998; Jago, Jonker, Missaghian & Baranowski, 2006; Aya, Yosuke, Yoshiyuki & Misaka, 2012), and the longest program lasted for 36 months in one research (Donnelly, Greene, Gibson, Smith, Washburn et al., 2009). Most researches lasted about 24 weeks which can be considered as the optimal period that can give visible results in the application of physical activities and weight loss. All studies were of longitudinal character as it is about the impact of physical activity on the level of nutrition.

Number of groups in the research was variable and ranged from two groups in nearly all researches to three groups in three researches (Hardin, Hebert, Bayden, Dehart & Mazur, 1998; Meyer, Kundt, Lenschow, Schuff & Kienast, 2006; McManus, Masters, Laukkanen, Yu, Sit & Ling, 2008). All of the researches were of aerobic type except for two researches that used resistance training (Lau, Lee & Sung, 2004; Treuth, Hunter, Figueroa & Goran, 1998).

DISCUSSION

Disease of the 21st century, which threatens to turn into an epidemic, is obesity. Children who are overweight in early childhood tend to be obese as adolescents and therefore increase the risk of cardiovascular disease (Dietz, 1998). Strategy needed to combat obesity is to raise the awareness of parents and children about the importance of sports (Epstein & Goldfield, 1999; Dao, Frelut, Oberlin, Peres, Bourgeois & Navarro, 2004). As such, a multidisciplinary approach is not easy to implement in practice, so for this reason the schools took over the responsibility to develop healthy habits of children through education (Bar, 2005). The biggest problem is that obese children are much less physically active than their peers who were not obese and do not spend more time in sedentary activities that adversely affect the reduction of body weight (Maffeis, Zaffanello, Pinelli & Schutz, 1997,1998). Reduced physical activity may be the cause of obesity as well as a potential trigger to many diseases which also leads to a reduction in aerobic and anaerobic capacity (Maffeis, 1997; Lafortune, 2002).

Significant loss of body experimental group compared to the control, was recorded by the research of aerobic type (aerobic, fitness, swimming, cycling and combination of aerobic training and strength training) whose frequency of physical activity was four or more times a week (Meyer, Kundt, Lenschow, Schuff & Kienast, 1999.2006; Carrel, Clark, Peterson, Nemeth & Sullivan, 2005; Owens, Gutin, Allison, Riggs & Ferguson, 1999; Jago, Jonker, Missaghian & Baranowski, 2006). With the increase of load muscle strength increases also, which takes the role of initiator and main consumer of calories which results in weight loss.

Researches that have examined the effect of strength training on the level of nutrition of children did not give positive results. Children recorded increase of muscle strength but not the reduction of body weight (Treuth, Hunter, Figueroa & Goran, 1998; McKay, Petit, Schutz, Prior, Barr & Khan, 2000). Also a bad indicator for the prevention and reduction of body weight of children has proved to be the teaching of physical education in schools with two hours per week (Lazaar, Aucouturier, Ratel, Rance & Meyer, 2007; Thivel, Isacco, Lazaar, Aucouturier & Ratel, 2011).

A large number of studies indicate that physical inactivity leads to a variety of diseases and premature death. There is a strong association between aerobic and anaerobic endurance, and mortality. Physical activity is important in youth and also in adult age (Lee & Skerrett, 2001).

Research of aerobic exercise (Stergioulas, Tripolitsioti, Messinis, Bouloukos & Nounopoulos, 1998; Nassis, Papantakou Skender, Triandafillopoulou & Kavouras, 2005; Kelly, Steinberger, Olson & Dengel, 2007), does not record a reduction in body weight of children but records a decrease in levels of lipoprotein density of cholesterol levels, increase of bone density, greater aerobic capacity and improve oxidative meetings. Children who make a greater number of steps during the day have lower risk of obesity (Ahamed, MacDonald, Reed, Naylor, Liu & McKay, 2007; Aya, Yosuke, Yoshiyuki & Misaka, 2012).

The largest number of studies includes both boys and girls. Four researches studied the changes in body weight with girls and only one research studies the boys. As the problem of the researches we can highlight the lack of comparison of boys and girls who of them lost more weight and for how much.

CONCLUSION

Typical sports activities for children of this age category are jumping, running, various collective sports activities of aerobic type of moderate and high intensity accompanied by strong emotions. Recommendations of numerous studies as well as the World Health Organization for maintaining condition and physical state in which children are, are at least three times a week of physical activity lasting for 60 min.

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THE INFLUENCE OF PHYSICAL EDUCATION ON MOTOR ABILITIES IN YOUNGER SCHOOL AGE CHILDREN

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SUMMARY

The purpose of this review paper is to examine the influence of physical education on physical activity in primary school children. Physical activities related to school have been evaluated – physical education, sports activities and free time activities. Male pupils are physically more active than female pupils. Attendance to physical education classes is high but the intensity is low and is even lower in female pupils than male pupils. Male pupils are more active in sports activities and the most common sports are football and basketball while with female pupils the most common sports are volleyball and tennis. Children that do sports mostly spend 4 hours a week in after-school activities during 9 months a year. A lot of free time is spent with the computer and TV, male pupils dedicate more time to sport while female pupils walk more.

Keywords: physical activity, physical education, anthropology, school age, motor abilities

INTRODUCTION

Regular physical activity is of great importance to health of the adults but also to proper growth and development in children (Strong et. al., 2005), their psycho-physical wellbeing (Steptoe & Butler, 1996) and cognitive abilities (Sibley & Etnier, 2003). Adequate physical activity in early childhood can be an important health determinant in the adulthood (Twisk, 2001), because some of the risk factors are connected to the inadequate physical activity in early childhood (Brage et. al., 2003; Nassis et. al., 2005; Andersen et. al., 2006). Insufficient physical activity or hypokinesia is, according to the World Health Organization, the no. 1 risk factor in connection to health and represents insufficient level of active movement or level of bodily activity which is chronically below the border point of stimulation that allows maintaining the functional capacity of the most important organs (Hollmann, 1975). Motor and functional indicators of school age children note catastrophic declining in the last decade as the consequence of insufficient physical activity (Gajevic, 2009). Insufficient physical activity and bad eating habits are identified as causes of obesity (Goran & Treuth, 2001), which have been ascertained in almost one fifth of children and youth (Public Health Institute "Dr Milan Jovanovic Batut", 2006). Around 60-85% of obese school age, pre puberty children remain obese in adult age, which leads to early and more common appearance of chronicle non contagious diseases (hypertension, early arteriosclerosis, diabetes mellitus-type 2 as well as other endocrine, orthopedic and psychological and social disorders (Cameron et al., 2003; Guo et al., 2000; Whitaker, Wright, Pepe, Seidel & Dietz, 1997; Power, Lake & Cole, 1997). Critical periods for development of obesity have been identified in different school ages according to gender so the male pupils in relation to female pupils are more at risk in lower grades while female pupils are greatly at risk in higher grades of primary school (Djokic, Medjedovic & Smiljanic, 2011). Long-term improper sitting in front of the TV and computer (Subrahmanyam, Kraut, Greenfield & Gross, 2000) and standing systematically impact the spinal cord and cause over load that crosses tolerance zone of soft spinal tissues and by cumulative acting through these repeating position and movement of tissue it leads to certain deformations regarding morphology and function. Today physical education occupies an important place in upbringing and education of children and youth. The process of perfecting

exercising is still in progress considering the continuous development of the society. Experts' opinion is that physical education is still not fully developed scientific discipline and there is still room for development. Is the reason for this that it is still young science in relation to others sciences or is the reason that humanity still doesn't fully comprehend its importance are surely some of the questions which will be answered by future researches.

METHOD

Literature search has been done by searching the data base. In order to closely define the search and to limit it only on papers that are the subject of these researches the following key words have been used: physical activity, physical education, anthropology, school age, motor abilities. With the advanced literature search only papers that have been published in the period from 2000-2013 have been considered and papers which are in connection to younger school age children or children aged from 7-11 years. Beside that all papers references have been viewed in order to find additional scientific papers that dealt with the same of similar topic. Papers have been selected based on several criteria from which motor ability and physical education represent the primary goal and should be specially emphasized.

HYPOTHESES

Based on the given topic a hypothesis has been defined:

H1 - Physical education influences motor abilities of younger school age children

RESULTS

Motor abilities of younger school age children from 7-11 years are characterized by perfecting basic forms of movement which are used as basis for manifestation of primarily motor abilities. This age, as noted by Bala (1981), is specific by significant variability and still undefined motor skill. Movement is done more or less successfully but not only abilities such as strength and speed are being manifested in some sort of isolated form but also one ability compensates another so child in different situations and tasks manifests its complex motor ability.

Nicin (2000) says "as a result of changing physical work and development of its structure, functional maturation and accumulation of motor experience, as well as the appearance of basic motor and stimulation of natural motor development, in the above mentioned period, the conditions for learning the most diverse movements and activities are created. On the other side, younger school age is a very sensitive age and is being considered as the period when first body deformities appear."

Research of latent structure of motor space for preschool children and younger school age children (4-11 years) is being difficult because of "children reacting with their whole being" which leads to instable general motor structure which has bouncy development as well as not having well enough assessment procedures for proper assessment of children's motor ability status (Bala, Stojanovic and Stojanovic, 2007). Even though many authors researched certain motor dimensions of children aged from 7-11 years (Krus, Bruininks and Robertson, 1981; Dukovski, 1984; Plesinac, 2001; Bala 2002; according to: Bala, Stojanovic and Stojanovic, 2007), it cannot be taken as researches in which they have organized motor space.

Milanovic (2006) has researched in which measure, programmed physical education classes through organizational form of exercise field as a mean, have the role in increasing the efficiency of the learning process with younger school aged children. Experiment with parallel groups has been used. Sample has been made from 538 pupils divided into two experimental and two control groups. She proves her hypotheses which state that organized teaching of physical education results in increasing the efficiency of teaching process or improvement of motor abilities of younger school age pupils.

The purpose of this research is assessment of physical activity of male and female pupils of primary school in Novi Sad, aged 11 years. Sample was made from 185 examinees (90 boys and 95 girls). Data was collected by questionnaire and as an instrument Bekeov's modified questionnaire has been used. Physical abilities in relation to school have been assessed – physical education, sports activities and free time activities. For all collected data frequency has been calculated while the significance of differences in involvement and type of physical activity of pupils according to gender has been determined by Chi-square test. In all three examined areas of physical activities an existence of significant differences between male and female pupils has been determined ($p \leq 0.05$). Male pupils are physically more active than female pupils. Attendance to physical education classes is high but

the intensity is low and is even lower in female pupils than male pupils. Male pupils are more active in sports activities and the most common sports are football and basket ball while with female pupils the most common sports are volleyball and tennis. Children that do sports mostly spend 4 hours a week in after-school activities during 9 months a year. A lot of free time is spent with the computer and TV, male pupils dedicate more time to sport while female pupils walk more.

Stamatović, Sekeljic and Markovic (2013) showed in their paper the results of the physical education or in other words the results of researching the effects of physical education classes on developing motor ability of flexibility (elasticity) and balance depending on the class organization. Namely, in one classical preschool experiment with parallel groups, in control group physical education classes have been implemented by teachers while in experimental group physical education classes have been implemented by professors of physical education. Sample included 360 fourth grade pupils. Based on the research results it can be concluded that classes implemented by professors of physical education significantly contributed to the development of motor ability of flexibility and balance. Results of this research match with the results of other researches in this area (Bigovic, 2003; Markovic, 2002; Stamatovic, 2001). This research supports the attitude about insufficient efficiency of physical education in junior grades of primary school.

The goal of Markovic's (2008) paper was to establish the effects of continuous planning and implementation of the programmed content of physical education and the effects of standard planning and implementation of programmed content of physical education which is often carried out in cycles with certain number of classes and possible differences between the two models of planning. The research has longitudinal experimental character (pedagogical experiment with parallel groups). Research – experimental treatment included 300 examinees divided into four special subsamples – according to gender and age criteria. Assessment of motor abilities has been done by nine standardized movement tasks – "EUROFIT" battery. In processing data obtained by empirical research, in addition to descriptive statistic procedures for testing differences of arithmetic means on initial and final assessment for each group they used: univariate analysis of variance (ANOVA), multivariate analysis of variance (MANOVA), Roj's test, Student's t-test and discriminant analysis. Physical education with continuous training and development of program content significantly influenced the improvement of motor abilities in male and female examinees and as such can be reliable basis and recommendation to modern physical education with permanent upgrade of the current knowledge.

This study has been carried out with the goal of determining efficiency of physical activity in six primary schools in Boston in the period from February to Jun 2011. There were 455 fourth grade and fifth grade pupils participating. The data showed that during the time spent in school pupils were more involved in physical activity in schools where the study has been carried out because they used better equipment in physical education classes. (Cradock et al, 2014).

By research Rafailovic (2013) has used batrijum tests which included 496 pupils (242 boys and 254 girls) from first to fourth grade, aged 7 to 11 years, from primary school, "Dr Dragisa Mišović" in Cacak. Defined in this way, the sample was distributed into 5 subsamples of boys and 5 subsamples of girls. The criteria for distribution are age, with rounding to ± 6 months, by which the following subsamples with both genders were obtained : 7, 8, 9, 10 and 11 (64 (34 boys and 30 girls) pupils aged 7 years, 116 pupils (51 boys and 65 girls) aged 8 years, 104 pupils (49 boys and 55 girls) aged 9 years, 138 pupils (73 boys and 65 girls) aged 10 years and 74 pupils (33 boys and 41 girls), aged 11 years). Only healthy children participated in testing. The criterion for not being present for testing equals the criterion for being excused from physical education. Totals battery result increases linearly with age, as can be expected considering that motor abilities in children usually improve with age. The results show that the battery can be used in the whole range of tested age group, from 7 to 11 years. The battery test wasn't too difficult for the youngest children and wasn't too easy or boring for the oldest children.

Authors	criteria	experiment	duration	result
Milanovic, 2006, Beograd		538 pupils divided into two control and two experimental groups		Organized physical education classes increase motor abilities
Stamatovic, Sekeljic and Markovic (2013)		360 fourth grade pupils divided into two groups , control and experimental		Significant contribution to development of motor ability of flexibility and balance
Cradock at al, 2014		455 fourth and fifth grade pupils	february-jun 2011	Increased fhysical activity
Markovic 2008				Significant positive effect on upgrading results of motor abilities
Rafailovic 2013	Healthy children from 7-11 years	496 pupils from first to fourth grade	may-september 2013	

DISCUSSION

In this paper some of the experimental researches, related to the influence of physical education on physical activity of children from 7-11 years, have been stated and processed. Physical activity implies motor skills of children of the given age. The greatest number of examinees is concentrated in Milanovic's research (2006) and the smallest number is concentrated in Stamatovic's, Sekeljic's and Markovic's research (2013). Duration of the experiment was mostly reduced to few months period. The common determinant for all paper was that any applied method has the positive effect on upgrade of motor abilities.

CONCLUSION

Without detailed studying and analyzing the total percent of physical education influence on physical activity of primary school children cannot be perceived.

With the growing need for bringing the children's physical activity to a higher level it is necessary to create proper educational and development programs that promote physical activity. Results show that different, improved approach to this problem leads to intensified activity during classes, greater efficiency of classes and thus the increase of motor abilities.

Results could be useful to physical education teachers in term of more quality planning and programming of physical education classes as well as the possibility of causing positive transformational changes in anthropological pupils' status.

Worldwide ENERGY programe (European energy balance required to prevent excess weight gain among youth) is applied and its goal is to reduce the inactive time, sitting at school and at home. In order to have a positive results from the intervention in its implementation all educational profiles teachers, parents and the youth itself must participate. We must focus on few different factors at the same time, changing diet, increasing physical activity and reducing physical inactivity.

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LEG MUSCLES FORCE IMPACT ON SWIMMING VELOCITY IN HIGH SCHOOL STUDENTS

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SUMMARY

Introduction: Problem of this research consisted from finding, establishing and checking connections between morphological characteristics and force with swimming velocity. Respectively, how and in what way, leg muscle force impact on swimming velocity in a certain distance. Based on subject, goals and tasks of research main hypothesis was established H_1: „leg muscle force affect on swimming velocity", and two under hypothesis $H_{1,1}$: „absolute leg muscle force affect on swimming velocity in 50m freestyle" and $H_{1,2}$: „relative leg muscle force affect on swimming velocity in 50m freestyle".

Methods: Participant sample was consisted from 30 healthy males, age from 15 to 18 years, with sport experience in swimming clubs that was more than 4 years. Measuring of muscle force was performed during isometric muscle contraction with dynamometer, data were after loaded on special hardware - software system, while measuring of time for swimming velocity in 50m freestyle was done by stopwatch. Based on participant sample, induct goal, tasks and hypothesis of research, statistical analysis of data was used, in this case, descriptive statistic and regression analyses. For statistical analysis of data statistical program "*SPSS 22*" was used.

Results: Results obtain through regression analyses showed no statistical significance between leg muscle forces with swimming velocity in 50m freestyle, $p<0.12$, which led to complete rejection of hypothesis H_1, and also showed no statistical significance between each leg muscle force separately with swimming velocity in 50m freestyle, which led to complete rejection of both under hypothesis $H_{1,1}$ and $H_{1,2}$.

Conclusion: After obtaining these results, it was concluded that leg muscle forces have no effect on swimming velocity in 50m freestyle among this population group, where participants in this research were only recreationally in swimming, and that main functions of legs in water was to maintain the body in a proper posture. It is consider that this type of research is more suitable for group of professional swimmers, which have already pass selection process and which are competing in national level. Nevertheless, impact of leg muscle strength and force should not be reduced in swimming, in fact, it is recommended to develop them through swimming process with combination of water and dry land exercises.

Keywords: Freestyle, 50 meters, Selection, Training process.

INTRODUCTION

From history it has been known that man was using different swimming techniques as solution for crossing water obstacles. It is interesting that most of mammals doesn't need to learn how to swim, and that the man is one of the rear being that needs to learn it. The reason for that would be that the animals are simply repeating the movement from dry land, and that is the same they are doing in the water, i.e., dog. Man on the other side can not repeat his upright standing position for walking, he needs to use arms and breath properly (Tomić, 2013).

Strength is considering as important thing in swimming (Shionoya et. al., 2001; Garrido et. al., 2005; Trinity et. al., 2006). Authors are citing today the importance of strength training because strength needs to provide specific physical willingness of swimmers for helping them in reaching high sports achievements (Rašović et. al., 2011). Strength with force in swimming is a reliable factor of velocity, especially in freestyle (D'Acquisto & Costill, 1998; Hawley & Williams, 1991; Seifert et. al., 2010; Sharp, 1986; Shimonagata et. al., 2002). In addition, strength training needs to be included in micro, mezzo and macro cycles in multiyear training plan (Rašović et. al., 2011).

Force or strength

In sport, term strength is consider as ability of muscle to develop specific strain (Nićin, 2000). That strain in physics is called force. This term is not sufficient to explain all specificity which are included during muscle contraction, so in this case we will use terminology that is entrenched in sport.

Strength types

Based on the character of the regime of muscular work, power can manifest itself in the form of static and dynamic forces, consisting of repetitive and explosive power (Stojiljkovic, 2003). Repetitive force also known as the power of repetition, has cyclic character of the manifestation of relieving stress and relaxing muscles. (Herodek, 2006). Often the boundary between repetitive strength and endurance strength can not be found. Some authors consider all activities involving expression of up to 30% of maximum strength, as strength endurance (Herodek, 2006). Anything over this limit is considered repetitive force. Other authors, however, equate this two terms where based on metabolic mode of action repetitive force is divided into aerobic and anaerobic, and where you can see a close relationship with the durability (Szanto, 2003). Explosive strength is defined as the ability of maximum strength for maximum short time (Stojiljkovic, 2003).

According to involved parts of the body strength of arms and shoulders, legs, trunk should be distinguished (Herodek, 2006).

Another division is on absolute strength which is the maximum muscle strength that a man can develop with his overall muscle mass and relative strength that can be developed per pound of his weight (Stojiljkovic, 2003).

Strength and velocity at high school age

For this research is important to describe the period of speed development and strength at the middle school age (15-18 years). This period of development is characterized by uneven development of certain motor skills, where some are rapidly developing, followed by periods of slower growth or stagnation. In the literature, these periods are called sensitive (Radivojevic, 2013). Sensitive periods are specific time phases in which certain dimensions within the motor space increasingly feel the effect of programmed forms of physical exercise (Trunić, 2007). Some authors believe that the sensitive period for the strength is from 12-13 years to 18 years (Winter, 1985). Depending on gender, for boys most muscle mass growth occurs from 13 to 15 years, while the rapid development of maximum strength and other forms of strength occurs from 14 to 15 years (Vorontsov, 2005). Period after puberty that occurs in girls between 14 and 17 years in boys aged 16 to 19 years, is characteristic by slow growth (Vorontsov, 2010). Understanding is that excessive efforts can slow bone growth in length and lead to a slowdown of physical and sexual maturation (Đurašković, 2002). Especially during this period, when there is a large difference in motor maturation in both sexes, height, strength and muscle mass, aerobic and anaerobic endurance needs to be careful (Vorontsov, 2010). This author believes that after 15 years, females lose significantly on their strength, aerobic and anaerobic capabilities, if they do not continue with the training.

As for velocity, in boys development happens from 5-18 years, while some research show rapid grow after 13. years of age. In girls, velocity is increasing up to 13. and 14. year, and a little more after 17. year of age (Malina et. al., 2004).

METHODS

In every sport, including swimming, people have always searched for ways that will lead to better results. These efforts have had its basis in the rich experience of swimming coaches. In recent years, the application of scientific methods and complex understanding of sporting activities play a crucial role in achieving the best results.

Subject of this research represents studying of high school students, age 15-18 years ± 6 months, their morphological characteristics and force of the leg muscles. The research problem consisted in finding, establishing and checking connections between leg muscle force and swimming velocity. Respectively, in what way force of the leg muscles affects the swimming velocity at a certain distance. In this research, the goal was to determine magnitude of leg force impact on swimming velocity in 50m freestyle in male high school students 15 to 18 years of age. Based on subject, problem and goal of this research, three tasks have been established: to determine leg muscle force levels; to determine velocity in 50m freestyle; to determine influence of leg muscle force on swimming velocity in 50m

freestyle. Based on subject, goals and tasks of research main hypothesis was established H_1: „leg muscle force affect on swimming velocity", and two under hypothesis $H_{1,1}$: „absolute leg muscle force affect on swimming velocity in 50m freestyle" and $H_{1,2}$: „relative leg muscle force affect on swimming velocity in 50m freestyle".

Participant sample

Participant sample was consisted from 30 healthy males, age from 15 to 18 years, with sport experience in swimming clubs that was more than 4 years. Investigated swimmers were from two swimming sport clubs from city of Nib:

- Pk "Niš 2005".
- Pk "Sveti Nikola".

Sample of measuring instruments

Measuring of muscle force was performed during isometric muscle contraction with dynamometer (IMADA Z2H-1100-Japan) which consisted from special cells with power up to 5000N and with sensibility of 1.25N. Conversion of ratio force / time was assessed with frequency of 1KHZ, then all the data from the initial force of muscle contraction to the maximum value was taken, and then loaded in hardware - software system (WinWedge 3.4, TAL Technologies, Philadelphia, PA, USA) (Beretić, Đurović, Okičić, & Dopsaj, 2013). Two varable were obtained for leg muscle force, medium absolute leg force (SASN) and maximal absolute leg force (MASN), while medium relative leg force (SRSN) and maximal relative leg force (MRSN) were calculated with mathematic formula.

Measuring of time for swimming velocity in 50m freestyle was performed with stopwatch and it was presented with variable (V50K).

Statistical analysis of data

Based on participant sample, induct goal, tasks and hypothesis of research, statistical analysis of data was used (descriptive statistic and regression analyses). For statistical analysis of data statistical program "*SPSS 22*" was used.

To determine the levels of investigated force in manifest space with swimming velocity basic statistical parameters were applied: arithmetic mean (Mean), minimum (Min) and maximum (Max) score, range (Range), standard deviation (SD), symmetrical distribution of results (Skewness) and elongation distribution of results (Kurtosis).

Regression analysis was used for determination of leg muscle influence with results of specific motor abilities in swimmers. Regression analyses was consisted from these parameters: correlation coefficient (R); partial correlation coefficient (Part R); standardized partial regression coefficient (Beta) standard error of the partial regression coefficient (Std. Err. of Beta); the size of the F-ratio (F); t-test (t) and statistical significance (p). For statistical significance, significance level to 0.05 ($p \leq 0.05$) was used (Bala, 1990).

RESULTS

Table 1: Descriptive statistic for swimming 50m freestyle.

	Valid N	Mean	Minimum	Maximum	Range	Std.Dev.	Skewness	Kurtosis
V50K	30.00	33.97	26.54	39.54	13.00	4.06	-0.41	-1.11

Table 2: Descriptive statistic for leg muscle strength.

	Valid N	Mean	Minimum	Maximum	Range	Std.Dev.	Skewness	Kurtosis
SASN	30.00	611.20	380.35	945.80	565.40	170.07	0.40	-1.12
MASN	30.00	981.20	477.00	1,374.00	897.00	220.28	-0.30	0.36
SRSN	30.00	8.90	5.52	13.50	8.00	2.46	0.07	-1.30
MRSN	30.00	14.30	7.61	20.00	12.40	3.11	-0.32	0.15

Table 3: Regression analyses of leg muscle strength.

	Beta	Std.Err. of beta	part-r	r	t(21)	p-level
SASN	0.05	0.08	0.13	0.11	0.64	0.53
MASN	-0.04	0.05	-0.17	-0.15	-0.86	0.40
SRSN	-3.29	5.68	-0.12	-0.10	-0.58	0.57
MRSN	2.21	3.44	-0.13	0.11	0.64	0.53
R= .50 R^2= .24 F(4,25)= 2.07 p < 0.12						

* represents statistical value on level 0.05 (95%)

DISCUSION

The analysis of Table 1, which presents the main statistical parameters of the velocity in swimming 50m freestyle style, it can be concluded that the results are quite good, and comparing the values in the intervals of the minimum (MIN) and maximum (MAX) results are from 3 to 5 standard deviation (Std . Deviation) which indicates that the results are reliable and that can be used for further analysis (Dopsaj & Bratuša, 2003). Skewness value ranges within normal limits. Kurtosis value in the instant case shows that there was a normal distribution of results and the results are fuzzy indicating the homogeneity of the group.

The analysis of Table 2, which presents the main statistical parameters of all forces, it can be concluded that the results are quite good, and comparing the values in the intervals of the minimum (MIN) and maximum (MAX) results are from 3 to 5 standard deviation (Std . Deviation) which indicates that the results are reliable and that can be used for further analysis (Dopsaj & Bratuša, 2003). Skewness value ranges within normal limits. Kurtosis value in the instant case shows that there was a normal distribution of results and the results are fuzzy indicating the homogeneity of the group.

The whole set of applied force does not gave the statistical significance $p < 0.12$ of swimming velocity in 50m freestyle style among high school students, where R is 0.50, a common variance (R^2) explained with 0.24%, which means that the force variables with 24% explained a result of swimming in 50m freestyle style in this group of swimmers, while the remaining 76% belong to other anthropological areas (motor, functional, etc.). Individually there is no statistical significance of a single force variable with swimming velocity in 50m freestyle style. Based on these results it can be concluded that the forces of the leg muscles have no impact on the swimming velocity in 50m freestyle in this group of participants. The reason for such results may be the choice of subjects. This testing was done on the so-called recreation group. In this group, swimmers were with several years of training experience, but they have not gone under any selection and did not professionally compete. These swimmers train to hone their swimming skills, however in some movements, whether they are correct or not, it is difficult to influence. So it is possible that this is the reason for no statistical significance between swimming velocity and leg muscles force. It is obvious that the movements made by certain leg muscles in these swimmers are not producing enough force for swimming velocity in 50m freestyle.

CONCLUSION

In this research goal came from subject of the research and it was to determine magnitude of leg force impact on swimming velocity in 50m freestyle. For establishing leg muscle force few tasks were needed to be completed: to determine leg muscle force levels; to determine velocity in 50m freestyle; to determine influence of leg muscle force on swimming velocity in 50m freestyle.

Based on subject, goal and tasks of this research and by following hypothesis the following conclusions can be made:

1. Results that we gain analyzing table 3 in which regression analyses of all forces were presented, we concluded that the hole set of measuring forces does not have statistical significance on swimming velocity in 50m freestyle, $p < 0.12$ which in these specific example means that the hypothesis H_1: „Leg muscle force affect on swimming velocity“ is completely rejected.
2. Results that we gain analyzing table 3 in which regression analyses of all forces were presented, we concluded that absolute leg muscle force does not have statistical

significance on swimming velocity in 50m freestyle $p < 0.53$ and $p < 0.40$ which in these specific example means that the hypothesis $H_{1,1}$: „Absolute leg muscle force affect on swimming velocity in 50m freestyle“ is completely rejected.

3. Results that we gain analyzing table 3 in which regression analyses of all forces were presented, we concluded that relative leg muscle force does not have statistical significance on swimming velocity in 50m freestyle, $p < 0.57$ and $p < 0.53$ which in these specific example means that the hypothesis $H_{1,2}$: „Relative leg muscle force affect on swimming velocity in 50m freestyle“ is completely rejected.

Numerous studies suggested that the estimation of peak power output enables accurate prediction of maximum speed during swimming, especially in short distances, since, as velocities become higher, necessity for greater power output is increased (Stager & Tanner, 2005). In front-crawl, about 90% of the total propulsive force is generated by the arm stroke, while the role of the legs is restricted to maintain the body in a proper posture in the water by reducing the trunk inclination (Hawley et al., 1992; Deschodt et al., 1999; Gourgoulis et al., 2014) (Dalamitros, Manou & Pelarigo, 2014).

The optimal level of strength is required in every sport so swimming is no exception (Newton, Jones, Kraemer, & Wardle, 2002). From all the above we can draw the conclusion that in this population requires working on strength (force) development leg muscles. Many authors recommend a combination of training on dry land and in water (Aspenes, Kjendlie, Hoff, & Helgerud, 2009; Trappe & Pearson, 1994; Rađo & Nurković, 2000) as one of the ways for development of these muscle groups. Swimming coaches often assume that the strengthening of the lower body muscles may improve swimming performance (Papadopoulos et al., 2009).

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THE MOTIVATION OF PHYSICAL EDUCATION SCHOOL TEACHERS TO TAKE PART IN AND WORK ON DEVELOPING SCHOOL SPORTS

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SUMMARY

Introduction: The motivation of teachers to take part in and work on the development of school sport is the main link in the further operationalization of the role of physical education classes, but also the work done in after-school activity clubs

Methods: The sample of participants included in this research numbered 39 sport and physical education teachers working in elementary (21) and high schools (18) in Serbia. In this research, we used a standardized questionnaire consisting of twenty-four (24) items. The questionnaire was distributed in the form of a five point Lykert-type scale. The answers were presented in the form of grades ranging from 5 to 1. The following statistical procedures were used for data analysis: frequencies, percentages and the Chi-square test. It was used to determine the significance of the differences and show the probability of a connection between the two cited research variables.

Results: The analysis of the results, that is, of the noted frequencies, has shown that there are no great differences in the level of motivation between the surveyed physical education and sport teachers working in elementary and high schools, as well as that the internal and external motivation are at approximately the same level among all the participants.

Conclusion: The results of this research have confirmed the first two hypotheses, that is, that the physical education teachers in elementary and high schools are motivated to participate in and enable the further development of school sport, and have rejected the third and fourth hypotheses which were in favor of the fact that the motivation between them differs, and that internal motivation is more dominant. The Chi-square test has only indicated the possibility of a connection between the two cited research variables (internal and external motivation

Keywords: motivation, school sport, participation, school sports clubs, competition

INTRODUCTION

Physical education represents the basis of school sport. A school sport team has clearly defined goals and tasks which originate from the aims and tasks of physical education. They unambiguously indicate the desire to create individuals with a broad education through the help of physical activities and exercise. The function of physical education and school sport should be reflected in the acceptance of those models of physical exercise which do not contain any kind of negativity. All of the negativity which is a "feature" of sport must energetically be removed from our schools *(Savić, 2014).* As a result, the authors, and rightly so, indicate that school sport has a multi-dimensional significance and should be viewed from various aspects. On one issue we are all in agreement, and that is that school sport creates a diversely educated individual.

The contemporary pedagogical approach and view on the educational process, and thus physical education in schools, indicates the need for motivation in physical education as an important factor, without which these classes would be impoverished. Motivation could also be understood as the basic instigator of a certain activity. Thus, motivation is a state of mind which motivates a particular individual to behave in a certain way or take part in a certain activity. What lies at the basis of these types of behavior are activities aimed at 1) the goal, 2) the requirements and 3) the action. Motivation originates from numerous factors, but is

itself an important factor in the improvement and education of individuals, and of groups as well. The motive for achieving success, as well as its subcomponents, are good predictors of the readiness for professional development *(Lazarević, 1987).*

In the teaching process, motivation can be found on all levels. We find it both among individuals as well as within groups. It directly influences the other factors of the teaching process. This study will present the first empirical findings on the motivation of sport and physical education teachers regarding participation and work in school sport clubs.

A general analysis of the work and research done to date on the motivation of school teachers for participation in and working on the development of school sport, and especially the segments which refer to the differences in the motivation level of teachers working in elementary and high schools, could only lead one to the conclusion: that practically no work on the subject has been done at all, that is, that very few studies exist on the topic. Numerous papers have been written on the motivation of schoolteachers for taking part in physical education classes. However, they all made a certain contribution to the further development of the studied problems and improvement on the curriculum and class content.

Ranđelović, O. (2008) outlines a theoretical consideration of the motivation of schoolteachers for self-education and professional development, where she indicates that among schoolteachers, anawareness of the social significance of creativity should be formed, and a need for innovation should be developed. They should be motivated to work on their professional improvement so that they could introduce innovations into their work more easily, with the aim of modernizing class in the modern-day schools.

Beara, M., and Okanović, P. (2010) presented the results of an empirical analysis of the preparedness of teachers to professionally improve. They used the SPR-N scale consisting of 17 reliable items. A factor analysis was used to obtain a five-factor interpretative structure. A sample numbering 452 teachers from Vojvodina was included in the study, which yielded a score of 67.42 in terms of the general readiness for professional development. The most important factor was the awareness of the importance of improvement in the teaching profession, while external motivation was the least prominent one.

Emina, H. (2007) analyzed the question of the need and the possibility for improvement of teachers in schools. She isolated and presented four elements, or indicators, of the individual development of schoolteachers. Our schools, according to the opinion of our participants, partially offer such possibilities to schoolteachers. In addition, constant work is needed to change all the elements of the content and structure of schools.

Koca, C., and Demirhan, G. (2004) studied the opinions of high school students towards physical education in relation to gender and the extent of participation in sport (school sports clubs). This study included 440 schoolchildren, aged 15. The analysis of variance indicated significant differences in the attitudes toward physical education between the schoolchildren who were members of sports clubs and the schoolchildren who were not, where the members of sports clubs indicated positive attitudes toward physical education. In addition, the boys had more positive attitudes toward physical education than the girls. In general, the members of school sports clubs had better scores on the scale for the evaluation of attitudes toward physical education compared to school children who were not, while male high school students had better scores in comparison to female high school students.

The subject matter can be found within the context of the motivation of sport and physical education teachers to effectively organize, operationalize and realize the content of school sport during their regular physical education classes in elementary and high schools.

The goals of the research include: 1) determining the motivation of the teachers who work in elementary schools, 2) determining the motivation of teachers who work in high schools, 3) determining whether there are any differences in the motivation level between elementary and high school teachers and 4) determining the differences in internal and external motivation of the surveyed sport and physical education teachers.

In accordance with the stated subject matter and aims of the study, the following hypotheses were formulated:

H1 –*Sport and physical education elementary school teachers manifest their positive motivation regarding participation in and working on developing school sport.*

H2 –*Sport and physical education high school teachers manifest their positive motivation regarding*

the participation in and work on developing school sport.

H3 *–There is a differencein motivation between sport and physical education elementary and high school teachers in terms of participation in and work on developing school sport.*

H4 *–Among the surveyed teachers, internal motivation is dominant.*

METHODS

The study was carried out in May 2014 as a part of the interactive master studies class of students taking the *School Sport* course at the Faculty of Sport and Physical Education in Niš. Following some consultations and the questionnaire design by the authors (for the purpose of a pilot study), the questionnaires were multiplied and distributed to the students who handed them out in the various testing locations. Prior to the distribution, the invigilators gave the participants certain necessary instructions on how to fill out the questionnaire.

The sample of participants

The sample of participants was selected from a population of sport and physical education teachers who work in elementary and high schools in smaller and larger towns throughout Serbia. The sample of participants consisted of 21 teachers of sport and physical education who work in elementary schools in the following towns *Čačak, Kraljevo, Niš, Zaječar, Žitorađa and Boževac,*with an overall work experience ranging from2 to 33 years, and 18 high school teachers who work in the following towns in Serbia *Požarevac, Niš, Blace, Surdulica, Grdelica and Belgrade,* with an overall work experience ranging from 7 to 36. In total, 39 participants completed the survey. The number met the requirements for a quantitative analysis, considering the number of variables and the possibility of result generalization.

In the study, we did not take into consideration the work experience of the employed teachers - participants *(which ranged from 2 to 36 years of experience)*, which did not diminish the significance of the research.

Measures

Two variables were used to meet the requirements of this study. They were defined in the following manner: 1) the first variable was encompassedby 11 items from the questionnaire and was defined as internal motivation, 2) the second variable was encompassed by the remaining 13 items and was defined as the external motivation of the sport and physical education teachers. The cited variables were studied in a single questionnaire which consisted of twenty-four (24) items.The questions were clearly and precisely formulated, following a particular order. In this study, the five point Lykert-type scale was used, and the responses ranged from 5 to 1.

Statistical analysis

The data analysis procedure in this study was based on the use of the following statistical procedures:frequencies, percentages and the Chi-square test. We used it to determine the significance of the differences between the obtained frequencies *(Malacko, Popović, 1997).*

In addition to the cited procedures, the following methods were used: a descriptive and comparative one.

RESULTS AND DISCUSSION

The aim of the research was based on the study of the motivation of sport and physical education teachers working in elementary and high schools regardingtheir involvement in and work on developing school sport. By studying the motivation of the participants, we studied the comprehension of the given situation by the teachers, their views, values and reactions, as well as their motivation to participate in certain activities. The structure of the questionnaire was in the form of a unique questionnaire consisting of twenty-four (24) items. For the purpose of a pilot study, 2 variables and 4 hypotheses were formulated. The analysis and the discussion of the results follows the order their order of presentation in the paper. The extent of the agreement is represented using grades ranging from 5 to 1. The meanings assigned to them were the following: **5** - I completely agree, **4** - I partly agree, **3** - I neither agree nor disagree,**2** - I partly disagreeand**1** - I fully disagree.

Table 1 Internal motivation of the participants

Extent of agreement - Count, %		5		4		3		2		1		Chi-Square
No	School: elementary, high school	ES	HS	ES	HS	ES	HS	ES	HS	ES	HS	
1.	I exhibit personal interest in school sport	17 81.0	10 56.0	3 14.3	6 33.3	1 4.8	- -	- -	2 11.1	- -	- -	.132
2.	I expect personal promotion from school sport activities	1 4.8	1 5.6	7 33.3	7 38.9	8 38.1	4 22.2	3 14.3	4 22.2	2 9.5	2 11.1	.869
3.	I require financial compensation in order to participate in school sport	3 14.3	8 44.4	11 52.4	1 5.6	1 4.8	4 22.2	2 9.5	- -	4 19.0	5 27.8	**.006**
4.	The medals and trophieswon at school competitions mean a lot to me	13 61.9	11 61.1	7 33.3	4 22.2	1 4.8	1 5.6	- -	1 5.6	- -	1 5.6	.597
5.	It is not difficult for me to stay after school and work with the sports club members	12 57.1	11 61.1	7 33.3	4 22.2	1 4.8	1 5.6	- -	2 11.1	1 4.8	- -	.455
6.	Most teachers only gather the team prior to the competition, but do not work with it during the entire year	7 33.3	5 27-8	3 14.3	10 55.6	6 28.	3 16.7	4 19.0	- -	1 4.8	- -	**.042**
7.	Victories and defeats are shared by the competitors	10 47.6	12 66.7	10 47.6	4 22.2	1 4.8	2 11.1	- -	- -	- -	- -	.238
8.	For school competitions I only work with the school children who are school sport club members	2 9.5	4 22.2	5 23.8	3 16.7	- -	1 5.6	8 38.1	6 33.3	6 28.6	4 22.2	.620
9.	I expect praise from the staff and the principal for a won medal or trophy	8 38.1	6 33.3	8 38.1	4 22.2	3 14.3	4 22.2	- -	1 5.6	2 9.5	3 16.7	.601
10.	It is enough for me to have the necessary equipment and props to take part in school sport activities	5 23.8	7 38.9	8 38.1	8 44.4	3 14.3	1 5.6	3 14.3	1 5.6	2 9.5	1 5.6	.654
11.	In school sport, I include all the students equally (winning is not important to me)	7 33.3	10 55.6	8 38.1	7 38.9	1 4.8	- -	1 4.8	1 5.6	4 19.0	- -	.249

The first variable in the questionnaire was evaluated by the cited 11 items, which indirectly referred to internal motivation. With a general insight into the results shown in table 1, we can conclude that the responses of the teachers were characterized as highly positive, that is, that they preferred high scores, with high extents of agreement (5, 4) on the offered claims. By analyzing the studied response frequencies, we determined that there were no statistically significant differences for 9 claims, that is, that the participants equally valued internal motivation.Thus, an interaction was determined between the elementary and high school teachers.

Elementary and high school physical education teachers show mutual interest for school sport, and do not expect any self-promotion.For them, medals and trophies have great significance, they do not find it difficult to work on developing school sport, they have empathy for the competitors, work with their students, work with minimal equipment and props, and they all expect congratulations from the staff and the principal. To an extent this is justified, considering that they only differed in their opinion on whether they needed financial compensation (elementary school teachers) and whether they should only work with their teams prior to the competition, that is, whether they should work with them during the entire school year. Generally speaking, the teachers who were more actively involved in school sport had a more positive attitude.

Table 2 External motivation of the participants

1.	My school develops and encourages school sport	8 38.1	7 38.9	8 38.1	4 22.2	- -	2 11.1	2 9.5	4 22.2	3 14.3	1 5.6	.301
2.	My school possesses enough sports fields and halls	9 42.9	1 5.6	2 9.5	3 16.7	1 4.8	1 5.6	6 28.6	5 27.8	3 14.3	8 44.4	.067
3.	The work of the school sports clubs takes place in the school	11 52.4	6 33.3	7 33.3	7 38.9	- -	2 11.1	2 9.5	2 11.1	1 4.8	1 5.6	.515
4.	Athletes are valued in our school	10 47.6	5 27.8	3 14.3	11 61.1	1 4.8	1 5.6	5 23.8	1 5.6	2 9.5	- -	**.030**
5.	The home room teachers need to have more understanding for school athletes	14 66.7	12 66.7	5 23.8	4 22.2	2 9.5	1 5.6	- -	1 5.6	- -	- -	.711
6.	The principal of the school should motivate and allow physical education teachers to take part in school sport	16 76.2	11 61.1	3 14.3	3 16.7	2 9.5	3 16.7	- -	- -	- -	1 5.6	.592
7.	The principal should stimulate physical education teachers to take part in school sport activities (sports clothes, shoes, equipment)	14 66.7	11 61.1	5 23.8	5 27.8	- -	1 5.6	1 4.8	1 5.6	1 4.8	- -	.710
8.	Physical education teachers who win medals do enjoy some benefits in the school	1 4.8	2 11.1	4 19.0	5 27.8	9 42.9	5 27.8	4 19.0	4 22.2	3 14.3	2 11.1	.815
9.	Physical education teachers should receive some kind of financial compensation for taking part in competitions (daily wages)	8 38.1	9 50.0	6 28,6	3 16.7	4 19.0	6 33.3	1 4.8	- -	2 9.5	- -	.373
10.	The complete staff of physical education teachers is interested in working in school sport clubs	7 33.3	5 27.8	10 47.6	6 33.3	4 19.0	2 11.1	- -	4 22.2	- -	1 5.6	.146
11.	The students motivate me to take part in school sport	14 66.7	11 61.1	7 33.3	6 33.3	- -	1 5.6	- -	- -	- -	- -	.545
12.	I expect greater support from the school during competitions	14 66.7	11 61.1	3 14.3	4 22.2	1 4.8	1 5.6	2 9.5	- -	1 4.8	2 11.1	.623
13.	School sport is underdeveloped in Serbia	9 42.9	11 61.1	8 38.1	5 27.8	2 9.5	- -	2 9.5	2 11.1	- -	- -	.444

By analyzing the results shown in table 2,we clearly see that the surveyed sport and physical education elementary and high school teachers have an identical view of the occurrences and processes regarding external motivation, as well as that they have identical motivators in the case of certain activities. External motivation is defined by the remaining 13 claims that were shown in table 2,and at the same time represents the second variable of the research. The responses of the participants do not differ in a statistically significant manner for most of the responses, except for the claim „athletes are valued in our school". Athletes are valued more in elementary schools. As a result, a fact of some concern is the common claim that school sport in Serbia is not sufficiently developed. In addition, the role, significance and need for greater involvement of the school, staff and principal in school sport should be greater. At the same time, they represent new fields for future study.

CONCLUSION

If we were to take another look at the historical overview of school sport in Serbia, we are of the opinion that it will have a bright future. The tradition of school sport competitions dates back to 1968/69 when the first Elementary School Olympic Games started taking place in schools. We must admit that school sports clubs have existed for a relatively long period time, with the ultimategoal of bringing together young people, enabling proper exercise and achieving results. We agree on one thing, that in this process, great motivation of the schoolchildren is needed, as is the motivation of the teachers themselves. Thus, motivation can be viewed as a limiting factor in the process of involvement in and work on developing school sport. It is undisputed that this process is characterized by a certain amount of demotivation. It was the intention of the authors in this pilot study to determine the motivation level of the teachers to take part in and work on developing school sport. It was especially interesting to see whether there were any differences in the level of motivation of teachers in elementary and high schools. In addition, this study in part also analyzed the external and internal motivation of the teachers.

Sport and physical education teachers must be able to understand the essenceof each individual

event, as well as to understand its connection to and conditioning by other occurrences and processes. That was also the case in this study. This speaks in favor of the fact that more detailed work is needed, as well as the construction of the most optimal conditions for and content of school sport in elementary and high schools.

The research results certainly open certain polemics and discussions which should be approached carefully, in detail and professionally. We would like to point out that the participation of the teachers in school sport is of great importance for the final outcome of school competitions. They should not be evaluated only based on their results. Without an active and professional relationship towards participation in school sport, it is not possible to achieve sublimated results. The research results clearly indicate that there is a certain level of motivation which is necessary in the aforementioned process.

The results of this research have confirmed the first two hypotheses, that is, that the physical education teachers in elementary and high schools are motivated to participate in and enable the further development of school sport, and have rejected the third and fourth hypotheses which were in favor of the fact that the motivation between them differs, and that internal motivation is more dominant. The Chi-square test has only indicated the possibility of a connection between the two cited research variables (internal and external motivation). It is necessary to point out that this study, according to its results, does not differ significantly from the other studies cited in this paper.

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THE ADAPTATIONAL CHANGES OF MORPHOLOGICAL CHARACTERISTICS INFLUENCED BY MODELLED COORDINATION AND FLEXIBILITY IN FEMALE STUDENT PRESCHOOL EDUCATORS

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SUMMARY

Introduction: The aim of the research was to determine the adaptational changes of some morphological characteristics in the final measurements compared to the initial ones with both the experimental and the control groups of the examinees. A specific aim was to determine the differences in some morphological characteristics at the end of the experiment between the experimental and the control groups of examinees.

Methods: Two measurements were taken with groups, one being initial and the other final. 66 female students of Preschool Teacher and Sports Trainer High School in Subotica, aged 19 to 22 (±6 months) participated in the 2-class-a-week additional recreational exercise practices in a Fitness club. The whole group was divided into two subgroups. The first subgroup of 33 examinees represented the experimental group which, along with the recreational exercise practices of 2 classes a week also had 3 classes a week of training sessions in which flexibility and coordination models were realised. The second subgroup of 33 examinees represented the control group which underwent the recreational exercise practices of 2 classes a week only. A set of seven anthropometric measurements was applied for defining morphological characteristics.

Results: The results of the canonical discriminative analysis showed that at the end of the experimental period there was a statistically significant increase in motor abilities on the multivariate level (P-level=.000) with the experimental group. The results of the multivariate analysis of variance showed that there was a statistically significant difference between the control and the experimental groups in the final measurement, with the experimental group having higher levels of morphological characteristics (Q=.000).

Conclusion: These results lead to the conclusion that the increase of the morphological characteristics was achieved through the training process organised by the strict methodological rules with the appropriate levels and the intensity of the load and the right number of rest intervals with the experimental group of examinees.

Keywords: training practice model, the initial and final measurements, discriminative analysis, female students

INTRODUCTION

The researches into quantitative changes of the development of morphological characteristics influenced by differently shaped models of transformation procedures (Malacko and Radosav, 1985; Najsteter, 1991) are particularly important when it comes to the theory and practice of any training process. Recent researches on different groups of examinees have outlined positive adaptational changes of abilities and characteristics caused by different models of training procedures.

The best source of information on the increase in the levels of morphological values caused by the application of the motoric exercise model could be found among sports people at the different levels of competition (Bala, 1981; Hirtz and Starosta, 2002). There has not been sufficient number of researches of this kind involving female preschool teacher and trainer students aged 19 to 22 to obtain reliable data on the transformation processes happening to morphological characteristics under the influence of different models of coordination and flexibility motoric exercises.

The aim of the research was to determine the adaptational changes in some morphological characteristics that occurred between the initial and the final measurements under the influence of recreational exercise and training process of the flexibility and coordination model with the experimental group of preschool educators and trainers students. A specific aim was to determine the differences in morphological characteristics between the control and the experimental groups at the end of the experiment.

METHODS

66 female students of Preschool Teacher and Sports Trainer High School in Subotica, aged 19 to 22, participated in the 2-class-a-week additional recreational exercise practices in a Fitness club in Subotica. The whole group of examinees was divided into two subgroups. The first subgroup of 33 examinees represented the experimental group which, along with the recreational exercise practices of 2 classes a week also had 3 classes a week of training sessions in which flexibility and coordination models were realised. The second subgroup of 33 examinees represented the control group which underwent the recreational exercise practices of 2 classes a week only.

The following set of measuring instruments was applied for determining the development of morphological characteristics under the influence of the flexibility and coordination motor practice model in the experimental and recreational training processes with the control group: circular dimensionality and body mass: the mean values of the chest volume (AOGK), the upper arm volume (AONL), the lower leg (the tibia) volume (AOPK), the body mass (AMAS); subcutaneous fatty tissue: the skinfold of the upper arm (AKNNL), the skinfold of the stomach (AKNTH), the skinfold of the lower leg (AKNPK). The suggested sample model of the anthropometric measurements for evaluating the selected morphological characteristics was used on the recommendation of the International Biological Programme (Lohman, Roche and Martorell, 1988). The research results were processed by the Statistica 8.0 for Windows programme for determining canonical discriminative analysis, as well as the analysis of the morphological characteristics of the examinees of both experimental and control groups.

The practice programme

The research into the quantitative changes of the selected morphological characteristics of the experimental and the control group examines lasted for 8 weeks and included 24 recreational classes. The structure of the load with the examinees of the experimental group was adapted to the individual needs of certain groups of examinees. The scope of the flexibility and coordination development motor activity was determined by the number of repetitive series. The intensity of the load was determined by the number of series and the repeated exercises with a series whereas the body pulse values showed the reaction of the body to the applied load. The structure of the motoric exercises with the experimental group was as follows:

Body shaping exercises for increasing motor flexibility: the arms and shoulders: frontal and sideways arm circling of high amplitude; backward arm movement; backward rubber skipping rope extension; simultaneous forward circling of the one arm and the backward circling of the other; the body: heel touch exercise with a great amplitude in the standing, kneeling and lying positions; toe touch exercise in the standing and sitting positions; sideways trunk exercise to the left and to the right with or without jerk; trunk flexion to the left and to the right; the pelvic section and the legs: flexing and the low toe touch exercise; trunk circling in different positions; forward, backward and sideways leg movements with a great amplitude; body circling in the ankle and hip joints; full leg flexion squats; stretching programme exercises.

Coordination exercises: walking and running (walking along a straight line on the toes, the heels, the inner and the outer feet, high and low skipping, forward and backward lower leg movement); rope skipping (at one place; with certain variations; in pairs and in groups); body movement control (skipping over a small hurdle/ obstacle, maintaining the upward and sideways position, 360° turn while holding a rubber); hand coordination (kinetic sensitivity): passing and catching props; shooting at and hitting targets; hand hitting while jumping; scoring while jumping; passing a ball with one or both hands from the below, and above the head, backward, and through the legs; stretching programme exercises.

RESULTS

The experimental group (the differences between the results of the initial and final measurements of the selected morphological characteristics)

Table 1. The significance of the isolated discriminative functions of the selected morphological characteristics of the experimental group on the multivariate level.

Discrim. Function	Eigenvalue	Canonical R	Wilks' Lambda	Chi-Squ.	df	P-level
1	3.568	0.70	134	122.35	7	.000

Explanation: Discriminative coefficients squares (Eigenvalue), Canonical correlation coefficients (Canonical R), Bertlett test values (Wilks' Lamda), Chi-square test values (Chi-Squ.), degrees of freedom (df) and the level of significance of the determination coefficient (P-level)

The result is a discriminative function of the medium high intensity (CR=70%), which shows the correlation of the data used in the discriminative analysis of the obtained results (table 1). The results of the equation of the antropometric measurements are shown by the Wilks' Lambda value .134, which proves the existence of significant differences between the initial and the final measurements of the selected morphological characteristics of the examinees of the experimental group (P-level). This is so due to the high values of the Chi-square test results (Chi-Squ.=122.35).

Table 2. The factor structure of the isolated discriminative functions of the selected morphological characteristics of the experimental group on the univariate level

Antropometric measurements	Root 1
AKNNL	0.575
AKNPK	0.455
AKNTH	0.452
AMAS	0.356
AOGK	0.302
AONL	0.292
AOPK	0.156

Explanation: The significance level of the coefficient correlation of the antropometric measurements (Root 1)

Table 2 represents the structure of the discriminative function of the part-take of the antropometric measurements of the selected morphological characteristics in forming significant discriminative functions. The shown group centroids represent the mean values of the initial and final measurements results. The results shown prove that the highest part-take in the discriminative function is by the antropometric measurements of the upper arm skinfold (AKNNL 0.575), the lower leg skinfold (AKNPK 0.455) and the stomach skinfold (AKNTH 0.452).

The results of the discriminative analysis of the final measurement of the experimental group examinees show that there are statistically significant changes in the values of the selected morphological characteristics influenced by the training process involving the flexibility and coordination model realization when compared to the initial measurements.

The control group

Table 3. The significance of the isolated discriminative functions of the selected morphological characteristics of the control group on the multivariate level.

Discrim. Function	Eigenvalue	Canonical R	Wilks' Lambda	Chi-Squ.	df	P-level
1	0.365	17	.805	18.02	7	.254

Explanation: Discriminative coefficients squares (Eigenvalue), Canonical correlation coefficients (Canonical R), Bertlett test values (Wilks' Lamda), Chi-square test values (Chi-Squ.), degrees of freedom (df) and the level of significance of the determination coefficient (P-level)

The result is a discriminative function of the low intensity (CR=17%), which shows the correlation of the data used in the discriminative analysis of the obtained results (table 3). The results of the equation of the antropometric measurements are shown by the Wilks' Lambda value .805, which proves that there are no significant differences between the initial and the final measurements of the selected morphological characteristics of the examinees of the control group (P-level). This is so due to the low values of the Chi-square test results (Chi-Squ.=18.02).

Table 4. The factor structure of the isolated discriminative functions of the selected morphological characteristics of the control group on the univariate level

Antropometric measurements	Root 1
AOGK	0.312
AONL	0.254
AOPK	0.211
AMAS	0.201
AKNNL	0.154
AKNTH	0.141
AKNPK	0.114

Explanation: The significance level of the coefficient correlation of the antropometric measurements (Root 1)

Table 4 represents the structure of the discriminative function of the part-take of the antropometric measurements of the selected morphological characteristics in forming significant discriminative functions. The results shown prove that the highest part-take in the discriminative function is by the low level coefficients.

The results of the discriminative analysis of the final measurement of the control group examinees show that there are no statistically significant changes in the values of the selected morphological characteristics influenced by the training process when compared to the initial measurements.

The differences in the final measurements of the selected morphological characteristics between the experimental and the control group examinees

Table 5 represents the results of the multivariate analysis of covariance between the examinees of the experimental and control groups in the final measurement. The results prove that there is a statistically significant difference in the selected morphological characteristics of the two groups of examinees expressed by the following values: of Wilks' Lambda .193 and of Rao's F-approximation of 14.02 leading to the difference of Q= .000. Therefore, it can be concluded that there are statistically significant differences in the applied system of the selected morphological characteristics of the examinees.

Table 5. Multivariate analysis of covariance o the selected morphological characteristics between the experimental and control group examinees in the final measurement

Wilks' Lambda	Rao's R	Q
.193	14.02	.000

Explanation: the Bartlett test results (Wilks' Lambda), Rao's F-approximation (Rao's R) and the significance level (Q)

Table 6. Univariate analysis of variance of the selected morphological characteristics between the experimental and control group examinees in the final measurement

Tests	Means (E)	Means (K)	F- relation	Q
AOGK	82.43	81.32	1.89	.148
AONL	25.72	25.90	1.28	.235
AOPK	36.40	37.00	1.52	.122
AMAS	70.28	71.54	1.82	.085
AKNNL	13.34	15.86	11.54	.000
AKNTH	14.62	18.72	12.55	.000
AKNPK	10.37	13.25	10.52	.000

Explanation: The mean value of the experimental group examinees (Mean (E)), the mean value of the control group examinees (Mean (K)), the F-test values (F-relation) and the significance level (Q)

Table 6 represents the univariate analysis of variance of the selected morphological characteristics by comparing the mean value results of the experimental and control group examinees in the final measurement. It can be concluded from the F-relation coefficient and the significance level (Q) that there are statistically significant difference in the level of the selected morphological characteristics between the experimental and the control groups in the values of the following parameters: the upper arm skinfold (AKNNL .000), the stomach skinfold (AKNTH .000) and the lower leg skinfold (AKNPK .000).

DISCUSSION

The results of the canonical discriminative analysis (tables 1 to 4) show that there are statistically significant differences influenced by the coordination and flexibility motor exercise model with the experimental group of examinees in the final compared to the initial measurement.

It can be presupposed that these changes appear as the result of the flexibility and coordination exercise experimental model which was properly methodologically shaped and organised in terms of planning and programming, dosage, distribution and control of the applied load as well as the necessary increase of the training process intensity following the authentic needs of the experimental group examinees.

The results of the research prove that such a procedure caused positive adaptational changes in the examinees' bodies, which, consequently, led to the increase in the antropometric measurements of the circular dimensionality of the skeleton and the decrease in the levels of the subcutaneous fatty tissue. Some researchers (Zeljaskov, 2004; Durakovic, 2006; Milanovic, 2007) claimed that such transformation processes could be explained by the adaptational processes within the body which enabled the increase of the muscle tissue leading to the development of the cranks and ligaments.

Bearing in mind the fact that the flexibility and coordination training process of the experimental group involved constant movement direction changes which implied the heaviest load on the thigh and lower leg muscles, the motoric exercise focused on the development of strength, coordination and flexibility of the specific muscles. Consequently, such approach led to the statistically significant decrease in the subcutaneous fatty tissue, which is, according to numerous researches, the ballast weight for many sports.

CONCLUSION

The flexibility and coordination training model realized over the 24 classes/ hours of motoric exercise in the experimental period enabled better functioning of all topological parts of the body, increased the efficiency of all the organs and the systems, which, in turn, led to statistically significant adaptational processes of the values of the selected morphological characteristics (P-level= .000) with the experimental group of examinees comprised of the female preschool educators and trainers students in the final measurement compared to the initial state. The applied exercises caused the decrease in the subcutaneous tissue and the increase in the level of the circular dimensionality of the body so the model can be defined as the process of concordant and all-encompassing development of the abilities and characteristics of the experimental group examinees. The usefulness of the flexibility and coordination training process model is supported by the covariance analysis results, comparing the results of the selected morphological

characteristics of the longitudinal dimensionality and subcutaneous fatty tissue between the experimental and the control group examinees in the final measurement. There is a statistically significant difference (Q=. 000) between the two groups of examinees. It can be presupposed that the positive transformation processes of the selected morphological characteristics of the experimental group examinees were achieved by the model which was properly methodologically shaped and organised and comprised of valid measuring instruments, innovative organizational forms and methods of work and the applied scope and the intensity of the load interchanging with the rest periods.

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PHYSICAL EDUCATION FOR JUNIOR SCHOOL CHILDREN

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SUMMARY

The aim of this paper is to collect and analyze the research conducted over the past twenty years, their classification and further analysis. 12 research papers that examined the influence of physical education on junior school children have been analyzed. Based on the research results, it can be concluded that the kind of teaching implemented by teachers of physical education have contributed significantly to the development of knee extensor muscle strength, repetitive strength of trunk flexors and static power of arm and shoulder muscles. This study supports the views about the necessity of introducing physical education as subject teaching in the lower grades of elementary school.

Keywords: motor ability, subject teaching, class teaching, junior school age

INTRODUCTION

The essence of teaching physical education is, in addition to optimal development of students' anthropological characteristics and acquisition of sports - technical educational contents, to include physical activity in everyday life, i.e. to make physical exercise a part of the students' value, if systematically practiced. It is necessary that the process of physical education trigger adaptive changes in motor skills and organ systems, especially cardiovascular and respiratory systems; however, this is achievable only by adequate choice of means of physical exercises (operators), the appropriate methods, burden and methodical organizational types of class management (Višnjić, Jovanović, & Miletić, 2004).

Class preparation involves theoretical, methodological and organizational lesson preparation. Adequate approach to physical education lesson, which can be perceived as a transformative process of students' capabilities and characteristics, should be a moral and professional obligation of every teacher. Planning and programming of teaching has been organized on the basis of the results obtained by diagnose of students' anthropological status. The level of physical ability determined by initial testing can serve as a basis for successful lesson planning and programming, which will primarily contribute to the development of those skills in which students perform poorly. The question of organization of teaching physical education, whether as a subject or as a class teaching, has been open for a long period of time. Several years ago, subject teaching of physical education was introduced in the fourth grade of elementary school when trained teachers of physical education started teaching it. Several years later, the subject teaching was also introduced in the third grade. It was proposed, due to many benefits to students, that classes of physical education should be introduced in all junior grades of elementary school. However, those initiatives remained unrealized. Contrary to these ideas and hopes, in the school year 2009/10 (third grade) and 2010/11 (fourth grade), subject teaching of physical education was completely abolished in junior school children.

METHODS

Descriptive methods and theoretical analysis were used for collection, classification and analysis of targeted research. The literature was collected by searching the web and the available papers in Google Scholar. The search was limited to the papers published in the 1997-2014 period. Additional literature and textbooks were used. The keywords used during the search were "motor ability", "subject

teaching", "class teaching", "junior schoolchildren", "physical education". References in these papers were also reviewed in order to find more studies on this topic. The study consists of 12 closely related researches. At the beginning of the search, 120 references responding to certain criteria were identified, but 80 papers were immediately eliminated because of their title and 28 were eliminated based on other criteria (Figure 1.)

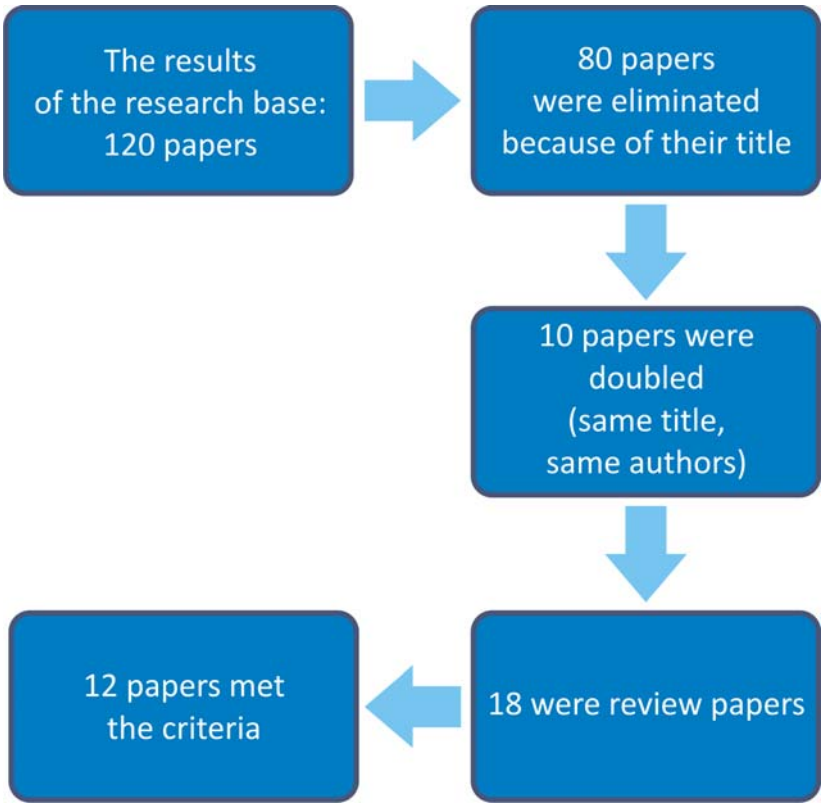

Figure 1. Flowchart of data collection

RESULTS

Author and year	No.	Gender	Year	Duration	No. of groups	Contents and intensity	Conclusion
1. Sallis, McKenzie, Alcaraz, Kolody, Faucette, & Hovell (1997)	955	450 m 505 f	10-11	2 years	2 groups	The curriculum of physical education in the experimental group was implemented by the specialists in physical education or trained school teachers. The students in these classes were compared with the students in control classes. After two years, the girls in classes led by a specialist in physical education were superior to those in the control groups, in terms of abdominal strength and endurance (p <.001) and cardio respiratory endurance (p <.001).	The conclusion reached by the authors was that such program of physical education can provide substantially higher level of physical activity during physical education classes. Improved physical education class can be beneficial to 97% of students in elementary schools.

2. Stamatović (2003a)	40	32 c 8 f	9-10	-	1c 1e	Based on the data obtained from educational research using the classical experiment with parallel groups of fourth grade students of elementary school, the author of this paper pointed to the development of motor skills, explosive and repetitive strength and static power.	Greater efficiency of physical education classes when organized as subject teaching, in terms of fulfilling the objectives and tasks of physical education.
3.Stamatović (2003b)	320	160 m 160 f	10-11	1year	2 groups	Physical education classes in two schools were implemented by class teachers (class teaching), and in two other schools the classes were organized as subject teaching. The control group comprised of students who took part in class teaching, and the experimental group comprised of the students involved in subject teaching. For each tested motor ability, two variables were used. Statistical method of covariance analysis was used for data processing.	It was discovered that subject teaching of physical education for 10 to 11 years old students, significantly contributes to the development of motor skills, in comparison to class teaching.
4. Pejčić & Uzelac (2006)	655	348m 307 f	9-10	–	2 groups 1-e 1-c	For assessment of motor abilities, a measuring instrument that was used was a set of universal tests common in the school curriculum, which consists of six variables: hand tapping, standing long jump, polygon backwards, trunk lifting, trunk bending and air plank	Based on the data obtained by canonical discriminative analysis, the results showed that in the whole system there were statistically significant differences (p = .000) between boys and girls. In this regard, the results of this study offered certain guidelines for improved physical education lessons.
5. Stamatović & Šekeljić (2006)	210	m/f	10-11	1 year	2-groups	Their aim was to determine the impact of physical education on motor status of respondents, depending on the concept of teaching. The survey was a classic pedagogical experiment with parallel groups.	The research results point to the fact that the classes organized by subject teachers showed statistically significant increase in the majority of motor skills than classes organized by teachers.
6. Grabavac (2007)	249	-	7-8	1 school year	2 groups	In order to control the effects, the respondents were examined in terms of 26 variables, 14 morphological and 12 motor ones.	The results showed that in both measurements, the first linear combination described the soft tissues and their repercussions on motor performance.

7. Milanović (2007)	538	190 m 255 f	8-9	14 work weeks	4 groups 2 c 2 e	The effects of programmed lessons of physical education were measured using two variables for the assessment of anthropometrical dimensions, and thirteen variables for the assessment of motor abilities of students in the experimental groups.	Statistically most significant differences, compared to the results of the students in control groups, were obtained in the tests for assessing sprint speed, agility, mobility, and coordinating abilities.
8. Krsmanović, Batez, & Krsmanović (2009)	117	117 f	9-10	–	2 groups	They investigated the influence of experimental treatment on the anthropological status and motor efficiency in schoolgirls. Motor efficiency was determined based on the results of a complex motor task - an obstacle polygon.	The results of this study confirm a significant influence of anthropometrical characteristics and motor abilities of schoolgirls on motor efficiency in the examined age.
9. Krsmanović, Batez, Krsmanović, & Kovačević (2009)	93	47 m 46 f	10	–	2 groups	The aim of this study was to determine the effect of anthropometrical characteristics and motor abilities on motor efficiency of students. Motor efficiency was determined based on the results achieved in resolving a complex motor task - an obstacle polygon (course), which is based on the curriculum for the fourth grade of elementary school.	The results showed a statistically significant influence of anthropometric characteristics and motor ability in schoolgirls on the result of motor efficiency in the examined age.
10. Marković & Višnjić (2009)	45	20 f 25m	10-11	–	2 groups	Their aim was to determine the differences in the development of motor abilities of students of junior school age under the influence of two different programs within the main part of physical education lessons. The experimental group had an additional exercise in the main part of the lesson, and the assessment of performance of both groups was evaluated using six standard motor tests.	The results were better in the final measurement in both groups, but the improvement was greater in the experimental group.

11. Šekeljić (2009)	296	164 f 132 m	10	–	3 groups	He conducted a survey in order to examine the effects of physical education lessons on motor abilities in terms of the applied experimental treatments (alternative and the current curriculum). A system of 35 variables for the evaluation of motor skills and motor skills assessment was used.	The results suggest that using teaching contents with the elements of basketball can effectively influence the fulfillment of goals of physical education lessons in terms of acquiring motor skills (sports and technical education).
12. Stamatović & Šekeljić (2011)	360	180 f 180 m	10	-	2 groups	They showed the results of the effects of physical education (explosive and repetitive strength and static power) depending on the professional skills of teachers.	Based on the results of the study, it can be concluded that the teaching organized by physical education teachers contributed significantly to the development of knee extensor muscle explosive strength, repetitive strength of trunk flexors and static power of arm and shoulder muscles.

DISCUSSION

In the majority of the analyzed studies in the experimental program, there were one experimental and one control group. The physical education curriculum in the experimental group was implemented by physical education specialists or trained school teachers. Only one study had three groups, one control group and two experimental groups (Šekeljić, 2009). Other studies had two groups, one experimental and one control group. Great number of studies was aimed at determining the impact of physical education on motor status of respondents, depending on the concept of teaching. Several studies (Sallis, McKenzie, Alcaraz, Kolody, Faucette, & Hovell, 1997) compared the physical education curriculum in the experimental group, where classes were organizes by physical education teachers or trained school teachers. The students in these classes were compared to the students in control classes.

The duration of the experimental treatment usually lasted for one full school year. The shortest research was the one by Jovanović (1999). That program lasted one term only. The research which had the longest program was the one by Sallis et al. (1997). This program lasted for two years. The assessment of motor abilities involved a measuring instrument – a universal test set commonly used in the school curriculum, which consisted of six variables: hand tapping, standing long jump, polygon backwards, trunk lifting, trunk bending and air plank. The results of many studies suggest that the effects of physical education do not only depend on the educational content, but also on the intensity of burden and, most importantly, on the number of classes per week.

In the study by Stamatović and Šekeljić (2006), it was concluded that the subject teaching showed statistically significant improvement in the majority of motor skills than the teaching organized by class teachers. In the research by Pejčic and Uzelac (2006), the results offered guidelines for better implementation of physical education lessons. It is essential to use additional exercises and trainings of different disciplines in order to enable the development of basic psychological and physical traits within a child. Periodic competitions among children of the same age in different sports disciplines are increasing the students' interest. The organism of a child in this age is not capable for long and continuous efforts and great statistical efforts, as well as for the activities that require precision and very complex coordinated movements. All these results indicate that there is a statistically significant influence of anthropometric characteristics and motor abilities on students' motor efficiency.

CONCLUSION

This paper analyzes the studies aimed at determining the influence of physical education on junior school children. Teaching physical education in this period of physical growth and development is a very important task. However, in practice, these lessons are not performed regularly or they are not organized by physical education teachers. In this period, the body is strengthening and a child becomes capable of mastering the techniques of individual sporting disciplines. A child has the desire to measure his/her powers with other children, and also he/she is already starting to show interest in particular sports discipline. Based on the data obtained from educational research using a classical experiment with parallel groups in elementary school students, it can be concluded that there physical education lessons implemented by subject teachers of physical education are more efficient than the lessons organized by class teachers, in terms of achieving the goal and the task of physical education.

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THE INFLUENCE OF LESSON CONTENTS ON ACTIVE TIME (LESSON) OF EXERCISING

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SUMMARY

Introduction: The goal of this study was to research eventual influence of different lesson contents on duration of individual parts of physical education lesson, as well as total active time (lesson) of exercising of younger school students. It was assumed that different physical education lesson contents would condition different length of active exercising for younger school students.

Methods: The research was realized in primary school "Jovan Jovanovic Zmaj" in Svilajnac during the second term of 2013/2014 school year. In order to determine active time of exercising by lesson parts and total active time of exercising in relation to lesson contents five lessons were monitored with exercises on equipment and floor and five lessons with sport games. Time of engagement was measured by the choice of one student who was monitored during the lesson. After finishing the exercises, the measured time of activity is added, the activity (engagement) percentage by the lesson parts and in total is calculated – active time of exercising. The student whose activity is measured must not know that he is the object of measurement and monitoring. Descriptive statistics and t-test for small independent samples were applied for the processing of data acquired by empirical research.

Results: The largest deviation from the middle value at exercising on equipment and floor and sport games is at the third part of the lesson and active time of the lesson. There are no significant differences in the length of introductory, preparatory and finishing part of the lesson. The values of t-test indicate statistically significant differences only in the length of main part of the lesson and total active time of exercising and they are in favour of lesson contents of sport games.

Conclusion: General statement indicates that lesson contents from sport games for younger school students condition longer active lesson exercising than lesson contents on sport equipment and floor.

Keywords: exercises on equipment and floor, sport games, t-test, student, younger school students

INTRODUCTION

It is sure that adequate organization of lesson contents in school means adequate time articulation of planned activities for students. Many renowned theoreticians dealt with lesson plans. In one of the definitions it is said that "teaching is studying by determined educational plans and programmes and (with direct or indirect) help of a teacher, i.e. education which is realized under (direct or indirect) leadership of a teacher by the use of determined teaching plans and programmes" (Bakovljev, 1988, 5-6). Physical education teaching is by its characteristics, except physical exercising, (exercise contents) similar to teaching in general. According to this it represents "unique teaching-educational process which demands general power and abilitiy of a student, his/her personality as a whole and his/her integral development (Berkovic, 1978, 15).

Teaching has three essential characteristics and these are: students acquire knowledge, skills and habits; students develop physical and psychological abilities, meet their needs and broaden their interests and by teaching students develop integrally. The three mentioned characteristics cover physical education teaching.

In physical education teaching, apart from three essential methodic factors – student, teacher and teaching material there is one more factor and that is wide material basis for physical education teaching, which is not the case with other school subjects.

Physical education lesson in most of our physical education methodic books is called " a lesson of body exercise", and it is the basic, mostly applied and

obligatory organizational way of teaching educational work in physical education teaching, which is determined by teaching plan and programme (Matic, 1978; Kragujevic 1991; Visnjic, Miletic & Jovanovic, 2004) So physical education lesson is a unique physical education teaching unit in which all phases are functionally connected in accordance with pedagogical, physiological and other rules of exercising.

The structure of physical education lesson was studied even in the 16th century by Merkurialis. He recommended that people should take care of children age and time of the day when exercises are done. Ling has structured physical education lesson (exercises) into five parts and duration of the parts is in accordance with students' age and the length of exercising (Ilic and Mijatovic, 2006).

In his book *Gymnastics skills* divided gymnastics lesson into three parts: preparatory, basic and final part. Since then, up to now, different authors have determined the structure of a physical education lesson in different ways. According to Ling, an exercise lesson has five parts and duration of the parts is determined according to students' age and duration of exercise lessons. This method of exercising (Swedish gymnastics) was applied at girls as well as at boys because there was no special way of gymnastics for girls. (Ilic and Mijatovic, 2006). In the beginning of the 20th century, in order to adapt physical education lessons with the demand of modern teaching methods, Linhart suggested shortening of time for exercising (Milanovic, 1986) very close to our conception is Austrian one, which was given by Groll, famous theoretician of physical education. he structures physical education lesson so that it has five exercises (lesson parts): heating exercises; shaping exercises; posture and movement; result exercises; dance and games and sedation exercises. Our lesson scheme does not contain third part (result exercises) and it contains: introductory part, preparatory part; basic part and final part.

Our eminent experts have determined different lengths of different parts of a lesson whicxh determines characteristics in structuring of a lesson (Polic, 1953; Sepa, 1958; Mejovsek, 1962; Matic, 1978; Arunovic, 1982; Tripkovic, 1983; Milanovic, 1986; Visnjic, Miletic & Jovanovic, 2004; Markovic & Visnjic, 2008). It is clear that lesson structure should not be accepted as a scheme, as a ready made recipe which would be applied in each situation (Krsmanovic and Berkovic, 1999, 79).

The use of time during physical education lesson can be observed from two aspects: the first is the duration of the lesson or so called *absolute lesson time* and the second is *active time of exercising.*

Stanojevic has determined that average duration of physical education lesson is 38.16 minutes. For real work with students 36.33 minutes are spent. From 36.33 minutes a lot of time is spent on lining up and preparation of equipment, explanation of a teacher and other preparatory work. From 30 minutes which are left over for exercising students use only 9.04 minutes of it, or 20,08% from 45 minutes.

Active time of exercising during physical education lesson was the topic of research in ten primary schools in Republic of Serbia. Checking the engagement of students during physical education lessons the researcher discovered that physical education lessons on average last 40.44 minutes. Considering activities during lessons, the students have actively exercised for 8.0 minutes, or 19.33%. The time of engagement during the lesson is insufficient and has little influence on physical functional abilities of students (Ivanic, 1969). The problem of student engagement on physical education lesson was researched by Lucic (1975) The students exercised only 12.26 minutes during monitored lessons or 27.24%. Lesson contents influence the duration of active exercise time, so that during athletics lessons students use 13.20 minutes or 27.40%, in gymnastics 13.42 minutes or 28.22% and in sport games 19.50 minutes or 41.66% (Miskovic, 1978) recommends the application of new methods of exercise organization (circle work, stations, individual tasks).

Almost the same results are found in the research (Arunovic et al, 1979) where the engagement on athletics lesson for students is 15.24 minutes or 33.86% and for female students 11.50 minutes or 25.50%. Differences between boys and girls in relation to the duration of active exercising are present during lessons with basketball, gymnastics and volleyball. The least active time of exercising is during the lessons of gymnastics and the longest time in sport games especially basketball.

The application of different organisatinal methods of work increases the time of active exercising during physical education lesson. By the application of additional exercise in the main part of the lesson active time of exercising is increased with 10.46 minutes without additional exercise to 13.60 minutes with additional exercise (Prskalo & Findak,

2004). Positive effects of additional exercises on active time of exercising and transformation of motor abilities have been stated in other research (Prskalo, 2001; Prskalo & Findak, 2003; Martinovic, Visnjic & Markovic, 2008).

A good choice is the method which contributes to intensification and optimizing of workand in this way humanization of teaching process and exercising adapting to real needs of each student, which is a condition for individualization ideal of every modern concept of education and teaching (Prskalo, Babin & Bavcevic, 2010).

It is a fact that different lesson structure can determine results of children in physical activities. The goal of this work was to research eventual influence of teaching contents on duration of certain parts of a lesson as well as total active time of exercising of younger school students. We started with the assumption that different teaching contents will influence different duration of active time of exercising.

METHOD

The research was realized in primary school "Jovan JovanovicZmaj" in Svilajnac in the second term of 2013/2014 school year. In order to determine active time of exercising by parts of the lesson and total active time of exercising on physical education lesson in relation to teaching contents the observation of five lessons with exercises on equipment and floor and five lessons with sport games was done.

The time of activity (engagement) is measured by the choice of one studentand he/she is monitored during the lesson. When the student exercises (runs, jumps, leads the ball, does shaping exercise and other) so when he/she is active, the controller activates the stopwatch, and when the students stops doing exercise the controller stops the stopwatch and records the result in seconds in the file form. After finishing the exercises the measured exercises are added, percentage of activities is calculated (engagement) of student by lesson parts and in total – active time of (lesson) activity. The student whose time is measured must not know that he/she is the object of measurement and monitoring.

The sample consisted of ten primary school pupils in year four. The choice of pupils was conditioned by the random choice of a controller. Beside the controller there was a recorder who recorded the measured time in previously prepared form. Descriptive statistics and t-test were used in the processing of data.

RESULTS

By looking into the Table 1. It can be seen that the values of duration of active time of exercising by parts and total active time of exercising are within relatively possible and expected limits. The biggest deviation from the middle value for exercises on equipment and floor and sport games is for the third part of the lesson and active time (lesson) of exercising.

Table 1. Descriptive parameters for parts of the lesson with teaching contents from exercises on equipment and floor

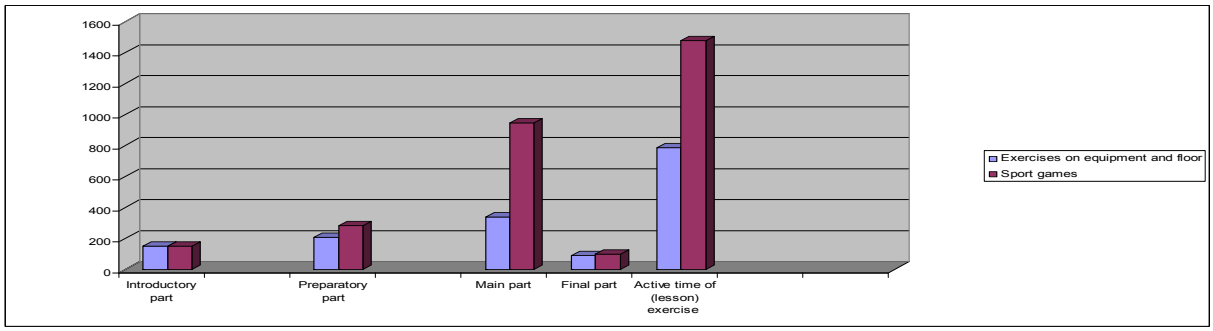
	Mean	Std. Deviation	Minimum	Maximum
Introductory part	151.60	66.71	80.00	234.00
Preparatory part	207.20	87.00	105.00	312.00
Main part	339.00	223.23	61.00	660.00
Final part	87.40	46.88	15.00	134.00
Active time of (lesson) exercise	785.00	367.25	268.00	1212.00

There are no bigger differences in the duration of lesson parts. For lessons with teaching content from exercises on equipment and floor introductory part is 151.60 seconds, and for sport games it is 149.60. For sport games average duration of preparatory part of the lesson is longer for 74.40 seconds. Interesting thing is the difference in the duration of active exercising during the main part of the lesson is longer for 607.80 seconds for lessons with sport games. The difference in the final part is also very small and it is 12.00 seconds in favour of lessons with sport games. The thing that leads to thinking is total active time (lesson) of exercising, which for lesson with sport games is 1477.40 seconds and for lessons with exercises on equipment is 758.00

seconds. The difference is 719.40 seconds or 51.31%.

Table 2. Descriptive parameters for lesson parts with teaching contents from sport games

	Mean	Std. Deviation	Minimum	Maximum
Introductory part	149.60	28.79	120.00	181.00
Preparatory part	281.60	75.15	181.00	360.00
Main part	946.80	282.29	601.00	1350.00
Final part	99.40	54.67	62.00	170.00
Active time of (lesson) exercise	1477.40	347.98	964.00	1882.00



Graph 1. *The presence of active time of exercising by lesson parts and active time (lesson) exercise in relation to teaching contents*

Diagrams of columns on Graph 1. Show minimal differences of active time of exercising in the first part of the lesson and they are in favour of teaching contents of exercises on equipment and floor. Minimal difference of active time of exercising is for final and preparatory part of a lesson and it is in favour of contents from sport games. The biggest difference is in favour of sport games contents in the main part of the lesson and it influenced longer duration of active part of (lesson) exercise.

Table 3. Significance of differences of duration of some parts of lesson in relation to teaching contents from exercises on equipment and floor and sport games

	t	df	Sig. (2-tailed)
Introductory part	0.062	8	0.952
Preparatory part	1.447	8	0.186
Main part	3.776	8	**0.005**
Final part	0.414	8	0.690
Active time of (lesson) exercise	3.059	8	**0.016**

The values of t-test indicate that between active time of exercising for introductory, preparatory and final part of the lesson there is no statistically significant difference in relation to teaching contents. The values of t-test show statistically significant differences only in the duration of active exercising in the main part of the lesson and total active time of (lesson) exercise and they are in favour of teaching contents from sport games.

DISCUSSION

Planning of physical education lesson in total process of planning makes its final phase. It is called micro planning or detailed planning. It starts with pointing out the special task of the lesson (unit for the main part of the lesson), on the basis of which the choice of body exercises and movements is chosen by which a certain planned lesson task is achieved. On the basis of the main part of the lesson the choice and distribution of contents is done on

other parts of the lesson. After lesson content preparation pedagogical preparation follows (the choice of methods and way of work), organizational, i.e., material technical preparation (prediction and preparation of equipment and marking of space) and in the end psychological preparation of a teacher. Planning is done immediately before the lesson and it is part of working and expert duty of every teacher. The results indicate that in the realization of teaching contents some procedures lack which influence very short active time of (lesson) exercise.

The values of active time of exercising of 13.08 minutes for exercises on equipment and floor are identical with active time of exercising of 13.42 minutes, with teaching contents from gymnastics in the research of Miskovic (1978) and Lucic (1975) in whose research the active time of exercising is 12.26 minutes.

In practice not a single lesson starts on time, a lot of time is lost on lining up, calling of students, and transfer from one to the other part of the lesson, pauses in shaping exercises, different stoppings and needless explanations in the third part of a lesson and the lesson always ends before certain determined time (Miskovic 1978; Markovic & Visnjic 2008).

Teaching contents from sport games with their effects have influenced active time of exercising of 24.62 minutes. Close values were acquired by the research of (Miskovic, 1978; Arunovic 1979) with the application of basketball.

Application of additional exercises and stations also influences on increase of exercise time (Prskalo & Findak, 2003; Markovic & Visnjic 2009; Prskalo, Babin & Bavcevic 2010). Short duration of active exercise is influenced by weak lesson organization, insufficient engagement of students and non-application of methodical-organizational work.

CONCLUSION

General statement is that the quality of teaching and active time of exercising depend on carefull and expet and responsible preparation of each lesson before its realization. The lesson without previous preparation can never be efficient, even if they is taught by experienced and good teachers. Lessons without previous preparation are more or less unsuccessful attempts which result in short active exercising, and insufficient influence on transformation of motor abilities of a lower grade students.

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PROBLEMS OF SPORT HIGH PERFORMANCE IN HIGHER EDUCATION INSTITUTIONS

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SUMMARY

This article describes the current research problems in the theory and practice of training process student-athletes in terms of its convergence with the sport of high achievements. Dependence was found between the activity of the sports club of the University and functional and psycho-physical formation of the student-athletes. Organizational and pedagogical basis for the development of university sports are considered as a set of state and public forms of activity.

Keywords: performance sports, sports club, functional formation, psycho-physical formation

INTRODUCTION

Difficulties development of university sports in general, and performance sports in particular due to the mismatch, and sometimes contradictory social, legal, economic and institutional foundations of the state and social structures in the universities of Russia in the new economic environment. Lack of responsibility for the lack of implementation capacity development of university sports and the conditions of its normative support from both the federal and regional structures, and limits the ability of universities students in the classes selected sport (Ilyinich, 1995). It should be recognized that the federal requirements for the formation of students' physical training of the person and the ability to use a variety of tools aimed Physical Culture, Sports and Tourism (Lubisheva, 1996) today are declarative.

It is in the higher educational institutions should create the necessary conditions for the teaching and training of the student-athlete, allowing them to achieve the level of preparation, the appropriate requirements of performance sports, as in many sports, especially in sports, the level of technical, tactical, physical and psychological trained athletes becomes necessary and sufficient for the implementation of new high achievement is the time of admission to higher education.

The object of this study is the development of university sports in the St. Petersburg Polytechnic University as an example of waterpolo. Subject of the study - organizational and pedagogical bases of formation of university sport in terms of its convergence with high performance sport.

Formation of university sports in the St. Petersburg Polytechnic University

St. Petersburg Polytechnic University qualitatively reconstructs the preparation of the graduates with higher education to meet the requirements of their future practical work in the modern economy. These requirements are fully applicable to the field of physical culture and sports. An analysis of their relationship in the training of students involved in sports and mastering the basic requirements of academic disciplines reveals their new relationship. An important role in this is played by the discipline "Physical Education" - an effective means of establishing a common culture, psychophysical formation and training of highly qualified specialists. (Kabanov, 20014).

Based on years of research at the St. Petersburg Polytechnic University, revealed the presence of groups of students at different levels of development of the sport, including a large group in number

(about 40%) ready-to-work training on the approximation of the boundary of performance sports. The changes due to institutional development of university sport in Russia, can solve this problem. At the same time it is necessary to correlate the legal, economic and organizational basis for the development of university sports with the existing international system of university sports and to ensure the integration of the activities of the World University Sports Federation (FISU).

The theoretical basis of the study were legal documents and regulations of the Russian Federation on socio-economy, management, law, research papers on management and economics of physical culture and sports, physical training theory (Seyran, 1995; Mihaliov, 1998; Matveev, 1999). Documentary analysis and statistics voluntary sports society "Petrel", Russian Student Sports Union (RSSU), as well as the results of the survey of students and interviews with faculty members of universities have confirmed the urgency of the problem.

Necessary conditions for the implementation of technical-tactical and physical training student-athletes competing for the realization of high achievements have been realized in the extracurricular activities at the University of team sports bases of the Department of Physical Education and Sports.

RESULTS AND DISCUSSION

The democratization of the requirements of federal programs on the parameters of academic load for students training in the sports department of the shortage of funding of higher education institutions, was the cause of failure in more than 50% of universities in the country claims 408 hours of labor input in the discipline "Physical Culture", which was one of the causes of clotting development programs of sports among the students and the elimination of sports clubs, universities. What managed to resist at the St. Petersburg Polytechnic University, where he actively gathering pace of development two sports club, "Polytechnic" - a club with more than half a century of history, organized and led by the Department of Physical Culture and Sports and the "Black Bears" - an ambitious young club with student government by which the national team of the St. Petersburg Polytechnic University's water polo and mini water polo manages to be as visible in the sports life of St. Petersburg (multiple winners of the Championships of higher educational institutions of St. Petersburg in these disciplines) and among amateur teams of Russia (the participants of the final stage of the championship and the Cup of Russia), as well as to enter the international arena, taking part in international tournaments in Serbia, Estonia and Russia.

When survey high-class athletes (MSIC and MS) and skilled athletes (HIC and grade 1) it was found that as the most important reasons for admission to higher education was not only the desire to get a trade, which in this case is not the dominant entrants. Revealed that the opportunity for students to continue to work out in the period of study - one of the leading reasons for admission to the university.

In the sports program of the University is constantly growing number of participants. To university sports competitions characteristic multilevel building. Student sport in many countries is the basis of the national sports policy and is governed by state laws and regulations; observes an increase in the role of universities in the development of the movement "Sport for All", which is in the interest of development of higher education institutions; opportunity to continue their studies in selected sports available to students in the university sports clubs that operate on the basis of contracts concluded with them; different approaches to government support of university sports (from the direct targeted funding to provide various tax benefits).

CONCLUSION

In order to improve the physical and sports students, organizational and pedagogical basis for the development of university sports should be viewed as a set of state and public forms of activities aimed at the implementation meet the interests and needs of student-athletes, including taking into account the need for training of sports reserve for national teams Russia.

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GROWTH AND DEVELOPMENT OF ANTHROPOMETRIC MEASURES AND THE PHYSICAL WELL-BEING OF STUDENTS IN THE EARLY AND MIDDLE SCHOOL AGE – A COMPREHENSIVE STUDY OF MACEDONIAN STUDENTS

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SUMMARY

Introduction: The main goal of this research is to determine developmental changes in height, weight and some indicators of body composition in Macedonian students from early and middle school age.

Methods: The survey was conducted on a sample of nine thousand two hundred and twenty eight) 9,228 students from nineteen (19) primary schools in central and eastern Macedonia. Samples (mean age 10.02 ± 2.4 years) were divided into two subcategories by gender: four thousand five hundred and nineteen (4519) boys and nine thousand two hundred and twenty eight (9228) girls. Each subcategory was further divided according to the chronological age: nine (9) age groups of nine (9) male and adult female groups in the span of one calendar year. So as to achieve the objectives of the research three anthropometric measures (IBP methodology), and body composition is determined by BIA were taken. The results were statistically processed with SPSS, v. 17.0 for WINDOWS (basic statistics, Student T - test).

Results: The results generally indicate a linear trend of increasing body height, weight and body mass index with the age of respondents. The percentage of adipose tissue shows oscillatory changes with age in both sexes. The percentage of muscle mass of the body constantly increases with both boys and girls up to their 12th year. In girls between the 12th and 14th year, there was a decrease in the percentage of muscle mass of the body, while in boys the upward trend continues.

Keywords: early school age, secondary school age, anthropometric characteristics, BMI, bioelectrical impedance.

INTRODUCTION

Undergoing physical development means the process of growth, differentiation and tissue maturation. All of these processes in the overall development of the individual do not always run parallel with the pace of change, and as such this requires a different structure of anthropometric dimensions. Hence it can be concluded that the anthropometric dimensions of the adult are not just the enormous dimensions of the child. All processes that characterize physical development, and the development in the period from 6 to 14 years of age, were determined by correlating the effect of various endogenous and exogenous factors.

Among the endogenous factors, the genetic factor holds a special place, and those dispositions, as well as the related factors of race, gender, endocrine system and effector tissues and organs all add up.

Among the exogenous factors, among others may be considered the socioeconomic conditions, geographical - climatic conditions, conditions of the season, as well as physical activity. Although the effects of these factors are present throughout life, they are especially pronounced in the first year of life and in phase of pre-puberty and puberty.

Movement in general, and especially the systematic physical exercise, sports, training and physical activity through play, consistent with adult characteristics are important factors for the development of man. Studies show that the efforts of

the muscles within these activities affect bone, muscle, cardiovascular, respiratory and other body systems, which is important and helpful, in conjunction with adequate rest and sleep, and optimal nutrition, which allows for better physical development.

The anthropological view of endogenous and exogenous growth factors to regulate interaction characteristics in humans, its development and behavior is important. Also, the impact of the favorable conditions of the external environment, including physical activity may, to some extent, improve the development of individual properties, but some properties on the overall impact may be relatively small.

Most of the previous research on this anthropological space focused on monitoring body height and weight at different age periods in children and adolescents (Medved et. al, 1987; Zdravković, 1978; Pavlović, 1999; Božić-Krstić et al., 2003). A smaller number of authors have dealt with the monitoring of body composition in different periods in children and adolescents.

The aim of this research is to identify developmental changes in height, weight and some indicators of body composition in Macedonian students from six (6) to fourteen (14) years of age.

METHODS

Sample of respondents

The research was conducted on a sample of 9,228 adolescents of Macedonian nationality, from 19 primary schools from central and eastern Macedonia, out of which 8 are in rural areas and 11 are in urban environments. The sample has been divided into two sub-samples by gender: 4,709 of the respondents are boys and 4,519 respondents are girls. The average age of the respondents of both genders was 10,02 ± 2,4 years. Each of the sub-samples is also divided according to the chronological age in 9 age groups in the span of one calendar year. The chronological age has been defined on the basis of decimal years (difference between the measurement date and date of birth, which are transformed into an appropriate sized division of the year into ten instead of twelve months). Accordingly, there are 9 male age groups and 9 female age groups established in span of one calendar year, as follows: 6 (6 - 6.9), 7 (7 - 7.9) , 8 (8-8.9) 9 (9 - 9.9) , 10 (10 - 10.9), 11 (11 - 11.9), 12 (12 - 12.9) 13 (13 - 13.9) and 14 (14 -14.9) years.

The study included students for whom their parents had given consent to take part in the research, who were psychologically and physically healthy and who regularly attended classes of physical and health education. The respondents were treated in accordance with the Helsinki Declaration. Measurements took place in March, April and May 2012, in standard school conditions at regular classes of physical and health education. The measurements were conducted by experts from the area of kinesiology and medicine, previously trained to perform functional tests and to take anthropometric measurements.

Anthropometric measures and body composition

Measuring anthropometric measurements was conducted according to the recommendations given by IBP-International Biology Program, (Lohman et al., 1988). For estimation of the morphologic characteristics the following anthropometric measurements have been applied: body height in standing position (cm), body weight (kg), as well as the body mass index (BMI).

Components of the body composition have been determined by the method of bioelectrical impedance (measuring of the electric conductivity - Bioelectrical Impedance Analysis - BIA). The measurements were conducted by using a Body Composition Monitor, model "OMRON - BF511", by means of which we have measured the body weight, fat tissue percent and muscular mass percent. Prior to commencing the measurement we had entered the parameters of gender, age and body height of the respondent into the Body Composition Monitor. In order to provide better precision of the results obtained from the estimation of the body composition, prior to each measurement, we ensured that the preconditions recommended by ACSM (2005) and Heyward (2006) had been fulfilled.

Statistical analysis

The results of our anthropometric measurements for assessing physical dimensions are grouped according to sex and age in a decimal year. For the

same age group the following was calculated: the arithmetic mean (Mean), standard deviation (SD), coefficient of variability (KV%) for each variable analyzed. The significance of differences of the means between boys and girls in each variable is tested with the significance fixed at p = 0.05.

Therefore calculated basic parameters of the distribution was applied to the T - test to determine differences between the means of adjacent age groups especially for girls and boys.

All the analyses were performed using the Statistical Package for Social Sciences software (SPSS, v. 16.0 for WINDOWS; SPSS Inc., Chicago, IL, USA), and values of p <0.05 were considered statistically significant.

RESULTS

From an analysis of Chart 1 and Table 1 we can see that the height of the body against age are continuously increasing in boys and girls. From the values of t - test that is applied to determine the differences between the means of adjacent age groups we can conclude that statistically significant differences were obtained in both sexes between all adjacent age groups. From examination of Table 1 it can be seen that statistically significant differences between boys and girls in anthropometric measurements of body height of those aged 9, 11, 13 and 14 years of age.

Table 1. Basic statistical parameters and statistically significant differences between age categories of anthropometric measure the height of the body with students from 6 to 14 years

Age	Boys			Girls			
	Mean	SD	P trend	Mean	SD	P trend	P
6	122,03	5,92	-	121,15	5,58	-	,038
7	126,73	5,92	>	126,27	6,06	>	,214
8	132,44	6,38	>	132,24	6,45	>	,610
9	138,07	6,73	>	137,25	6,96	>	,040
10	143,19	7,25	>	144,04	7,38	>	,059
11	148,91	7,65	>	150,00	7,62	>	,015
12	155,06	8,54	>	155,83	6,78	>	,109
13	162,43	8,71	>	159,64	6,58	>	,000
14	168,41	7,75	>	160,73	6,21	>	,000

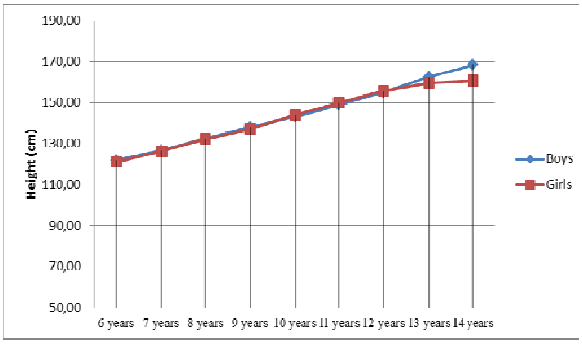

Figure 1. Development trend of anthropometric measure the height of the body with students from 6 to 14 years

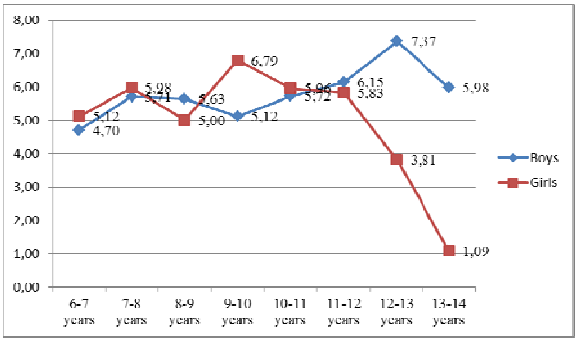

Figure 2. Change of anthropometric measure body height on a year level

Analysis of Figures 3 and 4 and Table 2 shows that the weight of the body is constantly increasing with age in both sexes. In both sexes statistically significant differences were obtained between all adjacent age groups. Based on the obtained results it can be seen that statistically significant differences

between boys and girls in anthropometric measurements of body weight set at the ages of 9, 13 and 14 years of age.

A study of Figure 5 and Table 3 will reveal body mass index, which shows a slight increase continuously with age in both sexes. From the values of t – test it can be seen that statistically significant differences were identified between 8th and 9th, 9th and 10th, 10th and 11th, 12th and 13th and 13th and 14th neighboring age group of boys between 8th and 9th, 9th and 10th, 10th and 11th, 11th and 12th, 12th and 13th and 13th and 14th neighboring age group for girls. Statistically significant differences between boys and girls in the index of body mass is determined only at the age of 9.

Table 2. Basic statistical parameters and statistically significant differences between age categories of anthropometric measure body weight with students from 6 to 14 years

Age	Boys			Girls			
	Mean	SD	P trend	Mean	SD	P trend	P
6	25,56	5,32	-	25,56	5,62	-	,999
7	28,66	6,73	>	28,11	6,47	>	,179
8	32,23	8,15	>	31,52	7,83	>	,134
9	36,93	9,54	>	35,52	9,34	>	,011
10	40,90	10,74	>	40,33	10,19	>	,375
11	45,52	12,43	>	44,82	10,95	>	,305
12	50,08	13,37	>	50,53	11,61	>	,568
13	56,06	13,23	>	54,24	11,17	>	,016
14	62,75	14,52	>	56,77	11,08	>	,000

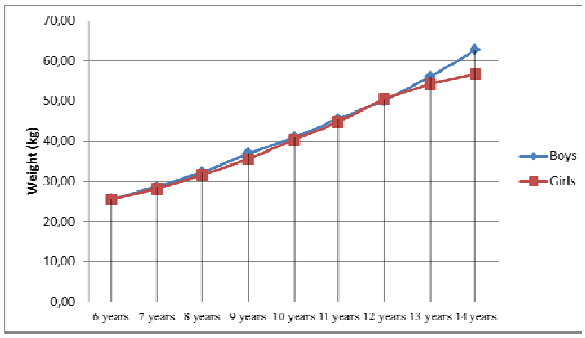

Figure 3. Development trend of anthropometric measure body weight with students from 6 to 14 years

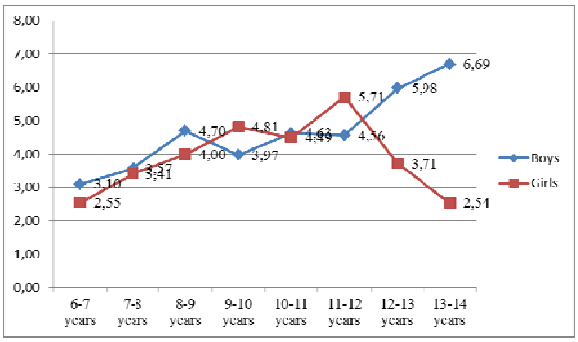

Figure 4. Change of anthropometric measure body weight on a year level

Analysis of the Figure 7 and Table 4 allows us to see that the percentage of adipose tissue shows oscillatory changes with age in both sexes. From the values of t – tests it can be seen that statistically significant differences were identified between the 8th and 9th, 9th and 10th, 11th and 12th, 12th and 13th and 13th and 14th neighboring age group in girls. In boys statistically significant differences were identified between the 8th and 9th, 9th and 10th and 11th, 12th and 13th and 13th and 14th neighboring age group. Statistically significant differences between boys and girls in the percentage of fat is set at 6, 7, 12, 13 and 14 years of age.

Table 3. Basic statistical parameters and statistically significant differences between age categories of anthropometric measure BMI with students from 6 to 14 years

Age	Boys			Girls			
	Mean	SD	P trend	Mean	SD	P trend	P
6	17,46	2,94	-	17,37	2,86	-	,698
7	17,80	3,12	ns	17,73	3,22	ns	,714
8	18,25	3,45	ns	17,90	3,26	ns	,077
9	19,16	3,67	>	18,70	3,69	>	,032
10	19,73	3,83	>	19,29	3,82	>	,061
11	20,33	4,34	>	19,92	4,17	>	,101
12	20,59	4,13	ns	20,67	3,97	>	,751
13	21,18	3,96	>	21,22	3,87	>	,870
14	22,08	3,99	>	21,89	4,01	>	,519

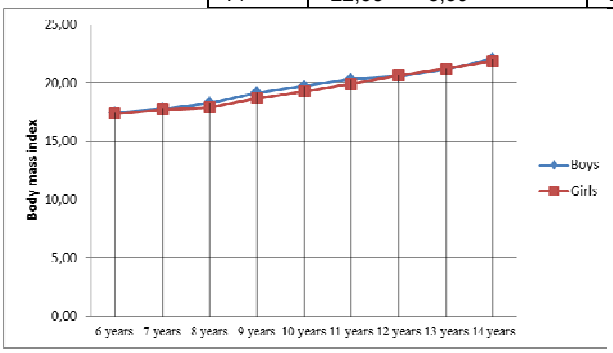

Figure 5. Development trend of BMI with students from 6 to 14 years

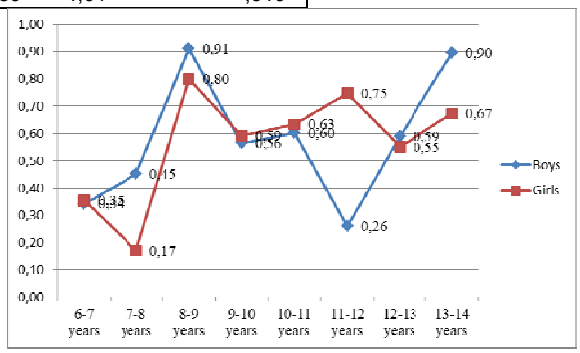

Figure 6. Change of BMI on a year level

Table 4. Basic statistical parameters and statistically significant differences between age categories of body fat with students from 6 to 14 years

Age	Boys			Girls			
	Mean	SD	P trend	Mean	SD	P trend	P
6	23,24	6,88	-	21,39	7,69	-	,001
7	23,01	7,48	ns	21,68	8,31	ns	,009
8	22,49	7,78	ns	21,61	8,42	ns	,069
9	23,32	8,07	>	23,06	8,66	>	,591
10	23,51	8,08	>	23,12	8,67	>	,449
11	22,82	8,60	<	22,93	8,03	ns	,830
12	21,41	8,36	ns	24,43	7,78	>	,000
13	19,01	8,20	<	25,99	7,28	>	,000
14	18,22	7,73	<	27,62	6,80	>	,000

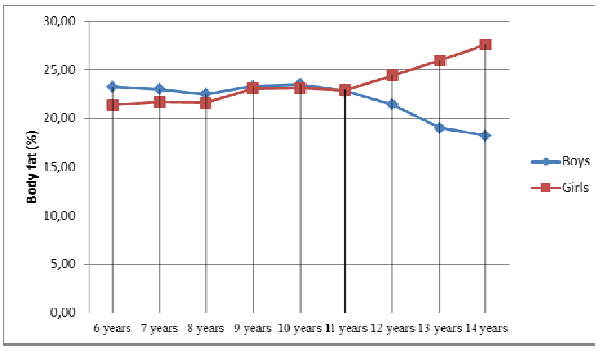

Figure 7. Development trend of body fat with students from 6 to 14 years

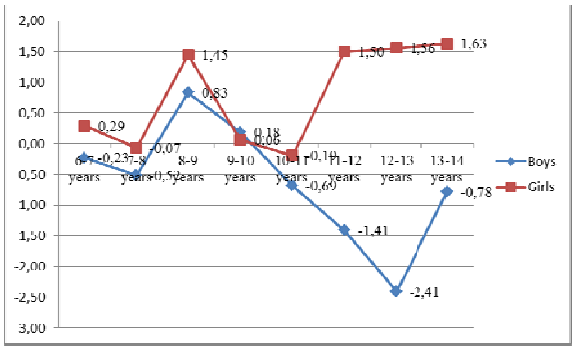

Figure 8. Change of body fat on a year level

Analysis of the Figure 9 and Table 5 shows that the increase in the percentage of muscle mass of the body is not linear in all age categories, but shows periods of faster and slower intensity. From the values of the t – test it may seen that statistically significant differences were obtained between all adjacent age groups in both sexes, but of note were the numbers generated by girls between the 11th and 12th and 12th and 13th neighboring age groups. Based on the results in Table 3 it can be seen that statistically significant differences between boys and girls the percentage of adipose tissue exist in all age groups except at the age of 7 years.

Table 5. Basic statistical parameters and statistically significant differences between age categories of muscular mass with students from 6 to 14 years

Age	Boys			Girls			
	Mean	SD	P trend	Mean	SD	P trend	P
6	26,36	3,54	-	27,06	2,32	-	,002
7	28,37	2,95	>	28,62	2,13	>	,133
8	30,43	2,65	>	30,14	2,06	>	,037
9	31,97	2,39	>	30,89	2,21	>	,000
10	33,10	2,36	>	32,13	2,41	>	,000
11	34,49	2,78	>	32,94	2,56	>	,000
12	36,00	3,02	>	33,33	2,41	ns	,000
13	37,85	3,16	>	33,15	2,42	ns	,000
14	38,59	3,06	>	32,63	2,43	<	,000

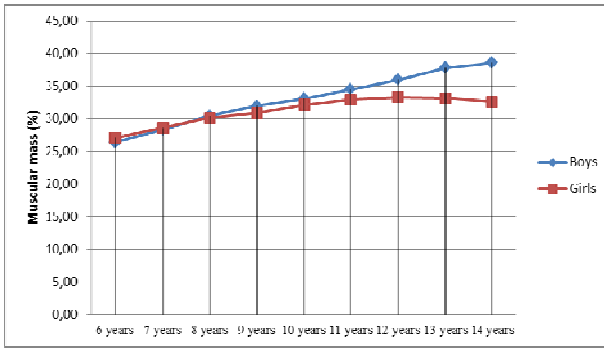

Figure 9. Development trend of muscular mass with students from 6 to 14 years

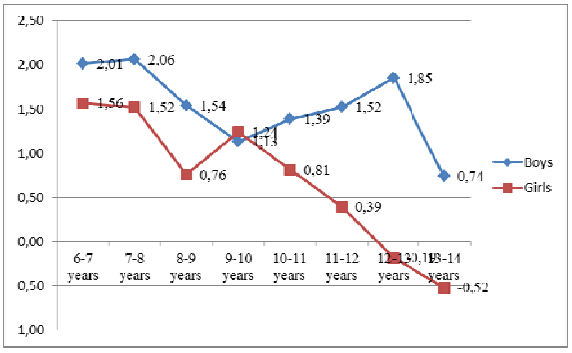

Figure 10. Change of muscular mass on a year level

DISCUSSION

The height of the body with age is continuously increasing in boys and girls. Growth is not linear in all age categories, but shows periods of faster and slower growth speed. The average increase in body height in boys between the 6th and 14th year is 5.80 cm and 4.95 cm in females and in both sexes the same annual increases ranging from 1.09 to 7.37 cm. The greatest increase in the amount of body girls have is between the 9th and 10th year average of about 6.76 cm. In boys the greatest increase in the height of the body between the 12th and 13th year averages about 7.37 cm. The coefficient of variation of the height of the body is most pronounced in 12th year for boys and in the 10th year for girls. Such behavior of the variability of the amount of the body is a consequence of the unequal pace of development in individual subjects (Rogol et. al., 2002; Malina, et. al, 2004). For some respondents sexual maturation starts early, so it starts a little earlier than is normal, but in others it starts later – as such, although respondents may be of the same chronological age, they are not all of the same biological age.

The weight of the body is constantly increasing with age in both sexes. The average increase in body weight in boys between the 6th and 14th year is 4.65 kg and 3.90 kg in females and in both sexes the same annual increase is observed in the range of from 2.54 kg to 6.69 kg. The largest increase in body weight was observed in girls between the 11th and 12th year, with an average of 5.71 kg, while the boys greatest weight increase is observed between the 13th and 14th year, an average of about 6.69 kg. The coefficient of variation of body weight is most extensive in the 11th year for boys and in the 9th year for girls. Slight variations in body weight were observed in the 6th year for boys and the 14th year for girls. Similar results in monitoring body height and weight were obtained in anthropometric surveys from 1999, 02/01/2000, with the realized sample respondents being children from the Serbian city of Novi Sad aged between 3 and 11 years of age. (Božić-Krstić et al., 2003).

Body mass index, shows a slight increase continuously with age in both sexes. Increasing body mass index is not linear in all age categories. In girls the greatest acceleration of body mass index was observed between the 8th and the 9th year, while in boys the greatest acceleration of body mass index was observed in the 8th and 9th and 13th and 14th year – at an average of about 0.90 %. The greatest variability in both sexes body mass index was seen at the 11th year.

The percentage of adipose tissue shows oscillatory changes with age in both sexes. In boys the greatest percentage increase in adipose tissue is observed between the 8th and 9th year at an average rate of 0.83 %. In girls the greatest percentage increase in adipose tissue is observed between the 13th and the 14th year, at an average of 1.63 %. In boys from the 10th to the 14th year there is a downward trend in the percentage of adipose tissue from year-to-year. In girls between the 10th and the 11th year, there was a decrease in the percentage of adipose tissue, averaging 0.19 %, and then came to a continuous increase in the proportion of fat in the 14th year. This situation is due to the effects of endocrine adaptations typical of sexual maturation. In boys, there is an increase in the level of male hormones (testosterone) that stimulates anabolic processes, leading to increased muscle mass and reducing the percentage of fat (Rosenbaum M, Leibel RL, 1999; de Ridder CM, et. al. 1992; Tanner, 1986; Legro RS, et. al., 2000). The greatest proportion of variability shows fat boys in 13th year, while the girls in the 8th year. The lowest percentage of variability shows fat boys in 6th year, while girls in 14th year.

The percentage of muscle mass of the body is constantly increasing both with boys and girls up until the 12th year. In girls between the 12th and 14th year, there was a decrease in the percentage of muscle mass of the body, while in boys the upward trend was seen to continue. In boys, the greatest percentage increase in muscle mass was seen between the 6th and 7th year, and the 7th and 8th year, averaging 2.00 % for 12 year olds and for 13 year olds averaging 1.85 %. From the 8th to the 10th year in boys the increase of annual decline, then the increase to be relatively constant annually until the 13th year. From the 6th to the 11th year in females the increase of muscle mass per year is relatively constant until the 11th year - then the increase of muscle mass every subsequent year declines. The greatest proportion of variability in muscle is seen from the 6th sixth and 7th year in boys and 6th year girls. The lowest percentage of variability of muscle was observed in the 10th year in boys and 8th in girls.

Girls at the age of 11 are statistically significantly higher than in boys, while boys are statistically higher in the 9th, 13th and 14th years of age. Boys compared to girls have a statistically significant higher average body weight at the age of 9, 13 and 14 years of age. In other age categories there are statistically significant differences in weight between boys and girls. The body mass index (BMI) were not significantly different between boys and girls in most age groups, except the 9th year, where boys show slightly higher values of body mass index. The age of the 6th and 7th years the boys have a statistically significant higher percentage of body fat compared to girls, while 12 to 14 year old girls have a statistically significant higher percentage of body fat compared to boys. At the age of 6 years old girls have a statistically higher percentage of muscle mass, while the 8th to the 14th year, the boys have a statistically higher percentage of muscle mass, which increases with age.

Young and middle-school age children go through many phases. Physical activity is essential for the healthy and balanced development of children and youth. Engaging in regular physical activity brings many uses on the physical and mental health and social functioning of children and youth. It is known that physical activity contributes to the construction and preservation of the health of bones, muscles and joints and helps control weight, and is useful in aiding body fat reduction and improving cardiorespiratory functions.

Because all states are recommended to parents, educators, teachers and children, systematic physical activity is a strong stimulus for correct growth for the whole body and for all major organs and organic systems, encouraging them to develop and become strong whilst strengthening the adaptive capabilities of the organism.

The results of this study represent a small contribution to resolving the problem of the growth and development of anthropometric measures and physical well-being of students in the early and middle school age. There is a possibility of comparing the results of this research with previously established norms for children and youth of the same age and sex, and comparing with the results of other relevant studies.

CONCLUSION

Growth is not linear across all age categories, but shows periods of faster and slower growth intensity. Body mass index shows a slight increase continuously with age in both sexes. In girls the greatest acceleration of body mass index is seen between the 8th and the 9th year, while in boys the greatest acceleration of body mass index is seen in the 8th and 9th year and the 13th and 14th year, averaging about 0.90 %. The percentage of adipose tissue shows oscillatory changes with age in both sexes. In boys the greatest percentage increase in adipose tissue is observed between the 8th and the 9th year, averaging 0.83%. In girls the greatest percentage increase in adipose tissue is observed between the 13th and the 14th year, averaging 1.63%. The percentage of muscle mass of the body is constantly increasing in both boys and girls up to 12th year. In girls between the 12th and the 14th year, there was a decrease in the percentage of muscle mass of the body, while in boys the upward trend continues. Girls at the age of 11 are statistically significantly higher than in boys, while boys are statistically higher in the 9th, 13th and 14th years of age. Boys compared to girls have a statistically significant higher average body weight at the age of 9, 13 and 14 years of age. The age of the 6th and 7th years the boys have a statistically significant higher percentage of body fat compared to girls, while 12 to 14 year old girls have a statistically significant higher percentage of body fat compared to boys. At the age of 6 years old girl have a statistically higher percentage of muscle mass, while the 8th to the 14th year old period notes that boys have a statistically higher percentage of muscle mass, which increases with age.

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CHESS AS A TOOL FOR YOUTH DEVELOPMENT

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SUMMARY

Introduction: The subject of study is the use of chess in the development of human resources, particularly cognitive and conative abilities. Centuries of practical experience indicates that active involvement in chess transformed into an accelerated spiritual development of players. The studies that have been conducted, and in this paper interpreted, directly show a direct link between chess activities and personality development, ie. careers of individuals. The research problem is the lack of "depth" research, target and methodologically well-designed, ie. relevant to the argument about the usefulness of chess. The aim of the research is to "handle" the existing research, but also to highlight the need for further research is the impact of chess on the disposition of people. The basic hypothesis is indisputable- chess has a positive effect on the overall personality development of players, their behavior, social role in society, ie. their achievements in the broadest sense.

Methods: Respondents in previous research are selected according to a subjective view of the author and so must be treated, with the caveat that some research are without statistics processing. The criterion of research is based on the chronological order and the case studies.

Results: Interpretation of the results is in the analysis of previous research, as well as finding of the work.

Conclusion: Analysis of the results shows that playing chess is correlated with a range of cognitive and conative dimensions of personality. The limit is in the weak methodological basis of previous research. Future research should be based on rigorous scientific methodology, statistical processing and qualitative conclusions.

Keywords: Chess, personality, disposition

INTRODUCTION

Archaeological discoveries in India and China as the forerunner of chess games, tied for the fifth century. "The Royal Game" and "Game of Kings" first gained adherents among the rulers and the courts in China, India and Persia. Chess is quickly spreading through the Arab world (Arab caliphs are passionate about playing chess), the northern part of the Mediterranean and southern Europe. In the Middle Ages known chess players are members of royal families, poets, scientists. Today, chess is a recognized sports industry with the vertical organization of the Chess Olympics.

What was so appealing about this ancient game to prominent figures in politics, science, art, military strategy? The answer to this question must be sought in the definition of chess, and the impact of chess, the broadest terms, to the human nature. There is consent of the authors, who dealt with the question of the essence of chess, it's a fun intellectual game that can impress and enchants players and makes them passionately devoted, often entire lifetime. The greatest English writer to the advent of Shakespeare, philosopher, diplomat, astronomer Geoffrey Chaucer, known for his work "The Canterbury tales" (XIV century) used the chess metaphors in the book of the duchess and the novel about a rose, saying, among other things, although he was not a renowned chess player: "I have to warn you that chess is not at all childish game". World Chess Champion Max Euwe emphasized that chess is undoubtedly the sport because "The aim of the game is to get the winner". Our famous grandmaster Gligorić thought that chess is "sport with elements of science", and world champion Karpov that chess is "the sport, and the arts, and science". Furthest in attempt to define chess went world champion Bobby Fischer who once made the chess game even with life itself and the famous English romantic poet, Byron, noting that "life is too short for chess."

When you master the art of chess beyond a certain critical level, it seems that this game has the magical power to act on people contributing to

"fight, which is the basis of all human destiny- the struggle for survival" (Emanuel Lasker, philosopher, mathematician, psychologist and world chess champion, which is the longest to retain the title). Competitive character definitely makes this game a specific sport. Today in the world chess plays more than 600 million people of whom about six million registered players competing at different levels, and approximately 200,000 chess players have an official rating devised by Elo. A huge majority of chess players are playing out of pleasure without pursuing top ranges, as in other sports, there are top representatives, the "ordinary" professionals, amateurs, hobby committed, observers, etc.. Chess, therefore, makes people a sports-minded, but also enables them to express their latent agon (competitive) motive without any harm to other people and society. Regarding that, some psychologists believe that chess allows sublimation of aggressive impulses of man in a socially acceptable manner. Psychoanalyst and chess grandmaster Fine raised other interpretation of chess and chess players, some of which are debatable and controversial (Fine, 1967).

This paper is interested in chess as a tool for raising the creative potential of the people and thus as a tool for human resource development as the defense of the process of destroying the natural environment and globalist establishment of human consciousness.

PREVIOUS RESEARCH OF CHESS EFFECT

It is believed that chess stirs the creative potential of the people, which is succinctly expressed by one of the most famous Russian grandmaster, Bronstein, saying: "The essence of chess is-imagination". There is no doubt that chess contains aesthetic component which occurs, for example, evident in the performance of the combination and sacrifice figures for checkmate attacks. Chess theorists consider this a kind of "victory of spirit over matter". It is assumed that playing chess requires and encourages concentration, memory, creativity, imagining new possibilities and predict the future of the game. It's rightly expected that chess contains many scientific principles- calculating the alternative, hypothesis testing, feasibility assessment, formulation, a realistic assessment of the position, logical thinking (the operation symbols), thoughtful decision-making, and so on. The research will show whether chess develops artistic expression and mathematical way of thinking, in particular the ability of spatial visualization, and accuracy, and combinatorics. It is believed that the chess player seeks and promotes responsibility, self-criticism, independence and self-confidence. There are many observations that chess game helps the socialization of the young and the adoption of democratic principles expressed in the motto chess organizations around the world, "Gens una sumus"- "We are one of kind". There is a belief that chess teaches young fair play, respect for rivals and the rules and not only in the realm of games, but in terms of transfer to other sports and social situations in general. It is obvious that chess requires and puts to the test the ability to economize time that is available to complete the task. Finally, the experience of victories and defeats, missed opportunities, studious rescue of defeat, oversight, etc.- all this means that a personality of the player can mature through the game, whose transfer to daily life is significant. Potential of chess games in the prevention of juvenile delinquency and re-socialization has long been observed, and certain therapeutic options of chess in various areas, including affirmation of the handicapped and socially deprived, but so far lacks empirical research that will confirm mentioned expectations and observations through rigorous methodological procedures.

That many claims about the benefits of chess would not be misused, and accepted commonsense, it is necessary to have methodologically well-funded experimental research specific hypotheses about the scope of chess with the use of control groups and appropriate statistical treatment plans. For example, it is known that chess attracts children and adults who are intellectually above average, that "the chess is touchstone of the human intellect" (Goethe), but that does not mean automatically that chess improves general intelligence which is known to be largely genetically determined. Belief that chess "makes kids smarter" (Dullea, as A. Graham and Dauregne; quoted in McDonald, 2012) sounded cute and enthusiastic, although seeking research evidence rather than projecting wishes and taking things "for granted". Also, the research contributions of chess development of various mental dispositions must take into account the phenomenon of the "Pygmalion effect" or Rozentalovog effect which manifests itself through the progression of the participants of the experiment due to increased attention and expectations of the experimenter to them (Rosenthal

and Jacobson, 1992), therefore, independent of the impact of the chess. It is possible that when there are expressed higher expectations of the participants in the experiment, that they get better results. The term is similar to "Hauthorne" effect of industrial sociology or the placebo effect in medicine. It is believed that the Pygmalion effect a variant of the phenomenon known as "self-fulfilling prophecy" which is a famous sociologist Merton (1968) determine as its prediction that directly or indirectly formulated to have to show exact due to positive feedback between belief and behavior. The authors who study the effects of chess must avoid the contamination due to the anticipation of the participants experience research hypotheses with the unconscious need to meet the authors of the experiment, and various other factors unwanted interference that can experimenter misled.

The first psychological studies of chess players took the famous French psychologist Alfred Binet (1857-1911.), who constructed a first test of intelligence and proposed the concept of intelligence quotient (IQ) with an average value of 100, which are obtained by dividing mental with the calendar age (up to 16-th, in some versions to age 18) and multiplying the quotient by 100. He has conducted a research in 1893 about the connection between math and chess on a sample of leading chess players finding that more than 90% of them have a good memory and the ability of mental calculations. He found that some mathematicians play chess, but only few of them are strong chess players. Bine in 1894. investigated the cognitive abilities of chess masters finding that only they are able to play chess "blindly", ie. not looking at the position on the board (with the mediator who was brought moves), while mediocre players were not able to do that. He concluded that the experience, imagination and memory variants relevant conditions that determine whether someone would be a good chess player or not. Strong really blind chess players have used different ways of memorizing positions (mnemonic) than chess amateurs, mainly burdened by unsuccessful attempts to visualize the position.

Three Russian psychologist (Đakov, Rudik and Petrovski) in 1927. founded that the memory power of eight chess grandmaster is superior compared to ordinary chess players, while in other areas the difference between the two groups were not impressive, even in terms of the amount of IQ. Based on the tests, they concluded that success in chess is based on good visualization, combining strength, speed calculating combination, concentration and logical thinking.

Leta Hollingsworth studied twenties of the last century highly intelligent children (IQ 180 and higher, IQ above 140 indicates a potential genius), but which were poorly adapted to the school because they had underdeveloped work habits, negative attitudes toward learning and school difficulties communicating with other children, a tendency daydreaming, and so on. It was concluded that playing chess could help this children to overcome social difficulties. The conclusion of this work fits into the case Bobby Fischer who at the age of 15 had IQ between 180 and 187, but dropped out of high school. Second world champion, Kasparov, psychologists in Germany found that he has IQ 135, although it is speculated that is identical to the Fisher IQ, but Kasparov tested an extremely high memory capacity.

Swiss international chess master and a psychology professor Fernand Gobet with one of her doctoral students (Gobet and Campitelli, 2007) found in a sample of 104 Argentine chess player that on average it takes seriously devotion of 11,000 hours to chess to achieve the rating of 2.200, which is approximately the level of the master but there are large individual differences, as some do these titles come after only 3000 hours on chess, and others should be 23,000 hours. For the master level rating it needs tentatively about seven years of practice. Non-professionals who are starting to play chess in childhood reach their maximum interest somewhere around the age of 18, but after this limit they have decreasing commitment chess for giving priority to studies, employment and marriage. However, mid-thirties, when working careers stabilize, many returning to the chess game. The first three years of childhood dedicated to chess are formative important than any three years later. Most chess masters opted for the serious approach to chess in the period when they were 10 to 12 years. These authors founded significant differences in the methods of preparation of chess players: 83% say that they play flash games, 67% use the database, 66% playing against chess programs on the Internet, 56% monitored the game of chess without using the table, 23% plays the game of chess "blind" and so on. Stronger players are particularly different from weaker players in terms of reading chess books, which was the best predictor of chess skill. Over the years of playing the strongest players learn the hundreds of thousands of typical positions, although

J. Polgar, the best chess player of the world, says that the number is actually ten times smaller if ignored well-established variations in the opening. Knowledge of these typical position patterns contributes to strong chess players, "intuitive", quickly and accurately find the best moves in the parties than unrated amateurs.

Adriaan de Groot, a Dutch chess team member and psychologist, received his doctorate in 1946, and his thesis was published in English in 1965 under the title "Opinion and choice in chess". He studied the cognitive processes of chess players of different strength. He has exhibited positions and track selection of moves of players in the next few seconds. He found the four stages of decision-making for moves: orientation (assessing the situation and making general ideas in this regard), exploration of the analysis of variants, research that results in deciding on probably the best solution and phase checks whether the selected move is really the best move. This author confirmed conclusions of Binea that visual memory and perception are important (reconstruction position exhibited no more than 3-4 seconds), and the ability to solve the most important problems in chess.

Four decades ago, there has been a fundamental change in the orientation of empirical studies of chess and chess players- research top players are thinned and there was a new trend: the study of the value of chess as an educational means. This turn of events have contributed to at least four factors:

(1.) the accumulated knowledge gained from the research of established players, but beginners and their mutual comparison;
(2.) the need to determine the influence of chess on the younger generations in their critical period of development;
(3.) lowering the age limit to play top chess, ie. phenomenon of children- grandmaster and master forces during the information revolution and
(4.) more frequent observations of work practices clubs and other organizational forms of playing chess, parents, teachers and school principals about the many positive effects of this ancient game on the young.

This tendency to study the effects of chess began in 1973. when Albert Frank (1978) in cooperation with the National University of Zaire conducted an experiment in high school in Kinsagani introducing seven weeks course of chess instead of regular work hours in mathematics. It has been shown that chess as an independent variable significantly contributed to arithmetic achievement, but to the surprise of the authors, and "verbal logic", the measured mainly by identifying synonyms and antonyms. And at the end of high school, two years after the end of the experiment the students of the experimental group had significantly better results in mathematics and French in comparison with a control group that did not have the experience of chess training. These findings in A. Frank dissertation are widely cited, stimulated discussion about the method and significance of the findings and contributed by other authors to focus their research in order to verify that chess "makes kids smarter", although this was Frank never claimed.

In his doctoral dissertation, "Chess and Cognitive Development" Johan Christiaen in Belgium from 1974. to 1976. (quoted from other sources) for fifth grade students who were divided into two groups of 20 subjects applied the experimental draft "before-after" with 42 hours of chess training only in the experimental group. In both measurements is applied battery of tests in which the majority were Piaget's tests of cognitive development. At the end of the fifth and sixth grade students in the experimental group were significantly better not only for the testing of cognitive development, but also in terms of the regular school curriculum, compared with students in the control group that did not attend chess classes. It is important to bear in mind that the students were randomly divided into two groups at the beginning of the experiment, ie. those groups are equalized at the start. However, the range of this experiment is limited because of the small number of participants.

Advertised Venezuelan project "Teaching of thinking" about which Rafael Tudela, the first president of FIDE action "Chess in Schools" in 1984, said: "There is no doubt that this project as a whole considered as one of the greatest social experiments of this century", was conducted on 4266 (1266 according to some sources) of primary school students in the period 1977-1984. in order to ascertain whether learning chess contributes to the increase in IQ, or intelligence. Wechsler Intelligence Scale for Children was used. After about a year of teaching chess it is registered a significant increase in the average capacity- higher IQ. Apparently the government of the state was so impressed that since 1988. has introduced chess as a subject in all the local schools. However, in the report for 2011. FIDE action "Chess in schools!" for this country is not

mentioned. Doubts raises about the claim that the increase IQ occurred in all groups of students- in both sexes, in terms of socio-economic background of children, their school success, etc. Conclusions about growth IQ are the least problematic. You can not see who is the author of the study, nor where it is published (except FIDE Report, 1984, p. 74), or the age profile of students. It is not known whether it was used a control group and how much time exactly passed between the first and second measurements (as a data 4-5 months, and the other less than a year). Skilled researchers and statisticians know that in such a large sample (if N really was 4.266) and minimal differences, which have no logical significance, reaching the criterion of statistical significance. Furthermore, the lack of a long distance between the two measurements usually increases results because of the intervention of memory tasks in tests. Critics still have not ruled out the possibility that chess, if methodologically adequate study may encourage speeding and intellectual development of children.

Ferguson's first project involved the intellectually gifted students from seventh to ninth grade school in Bradford (USA). The primary independent variable was included variations of "chess treatment, computerized treatment and non-participatory treatment". Each group had one session a week when they dealt with the subject of his interest for a period of 32 weeks. The average annual income of chess group was 17% measured by Watson-Glaser critical thinking assessment (growth in not chess group was below 5%). The greatest improvement that could be attributed to the application of chess was in domain of originality (the gain at 70% toward the chess 35% in not chess group). The corresponding figures for the disposition of critical thinking- fluency were 20% vs. 6%, and the flexibility of 23% vs. 10%. Thus, in all four aspects of critical thinking, there was a noticeable increase in the chess group than in the control group. In this well-conceived experiments, however, involved only 15 subjects (!?), So the question is whether the relatively large differences reached statistical significance threshold withholding of progress in the control groups.

Another Ferguson's experiment related to memory and verbal reasoning. In the course of two years, 14 students of the sixth grade passed through chess training performed two or three times a week, including playing chess over a period of eight months. In the initial and final measurements were used corresponding subtests of the California achievement test (CAT), and the differences between the two tests were compared with national norms. Chess group significantly outperformed the general population in terms of memory subtests, while the verbal reasoning gains of chess group, despite having surpassed the population norms, was slightly below the level of 95%. Unfortunately, the sample in this experiment included a small number of subjects, and there was a random selection of subjects in groups and the control group to verify the existence of any parallel influences, in addition to the effects of chess, such as the potential impact of tutor participation chess and other intellectual activities in the meantime, etc.

Several studies relevant to the topic of the role of chess in the development of children was conducted by Horgan (1987.; 1992.), focusing on the phenomenon of calibration under which meant "the accuracy with which one can predict its own achievement". They conducted three experiments and found, among other things, that children who better played chess, have a better calibration, even as adults non chess players. Confidence and calibration are negatively correlated, which means that the lower-ranked players in the exaggerated self-confidence. This finding may have some implications for the hypothesis that chess contributes to the realism in children.

The impact of chess training on achievement in reading skills tested in the area of the South Bronx (New York) in 53 primary school students whose results were compared with 1,118 students without a chess program (Marguilies, 1991). The author concluded that the participation of students in the chess club at school with teaching by chess master (in the first year of the experiment) and the activities using the computer for chess training (in the second year of teaching chess) results in greater progress in reading ability than in the case with their peers in the control group. However, it turned out that the chess group of children were previously selected with regard to intellectual ability and maybe motivation (voluntarily declared themselves to work on the chess club in school), although the difference in their favor and when their results are compared only with approximate "peers" in intellectual terms in the control group.

A Canadian study in the province of New Brunswick (by Louise Gaudreau, quoted from Ferguson, 2012), was carried out in the period 1989-1992. on 437 fifth graders divided into three groups:

the control group had a traditional mathematics program for the duration of the experiment, second group besides the traditional had enriched chess program starting from the second year of experience and furthermore, a third group received enriched chess program from the very beginning. Between the groups there was no significant difference in terms of basic mathematical operations on a standardized test, but the experimental group were better than in the control in part of the test of solving problems, especially high was third group (21% better than the control where no chess) and on the part of the test intended for the understanding of mathematics (12% difference in favor of the third group).

In a Texas study (Liptrap, 1998), the aim was to investigate the extent to which student participation in the activities of the chess club affects their scores on standardized tests. Checkerboard pattern group included 67 students of the fourth and fifth grades, while non chess group of the same age were more numerous (N=504). Comparisons were made when the students were in the third grade, therefore, before the presentation of chess teaching to the experimental group, and during the fifth grade when he made the post-test in both groups. Used the TAAS (Texas Assessment of Academic Skills), or one derived measures (TLI or Texas Learning Index) in order to enable broader comparisons of standard scores. The measurement in the fifth grade participants in chess groups were clearly better at math than members of the control group. Critics have pointed out that the weakness of this experiment in a non-random formation of two groups and the existence of some selectivity because members of experimental- the chess group at the start were better in terms of school achievement (Gobet and Campitelli, 2006).

In the Brooklyn study (Fried and Ginsburg, without the labels) checking the effects of the training of chess on the development of perceptual skills and visual-spatial abilities. The sample of students is characterized by the fact that the children had problems with behavior and learning. Thirty of these fifth graders were randomly divided into three groups: chess, those who undergo psychological counseling to correct their problems and the group without any treatment. Chess intervention lasted 18 weeks and included lectures, demonstrations, and playing chess. Instrument of test consisted of two subtests of the Wechsler Intelligence Scale for Children aimed to measure the aforementioned abilities. To the surprise of the authors examination did not reveal statistically significant differences between the three groups. This study shows that preselection (which is suspected in other studies) may be an important factor hindering the adoption of correct conclusions. The weakness of this study is the absence of initial measurements, which means that it has been applied so called experimental draft "only after" having some immanent disadvantages.

Research of mentally retarded children (IQ 70 to 85) in Germany (Scholz et al, 2008) related to the potential benefits of learning chess in mastering basic math concepts such as counting and summation and the ability of concentration of these children. Four departments of the biggest school in Germany for handicapped children are selected. Certain students in the control group are soincidentally selected with which had not been implemented chess program (N=10) and the experimental group in which the children had learned chess at one hour per week during the school year (N=20). Content of chess classes related to introducing children to the rules of chess, notation of moves, the relative value of the figure and the Single Stroke matting (checkmate tasks). It has been found that learning chess contributed to a significant improvement in terms of elementary calculation, while a differential effect on the ability to concentrate is not registered when comparing changes in the two groups. The authors assume that the change in personality traits such as the ability to concentrate one-year practice of chess perhaps not long enough, at least in the case of children with disabilities in intellectual development.

CONCLUSION

General characteristics of the studies that are cited can be reduced to the evaluation that are methodologically unscientific (samples are small, the control group of insecure, random selection, reporting the effects of Pygmalion, placebo and unconscious need for "embellishment", poor use of statistical techniques, in particular the analysis of covariance). Durability of transfer effects of chess is not enough explored, and they have not investigated the consequences of chess in relation to its Structure- elements of the game.

However, conditionally would be accepted that chess has a positive effect on cognitive abilities: concentration, memorization, creativity, foresight, logical reasoning, spatial visualization, precision, combinatorics. Also, chess has a positive effect on

conative dispositions: responsibility, self-criticism, independence, confidence, diligence, perseverance. The third field of the positive effects of the ethical, social. Playing chess affecting the general socialization: friendship, fair play behavior, economise on time, prevention of delinquency, re-socialization, the affirmation of a person with special needs.

Finally, we should intensify the expansion of the chess game, especially in schools, as well as investments in new research with respect to genetics, traditions and customs, culture, social conditions and ideologies.

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NEW PROSPECTS IN SPORTS EDUCATION

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SUMMARY

Introduction: In recent decades, sports industry has become one of the most valuable of industries, run by the volume of money that it reverses. Sports industry development, with the help of management, marketing and sponsorship, is progressing every day. The rapid development of the sports industry has created a demand for educated personnel in the sport. Today we have a large number of sport officials who do not have the proper degree, diploma or license in the field of sports in which they work. This sitation has opened space for schools and colleges engaged in educating sports personnel to contribute the sport development, as well as their financial profit.

Conclusion: In addition to the positive, there are also negative aspects of the development of the sports industry. Violence in sport, doping and sports betting became a community problem. Reactions to these problems are usually delayed, and should be dedicated in prevention efforts through education of young people, who are the riskiest population and that can easily be fall for the negative phenomena.

Keywords: sports industry, education, training, doping, sports betting

INTRODUCTION

In recent decades, sports industry has become one of the most valuable of industries by the volume of money that it reverses. Sport has evolved into such a huge industry that establishing some market data has become a very onerous task (Masterman, 2008, 19). Data from the end of the twentieth century show that the total turnover of sports business in the United States during the eighties was around $ 63 billion, and in the second half of the nineties, reaching a turnover of over 300 billion dollars (Tomić, 2001). Research which was conducted in 2011 by consulting firm ATKearney showed that the value of the sports industry is estimated at 350-450 billion euros. This includes the construction of sports infrastructure, sports equipment, licensed products, and sporting events (ATKearney, 2011).

Sports industry, with the assistance of management, marketing and sponsorship, is progressing every day. Expansion of the sports industry enables the development of other areas that are not directly related to a tangible, physical products related to the sport. This will increase the demand for educated professionals and educated people in the field of sports, as it is the case with the occupation of sports trainers, sports managers and sports journalists. Growing sector is the services market, so that increases the number of required capacities in the field of sports and recreational tourism. All these sectors require trained personnel. Therefore, institutions in the field of sports education must adapt to new trends, which will include them in profitable area of the sports industry. There is a large number of former athletes who want to gain formal education and build it on the experience they gained during their career. They represent a significant base of potential students of sports colleges and universities. Their practical knowledge will enrich and receive formal acknowledgment and recognition in the form of professional or academic titles, and so they will remain involved in the sport industry and contribute to its development.

The effects of the development of sports industry cannot be expressed only through positive indicators. In the race for conquering the market, as a part of the profit of sports industry, they are exposed to risks of all those who participate in it. Athletes and coaches are exposed to the challenges of doping and other supplements in order to achieve top results. Sports organizations are constantly tempted to match-fixing and linked with

bookmakers for sports betting, which can produce enormous profits. Along with them, members of wider community who think that they can take part in the race for profits are also exposed to risks. Sports betting is available to all sports fans who see it as an opportunity for a quick profit also risk that what starts as a hobby leads to addiction, hence the disease. Reactions after observing these phenomena are negative and in most cases delayed. When it is determined that athletes achieve their results influenced by doping, the results will be annulled, and the health of the athlete due to the use of illegal assets is permanently impaired. If betting turns into addiction it becomes a problem of addicts and their families, and bearing in mind that in this group are a large number of young people, then it becomes a larger social problem.

Education in sport is the common denominator for both positive and negative sides of the sports industry. As the training of qualified personnel to work in the sports industry is necessary, it is also necessary to educate a wider circle of sports fans in order to prevent adverse effects. The way of education is still very distinct. Training of qualified personnel is conducted in the formal system of sports schools and colleges; education of athletes and sports professionals in order to prevent doping is done in sports clubs and federations, while education of wider community can be made only through the media, promoting true sporting values and displaying the dangers to which individuals can be exposed.

EDUCATION IN SPORT

Education through formal education

The rapid development of industries and occupations within the sports industry has created a demand for educated sports staff. This is particularly evident in the very bearers of sports activities, such as managing people in sport structures and sports coaches. Today we have a large number of sports officials who do not have the proper degree, diploma or license for this area of sports industry. We have a large number of former athletes who have gaming experience, but other than that they do not have any confirmation of theoretical knowledge in the form of diplomas, licenses or the course to deal with coaching or managerial job. These candidates represent a resource on which a strategy of development of sports organizations should be based, since their experience gained in combination with proper training can give very good results. Strategic approach to human resource management involves investing in human resources, since a significant proportion of human capital determines the knowledge and skills that individuals acquire. Knowledge and skills greatly affect the performance of employees, so that education is a very important factor in the economic development of a country and the individual organization and they lead to the achievement of economic and social objectives (Djukic, 2010, 19).

Condition for successful working in the sports industry needs to be knowledge of sport based on practical experience and theoretical updates. Love of the sport is simply not enough for a successful business in the industry of sports (Kastratović, 2004, 81). There is a large number of sports fans who work in sport and know different sports branches and ways of functioning, or former athletes who have personal experience gained through professional sports. For them, it can certainly be argued that the extensive experience highlighted a serious bid for the professional work in certain areas of the sports industry. On the other hand, if it is not upgraded to quality of formal education and the acquisition of certain professions in the field of sports, a person employed in the sports industry will not have full credibility and knowledge needed to do his/her job. The necessity of acquiring formal education and sports titles is not just a theoretical assumption, but the specific requirements and mandatory requirement as prescribed by special regulations[16] of the Sports Law of the Republic of Serbia for 2013 (Official Gazette of Rep. of Serbia, no. 24/2011). This is why the demand for educated sports officials created the conditions for the opening of the sports faculties who belong to various branches of sport, where future students will be educated to work in the sports industry. In addition to the already existing profiles for sports coaches and managers, it is anticipated that in the future professions such as sports reporter and manager of sports tourism will be required. "There is a wealth of business

[16] Regulations authorizing the operation of sports experts, (Official Gazette of Rep. of Serbia, no. 7/2013); Regulations on professional training of certain professional activities in sport (Official Gazette of Rep. of Serbia, no. 78/2013); Regulations on conditions for performing sports activities (Official Gazette of Rep. of Serbia, no. 17/2013)

opportunities and career paths include sports team manager, finance, sports medicine and athletic training, journalism, TV broadcasting, public relations, fundraising, sports information, facilities management, etc. (Ljubojević, 2001, 12).

There are many reasons why a new approach to education and training in sport has to be introduced, especially in the management structure and between experts for the training technology. Some of them are:

- Development trends in the world of sports that require the need for educated sports managers and coaches,
- The tendency of the sport is focused on market profit aspect,
- The need to educate managers and trainers must take place in the sports environment, through resources of sport,
- Due to the lack of educated sports managers and coaches,
- Modern sport cannot tolerate voluntary approach to management (Milić, 2007, 203).

Our educational system in sport includes several academic and higher education institutions. Study programs and degrees that are acquired in these institutions are in most cases oriented towards the education of professionals in the field of athletic training. In addition to these educational backgrounds, universities in Belgrade, Novi Sad, Nis and Pristina and the University "Singidunum" educate physical education teachers. Dominant in the education of graduate sports managers are the private colleges and universities, who recognized the need of the sports industry market for the sports staff. So far, the only faculty which has dedicated to the education of sports journalists is the Faculty of Sport of the University "Union-Nikola Tesla" in Belgrade.

Table 1: Academic and higher education institutions in the field of sport and education profiles

No	Faculty	University	Coach	Manager	Journalist
1	Faculty of Sport and Physical Education - Belgrade	University of Belgrade	X		
2	Faculty of Sport and Physical Education - Novi Sad	University of Novi Sad	X		
3	Faculty of Sport and Physical Education - Belgrade - Niš	University of Nis	X		
4	Faculty of Sports and Physical Education - Leposavic	University of Prishtina	X		
5	Faculty of Sports - Belgrade	University "UNION-Nikola Tesla"	X	X	X
6	Faculty of Management in Sport - Belgrade	ALFA University		X	
7	Faculty of Physical Education and Sports Management - Belgrade	University "Singidunum"	X	X	
8	College of Sports and Health - Belgrade		X	X	
9	College of Vocational Studies Sports Academy Belgrade - Belgrade		X		
10	Faculty of Sport and Tourism - Novi Sad	University "EDUCONS"	X		
11	Vocational colleges for the education of teachers and trainers - Subotica		X		

Also, the Sports Development Strategy in the Republic of Serbia, in Section 7.3, p. 20, The development and promotion of sport, "insists on permanent education of trainers in the sport system, both through formal education and by connecting through a network of universities."

Working with young athletes is essential for the development of sport and the foundation to achieve

top results. Proper work with this group of athletes lays the foundation of their relationship to sport, sporting culture and behavior, but also the basis of proper sports techniques, tactics, and injury prevention. To work with this vulnerable category of athletes should be given to experienced and qualified coaches so that young athletes could be properly formed and adopted the basic sports skills and knowledge with minimal risks. Education of coaches, which is implemented in most sports schools and colleges, meets the basic requirement of their expertise in the training context, but to acquire the necessary experience to work with the youngest athletes.

At present, we can notice that young coaches begin their careers by working with the most sensitive category of athletes, and that athletes are in the younger age categories. In addition to the lack of necessary experience in the training part related to physical exertion of young athletes, there is a lack of experience in the pedagogical approach. The pedagogical approach is very important while working with young people. "The educational role of the coach is largely dependent on the "pedagogical tact" that he/she possess. The term "pedagogical tact" subsumes the ability to establish proper relationships with athletes, tying their attention and motivate athletes to perform the tasks of training and achieve competitive results"(Stefanović, 1983, 221). Incompetence in training with youth categories often can have far-reaching consequences of acute injuries of the locomotor apparatus, and the chronic problems of the cardiovascular system. This confirms the conclusion that the possibilities of the respiratory and cardiovascular system at a younger age are restricted because children's heart on exertion consumes more energy; the increased cardiac output of blood comes at the expense of increased cardiac activity, and therefore avoids activities that require long-term trends (Sturža Milić, 2011). There is a large number of talents who were not lucky enough to be trained by a top – class coach who could work with them every day, working on improvement and development, as well as the elimination of deficiencies both at the individual and team level. In many countries, there are already set of standards for the performance of the coaching profession which define what the coaches of different skill level (from beginners to coach the highest level of expertise) should know and are able to work independently. For example, a program for the certification of trainers in England (UK Coaching Certificate - UKCC) is based on national professional standards for training, teaching and training, according to which the coach should be trained to carry out activities such as: planning short and long term training programs, implementation training programs and evaluation – evaluation of the program, achieved development and progress of athletes and their own work (Bačanac, Petrović & Manojlović, 2011, 13).

Sport and media have become dependent on each other, inseparable duo whose interests are closely linked and there is no reason for this to be changed in the future. Though, at first glance, it might be considered that this statement is a sufficient condition for the development of sports journalism schools, in our case it is not yet the case. Today, in our region, every sports fan can work as sports journalist. The fact that until 2013 there was no department of sports journalism at universities in Serbia, tells us about the absence of journalists who specialized in monitoring competitions in the sports industry. Bearing in mind that any media, print and electronic, has a sports newsroom and that there are more and more media specialized for sports, it can be concluded that the trained personnel in the field of sports journalism could easily found work placement in their field. For now, in our higher education there is only one institution engaged in specialized education of sports journalists, so there is more space in the education market in this area that may include other, not just sports educational institutions.

Sports tourism is a growing segment in the sports industry system. A wide range of tourism services that may be associated with sport is a clear signal for one more direction of education in sport. Preparation of athletes are seasonal, performed before the start of each sporting season, and are just one of the opportunities for linking tourism and sport. Being carried out in areas of specific climatic conditions, where there are already tourist facilities, the development of accompanying sports facilities that meet the needs of professional sportsmen is still at an early stage. The development of sports infrastructure in tourist centers would be a clear call for cooperation with a number of clubs and associations. Recognizing the business opportunities and its proper utilization depends on the personnel who participate in the management of tourist facilities and that would have to be educated on the proper way to make this opportunity. In addition to these indications linking sport and tourism we

should not forget the organization of sports competitions for the younger categories, sports camps and use of natural resources which are required for individual sports (orienteering, mountain bike, cross country). Mountain tourist centers that organize specific sports competitions, camps and pre-season training would be open throughout the year, not just during the winter season. In addition to the orientation of the sports clubs and associations, tourist centers of the large market can be found among recreational athletes. Outdoor activities are very popular in the category of recreational athletes, who at the same time don't have great need for additional sport facilities and means of recovery (swimming pool, massage, medical center), so the tourist centers with modest investments in sports infrastructure could orient towards this user group of sports-tourism services. It can be concluded that the expansion of the tourist offer and linking tourism facilities with activities that are directly related to the fulfillment and quality leisure time through sport and recreation can have multiple positive implications for all participants in the supply chain and the use of travel services (Marković, Radošević, 2014). Opportunities that arise in the provision of services for sports fans going to the biggest sporting events, booking and purchasing tickets and other travel related services to the sports industry, only confirm the potential of this market and highlights the need for educated personnel in the field of sports tourism.

Education in order to prevent the negative phenomena in sport

Contribution to sports industry development is more than obvious, but we have to mention the other side of the sport, which has negative consequences for the health of athletes and the social life of young sports fans. Among the biggest problems facing the entire sporting public and the sports industry are violence in sports, sports betting and doping in sport. So far, on the negative aspects of sport not so much has been said; we mostly have had arguing on the results and achievements of athletes at big competitions. However, avoidance of dealing with this phenomenon does not mean it does not exist.

Sport has become a subject of general appeal, enthusiasm and commitment, and subject to manipulation, with the manifestation of hatred and conflict (Mihajlovic, 2013). Violence at sporting events is a phenomenon of which carries a number of negative consequences, and there are several common forms. Verbal violence, emphasizing hostile and homophobic slogans, racist incidents, to physical violence in sports arenas around them are the most common forms of violence in sport. Recognizing the importance of the dimension of the problem and its impact on the whole society, the Ministry of Youth and Sports has made a national strategy to combat violence and misbehavior at sports events ("Off. Gazette of RS", No.63/2013), which shows determination of the state to deal with this problem. As the state response to this problem was clear to all citizens, who are directly or indirectly interested in solving the problem of hooliganism in sport, presenting the principles of the National Strategy for the Combating violence and misbehavior at sports events would have to be more represented in the media, at least in a shortened and simplified form, so that everyone is aware of the penalties provided for by law and the modus operandi of the state in such situations (Marković, Krasulja & Ratković, 2014).

The media must be more involved in promotion of National Strategy for Combating violence and misbehavior at sports events, since their great impact on the population. We should organize more educational media programs and actions to meet the problem of youth violence in sport and the risks that entails connecting to supporting groups. It is important to mention the impact of the media and educational system, which, as powerful transmitters and instruments of socialization, can make an immense contribution to the suppression of violence in relation to sports, primarily through pointing out its negative consequences and promoting and enhancing peaceful supporting and fair play. (Jovašević, Batrićević, 2013, 236).

Sports betting has become one of the most lucrative ways to make profit within the sports industry, but became one of the major social problems. Power that bookies have, can be seen in the examples of sponsorships with the largest sports clubs such as Real Madrid, Bayern Munich, Barcelona, Milan, Manchester United and Juventus. Since 2006, the largest sports betting Bet&Win is an official partner of FIBA and the Euroleague, the highest international basketball association. Using sport, which should primarily promote a healthy way of life, bookmakers were able to get closer to the new target audience - the youth. Proof of this lies in the fact that there are more sports betting whose actions have spread to all parts of the cities, often in

addition next to primary, secondary schools and faculties, often consciously recruiting minors who unwittingly become addicted. A large number of betting disregarded the Law on Games of Chance, which provides in Article 86 that the distance from educational institutions (primary and secondary schools) may not be less than 200 meters ("Off. Gazette of the RS", no. 88/2011 and 93/2012). Even besides these state response and effort to separate the young physically from betting, studies have shown that a huge number of young people practiced betting close to their place of residence (Kordic, Babic, 2010). It becomes evident that the removal of betting from school area is not crucial in the fight against betting among young people. Removal betting of the school area is still a reactive measure, and the approach to this problem would have to be proactive and to work to prevent its occurrence. It can only be achieved by educating young people about the harmful effects of gambling and develop their awareness of gambling addiction as a disease. Though in one of the studies, even 90% of the young said they are aware of these risks and the possibility of addiction on betting (Dimitrijevic et al., 2011), the volume and intensity of action of educating young people in this field should be increased.

In order to achieve the best results, a large number of professional athletes are reaching for illegal substances in order to improve their sports performance. Each year there is a growing number of athletes who have failed anti-doping control, while the penalties prescribed by WADA are increasing. List of illegal funds that are on the list of the World Anti-Doping Agency are also increasing. Athletes, despite the harsh regulations, however, choose to use a variety of substances aware of the risk of punishment, but also with the positive impact that substance use is providing for achieving athletic performance. On the other hand, it is a big question how many athletes are familiar with the negative effects and health hazards that entails the use of doping. Research that was carried out in Italy among the athletes, (Tavani et al., 2012) showed that 88.2% of them believed that supplements were effective to improve performance. On the other hand, only 4.8% were aware that using of supplements is potentially dangerous.

Hazards and risks that entails use of drugs are not exposed to the amateur and recreational athletes. Their risk may be greater, not only because of the lack of education about the consequences of doping, but choice range of what it takes uncontrollably, without consultation with your doctor or pharmacist. The survey, which was conducted among a population of students of the Faculty of Physical Education and Sports of East Sarajevo, Faculty of Sports and Physical Education from Niksic examined their views on doping in sport. It was concluded that the results of students in terms of statistics on the use of doping, knowledge and awareness about the negative effects of doping are insufficient. It is this population of students that is the future of sports and therefore the need for additional education on this issue is needed (Pavlovic, Idrizović, 2013, 111).

One way of education of athletes about the harmful effects of doping is carried by ADAS (Anti-Doping Agency of Serbia) that gives lectures to athletes (professional and amateur), clubs and associations, across the whole country, explaining the role and consequences is the use of illegal substances. Some authors (Mitic, Radovanovic, 2011) after analyzing conditions, have proposed a plan for preventing and reducing the use of doping in amateur sport, which consists of four points:

Education work

Information and planning of optimal nourishment as a base of enhancement of psychophysical abilities

Conversation and creation of a plan of supplement use in relation to person, sports discipline, preparation of plan and set goals

Conversation and instructions for making of a plan of individual training system in relation to personality features, sports events and set goals

These points are expanded with additional instructions, which explain in detail the method of implementation. Such initiatives need to be expanded to all the objectives of the society. From sports federations and clubs to professional and amateur athletes, who are not aware of the consequences that may befall them. It is necessary for the media to use their influence and educate their viewers, by showing them the life stories of professional and amateur athletes who now bear the consequences of the use of doping.

CONCLUSION

In the 21st century, sport will become an area in which the largest number of new jobs will be opened! Sports industry is already established as one of the most important industries in the world (Tomic, 2007, 644). Considering these predictions of

experts, the insistence of the training of personnel in the sport is absolutely justified. Whether it is sports coaches, managers, reporters or any other profession, connection the love of sport, sports experience and formal sports training is required. Only one of these conditions may not be sufficient for quality work in the sport as well for progress in the sport industry.

Therefore, the opening of a larger number of institutions dealing with education in the sport, as well as the diversification of the profile that will be educated, can be seen as a necessary condition for the development of sport, but also as an excellent business opportunity. There is an enormous number of former athletes or already experienced sports leaders and coaches who do not need a formal education, therefore there is no professional degree and still want to get involved, or to continue to work in the sports industry. This potential is necessary to be used, channeled and further educated in order to create the conditions for the use of their experience in the right way and in order to give additional credibility to their work.

Analysis of sports education is necessary to deal with, primarily because of the youngest athletes, so we can point on time to potential problems. Sports psychologists, physical education teachers, coaches and other sports professionals point out that sports not only affects the development of character, but is also an important factor in preventing negative behavior, because it keeps young people from the street, various problematic situations and delinquent groups (Bačanac, Radovanovic, 2005, 239). With the above scandals, we risk losing the original meaning of sports and the promotion of healthy living. The children used to dream of becoming a famous athlete to engage in work they love; today, when they grow up they dream of becoming athletes to earn big money. These facts represent distorted value system, where material values are in the foreground, neglecting all other reasons for playing sports.

We pointed out the issue of unqualified persons who were in leadership positions in the sports industry, for their lack of education, training and references faced, as well as the requirements and potential solutions that applicants must meet to be able to work in some of the branch of sport industry. Lack of knowledge, references and licenses to perform the job of coaches, managers and journalists in the sports industry automatically leads to a potential danger, especially when working with younger categories. The problem of betting in the sports industry has taken more and more momentum, awareness of the problems that can arise when this hobby grows into the addiction exists, but young people are still exposed to the challenge of a quick buck that is hard to resist. The reaction of the state related to juvenile betting exists, as in the case of violence in sports, and is expressed through the adopted laws and strategies. However, it will remain just another in a series of documents unless it is not put into action, especially if these documents are not enough presented to the public and are not used for educational and preventative purposes.

The necessity of education in sport is even greater if one takes into account the lack of information about the negative consequences of using illegal substances, for which not only professional but also amateur athletes reach, leaving a lasting impact on their health. We can place the question of logic and conflicts of interest in the sport, because sport should be a synonym for healthy life, while examples of the use of illegal substances lead to its antagonism.

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Physical Exercise and Health

IMPORTANCE OF INTRINSIC ORIENTATION AMONG SPORT DANCERS

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SUMMARY

The main purpose of the present research was to identify importance of intrinsic orientation among sport dancers by analyzing possible influence of intrinsic and/or extrinsic approaches on competitive rang, separately by gender. Secondly, differences between female and male dancers in years of dancing, hours danced (weekly), and musculoskeletal pain status were established. The investigation was conducted on the subject sample of 173 female and 200 male active sport dancers from all over the world and with international competitive experience. Data was collected with on-line questionnaires translated into eight world languages. To determine the type of motivation in sport, a questionnaire Task and Ego Orientation Sport Questionnaire (TEOSQ) was use. To define the proportions of pain status of 14 body regions, Self-Estimated Functional Inability because of Pain (SEFIP) questionnaire was used. For group of orientation profiles definition, taxonomic analysis by K-means clustering was applied. In the clustering, four groups of subjects were formed and intrinsic orientation was dominated. Low values of the extrinsic orientations were established. The results obtained (one-way MANOVA with the post-hoc Tukey's test) indicate significant differences in extrinsic orientation in advantage for female group, and not significant differences in intrinsic orientation between female and male dancers. According to regression analysis, only high ranged female dancers had significant correlations with extrinsic and intrinsic orientation. Intrinsic and extrinsic oriented subjects seem to provide a crucial element for the higher level of dance performance only among females.

Key words: gender differences; on-line survey, high level competitors

INTRODUCTION

Competitive dancing is an extremely demanding physical activity. A high level of physical fitness is needed to accomplish a good performance and to prevent injuries that could permanently undermine a dancing career. Uniqueness of dancing as a competitive discipline is its link to art where the human body is used as an instrument of expression in which the artistic idea is carried in to the spectators by motion. Behind every valuable dance performance there are numerous hours of exercising and perfecting techniques which are characterized with preciseness, grace, movement amplitude and frequent choreography performing. That's why it is of great importance for dancers to analyze and keep track of the factors such as dancing experience, training intensity connected with type of motivation and occurrence of pain while training which can affect all of the three previous factors.

According to Hoffman and Harris (2009), there are four basic features of a subjective experience of physical activity: physical activity is always accompanied by a certain subjective experience; subjective experience is personal and unique, physical activity can be performed without understanding the activity; physical activity alone loses its meaning if it is not pleasuring to the one doing it. That last feature is the one that is the most important for dancers. Expressed intrinsic orientation or the feeling of satisfaction while exercising is very significant for every physical activity, but with dancers it has a special meaning. The term of an expressive performance is related to a successful dance interpretation. Successful manifestation of an expression is also emotional. Expressing emotions with movement is not possible without intrinsic motivation.

The best known and most widely used measuring instrument to assess the level of intrinsic (IO) and extrinsic (EO) orientation is the TEOSQ

questionnaire (Task and Ego Orientation in Sport Questionnaire). It is constructed by Duda and Nicholls in 1992. Later on, certain conducted researches have determined stable factor structure of the questionnaire, satisfactory test-retest reliability and high internal connectivity (Fox, Goudas, Biddle, Duda, & Armstrong, 1994). Barić and Horga (2006) have constructed and validated the Croatian version of that questionnaire. The authors came to the conclusion that there are four groups, or four possible orientation profiles: high IO/high EO, low IO/low EO, high IO/low EO, and low IO/high EO. The first group shows the biggest motivation for the activity, while the least motivation is seen within the second group. When regarding the sport dance it is particularly interesting to establish the relationship between the dominant type of orientation among female and male dancers.

Extrinsic oriented dancer will be concentrated on an outcome which is estimated by some outside indication of success, such as an accomplishment in results or the cognition that he or she is better compared to others. Regarding dancers, the third group (high IO/low EO) is considered desirable. High intrinsic orientation can be a good precondition to a good performance on a principle: higher intrinsic orientation, better emotionality and expressiveness, and a more convincing performance. Many previous researches have shown that either connection or that is to say the interaction of IO and EO mustn't be ignored (Hanrahan & Biddle, 2002; Gano-Overway, Guivernau, Magyar, Waldron, & Ewing, 2005; Thomas, 2005; Barić & Horga, 2006; Grgantov, Gabrić, & Miletić, 2008; Miletić, Miletić, & Maleš, 2008; Murcia, Gimeno, & Coll, 2008). Dominating EO often leads to quitting sport overall (Cervelló, Escartí, & Guzmán, 2007), especially in the adolescent population, while dominating IO connotes achieving an optimal performance on a competition, continuation with the activity after a failure, maximum effort, cooperation and compliance with rules (Duda, Olson, & Templin, 1991).

The main objective of the research was to identify importance of intrinsic orientation among sport dancers. More specifically, the study aims were: (1) to determine the existence and significant differences in the levels of dancer's intrinsic and extrinsic orientation between female and male dancers; (2) to identify the differences between female and male dancers years of dancing, hours danced (weekly), and SEFIP; (3) to establish relations of the most successful dancers between EO/IO and WDSF rang separately by gender and dance style (Latino and Standard).

METHODS

Sample of examinees

The sample for this study consisted of 173 female and 200 male dancers from all over the world who participated in international competitions in Latin (samba, rumba, cha-cha-cha, paso doble, and jive) and standard (English waltz, tango, Viennese waltz, slowfox, and quickstep) dances. Mean age of the overall sample of dancers was 25 years (range, 15 to 40).

The data was collected through an on-line survey and via intercession of trainers and fellow dancers on trainings and tournaments. The questionnaire was translated into eight world languages (English, Italian, German, Spanish, Russian, Japanese, Portuguese, and Croatian). To enable the participation of a larger number of dancers, an "online" questionnaire was posted on a specialized server (*survey monkey*) for collecting and analyzing data electronically on a global level. The server and the application enabled a password level of access security and automatic identification of subjects when filling out the questionnaire from a computer defined by the IP address and personal information. The subjects were asked to answer the questions of the questionnaire sincerely, based on their own observations and experience. 25% of total sample of dancers who fulfilled the survey were ranked in the WDSF list up to the hundredth place.

Sample of measuring instruments

The Task and Ego Orientation in the Sport Questionnaire (TEOSQ) is an assessment of the dispositional achievement goal orientations. It is a 13-item scale that asks participants to respond to task end ego statements following from the stem, "I feel successful in (dance) when..." Each item is answered on a five - point scale. Task orientation is assessed by statements revolving around the feeling of success, derived from learning new skills, fun, trying hard, and practising. Assessment of ego orientation is based on the responses concerning doing better than friends, scoring the most points, and being the best.

A SEFIP questionnaire is a simple and valuable tool in defining pain status in certain regions for dancers approved to be of high applicability in professional ballet dances, S&L dances, and dance students. SEFIP is an instrument that asks the subjects to assess their current pain on a 5-point scale; with 0 being no pain and 4 being pain so severe they are unable to dance. The questionnaire covers 14 body regions (neck, shoulders, elbows, wrists/hands, upper back, lower back, hips, thighs (front), thighs (back), knees, shins, calves, ankles/feet, and toes). A sum score (range, 0-56) can be achieved where 0 represents no pain and 4 maximal pain. Everything above zero is regarded as a positive finding.

Statistical procedures

K-means clustering was used to derive four groups of subjects according to IO and EO. A multivariate analysis of variance (one-way MANOVA) with the post-hoc Tukey's test was used to test the differences between the female and male dancers according to years of danicng, hours danced (weekly), IO and EO, and SEFIP.

RESULTS

Taxonomic analysis (option ˝K-means clustering˝) for four groups validates the group *high IO/high EO* and the group *high IO/low EO* that have been formed in both sexes. In group 4, both sexes have formed clusters of lowest IO and EO value, but cannot be considered as usual clusters of *low IO/high EO* due to above average values of intrinsic orientation.

Table 1. K-means clustering analysis set on four clusters (arithmetic means in EO and IO variables) for female dancers

	group 1	group 2	group 3	group 4
Extrinsic orientation (EO)	4.39	3.73	2.49	2.21
Intrinsic orientation(IO)	4.67	3.98	4.61	3.41

Table 2. K-means clustering analysis set on four clusters (arithmetic means in EO and IO variables) for male dancers

	group 1	group 2	group 3	group 4
Extrinsic orientation (EO)	4.03	3.13	2.49	1.90
Intrinsic orientation(IO)	4.59	3.70	4.61	3.48

To establish a difference between male and female dancers, one–way MANOVA (Table 3) has been applied with five dependent variables: years of dancing, hours danced (weekly), extrinsic orientation, intrinsic orientation, and sum of SEFIP score. According to the results of the Wilks test there is a considerable multivariable effect ($F=5.37$; $p<0.01$) whereby the composite set of variables significantly discriminates groups of dancers by sex.

According to the results obtained, there are no considerable differences between male and female dancers in dancing experience, hours danced (weekly) and in intrinsic orientation. Both in average have between 9 and 10 years of dancing experience, and train in average approximately 12 hours per week. Intrinsic orientation is above average (4.2).

Significant differences between sexes were established in extrinsic orientation and pain prevalence.

Table 3. Descriptive statistics (mean±SD) for female and male dancers and the results of MANOVA analysis (post-hoc Tukey's test).

gender	Years of dancing	Hours danced/week	EO	IO	sum SEFIP
F N= 173	9.95±6.22	12.09±7.96	3.28±1.00*	4.26± .60	20.51±5.61
M N= 200	9.58±5.63	12.62±7.01	3.03± .87	4.20± .63	18.88±4.77*

*statistically significant on $p<0.01$

For forming a criterion variable of a ranking that represents success in dance in regression analysis, only dancers that are ranked up to the 50th place are taken into account, and are therefore considered the best in the world. Considering that the feedback to the survey was voluntary, the number of subjects varied in certain groups. *Latino* (Table 4) and *Standard* dances (Table 5) data has been analyzed separately as two competitive dancing disciplines. All applied criterion variables have had normal distributions (according to results to the Kolmogorov – Smirnov test), and their limiting values are shown in the table descriptions.

Regression analysis indicates a significant correlation between IO and EO with an achieved competitive ranking only in female dancers, whereas in male dancers no significant correlation of the predictor system to the criterion of competitive ranking has been established.

Table 4. Regression analysis EO i IO and competition rang in Latino dances

LATINO RANG* (until 50 on WDSF)	female N=25 BETA	p	male N=17 BETA	p
Extrinsic orientation (EO)	**0.50**	**0.02**	0.11	0.68
Intrinsic orientation(IO)	**-0.41**	**0.05**	0.16	0.56
R	**.50**	**0.04**	.21	0.73

*limiting value of KS test for criterion variable on the sample of female dancers is D=1.358/√N for N-25= .27; and, on the sample of male dancers is D=1.358/√N for N-17= .33

Table 5. Regression analysis EO i IO and competition rang in Standard dances

STANDARD RANG * (until 50 on WDSF)	female N=17 BETA	p	male N=15 BETA	p
Extrinsic orientation (EO)	**0.51**	**0.04**	0.02	0.96
Intrinsic orientation(IO)	**-0.48**	**0.05**	0.05	0.88
R	**.58**	**0.05**	.04	0.99

*limiting value of KS test for criterion variable on the sample of female dancers is D=1.358/√N for N-17= .33 and, on the sample of male dancers is D=1.358/√N for N-15= .35

DISCUSSION

By proving the existence of four orientation profile groups in previous literature (Fox et al., 1994; Moreno, Hellín, Hellín, Cervelló, & Sicilia, 2008) it has been hypothesized that these same groups exist in the sample of sport dancers. The taxonomic analysis (option ″K-means clustering″- 4 groups) has shown that such groups could not be defined on a sample of competitive female (Table 1) and male dancers (Table 2). In a broader discussion, previous researches have affirmed the existence of two types of high IO/low EO clusters on a sample of competitive dancers. Second cluster is characteristic for the dancer population, and is presented in moderate values of EO and IO (Musa & Miletić, 2011).

It is important to mention that in this population, cluster low IO/high EO has not been formed in both sexes, which was expected in a dancing population that has a dominating intrinsic orientation as a recognisable element of success. This kind of IO result is a precondition to a successful dance performance that will in general be expressive, inspired and emotional. If the dance performance is only a manifestation of a well rehearsed and memorized motor structure, the technical performance of the choreography alone will be good, but it is the emotional performance that will make an impression on the spectators and the judges, and by that differentiate the best dancers from the average ones.

Results presented in Table 3 indicate that there are significant differences between male and female dancers in extrinsic orientation in favor of the females. That means that female dancers in average are more motivated by some outside indication of success, such as the cognition of being better

comparing to others. Further researches are needed to accurately determine which outside elements dominantly affect on the obtained higher EO values in female dancers. The competitive attitude of females in sport dancing is reasonable because in average there are a lot more female competitor dancers than there are male. It is often hard for capable and motivated female dancers to find a partner to compete with, which is especially shown in the younger categories. Oftentimes young girls tend to quit intensive training because they cannot find a partner and achieve a successful competitive career. This intensive training could be the reason why female dancers report musculo-skeletal pain more frequently than male. Also, it is well known that dance training particularly increases during periods of accelerated growth, compounding the risk of overuse injuries (Hess, Cappiello, Poole, & Hunter, 1989; Bronner, Ojofeitimi, & Rose, 2003). Miletic. Kostic and Miletic (2011) obtained the similar results in monitoring pain status among S&L dancers of both sexes. According to results of this research, female dancers are more likely to report musculoskeletal pain. For an explanation of that kind of pain occurrence, further researches that will include social and medical aspects are needed.

According to the results of regression analysis, it is indicated that only a high level of extrinsic orientation is in a positive correlation to a high competitive ranking. That is confirmed by a premise that in female dancers, competitiveness is considerably more expressed than in their male colleagues.

CONCLUSION

Dancing, as an aesthetic activity, is impossible to perform without certain emotions and expressions. Therefore, the lack of the group that has a low IO/high EO is understandable. Finally, intrinsic orientation as the basis of emotional expression and competitive success plays a significant role among high competitive sport dancers. But, interaction of IO and EO is complex among dance population and more extensive researches which include social and medical aspects are needed.

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MOTOR BALANCE OF DISCO DANCE AND HIP HOP DANCERS

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SUMMARY

The aim of this research was to determine if theire is any difference in the motor balance of "Disco Dance" and "Hip Hop" dancers and non - dancers. The research sample comprised 60 subjects, aged 12 to 14. The sample was divided into three subsamples, two experimental groups in which the subjects were actively involved in the dances, a year on average, and a control group in which the subjects did not have any other activities besides regular physical education classes in school. The sample of measuring instruments consisted of five measuring instruments for the assessment of motor balance. The results showed a statistically significant difference in one variable of "Hip-Hop" dancers and the two variables of "Disco Dance" dancers in favor of dancers.

Keywords: dancers, training, balance, modern dances

INTRODUCTION

From the first dance performances, dancers have always stood out with theirs impeccable grace and control of movement, as well as an enviable balance in various dance poses, demonstrating the art of movement and motion to the viewers. Professional dancers, with their graceful movement on the dance floor, have always showed exquisite coordination in space. Their spatial skills, together with extensive dance training, flexibility, strength and other abilities contributed to the exceptional balance both in static positions and during movement and complex dance figures. During years long training and performing complex dance moves in different conditions, dancers have become accustomed to moving their bodies through space, creating compensatory movements allowing them to correct body position and fine tune their sensomotor systems (Crotts, Thompson, Nahom, Ryan, & Newton, 1996). Large number of studies show that dancers display better level of balance in relation to non-dancers (Golomer, Dupui, & Monod, 1997; Golomer, Crémieux, Dupui, Isableu, & Ohlmann, 1999; Perrin, Deviterne, Hugel, & Perrot, 2001). Also the strategies and techniques that dancers apply during the dance, contribute to the fact that they have better postural control and postural stability due to the specific distribution of body weight (Rein, Fabian, Zwipp, Rammelt, & Weindel, 2011).

"Disco Dance" is a modern dance characterized by specific dance technique consisting of explosive, quick and powerful movements performed in pirouettes, jumps, turns and other dance technique elements. On the other hand "Hip Hop" includes certain ways of rocking, bouncing and jumping with additional structures such as breaks, fast movements after breaking, intermittent and sudden quick movements. Both "Disco Dance" and "Hip Hop" require a high level of balance for the correct performance of all dance technique elements. Considering these characteristics of dance and the requirements imposed upon dancers, the study aims to determine if there are any differences in the balance of the two types of dance dancers and non-dancers, due to a specific dance training of the "Disco Dance" and "Hip Hop."

METHODS

Sample of examinees

The research sample consisted of 60 subjects divided into three sub-samples, two experimental and one control. The first sub-sample consisted of 20 Hip Hop dancers, members of the dance school „ Quick 010" from Pirot, aged 12 to 14, with average body height of 157cm and average weight of 49kg. Dancers were actively engaged in Hip Hop dance on average, for about one year, twice a week for 60 minutes. The second sub-sample consisted of 20 Disco Dance dancers, members of the dance school„ Quick 010" from Pirot, with the same chronological status, average body height of 152cm and average body weight of 43kg. They trained twice a week, and the average training time was also around one year. The third sub-sample consisted of 20 girls not engaged in dancing, or not involved in the training process of any other sports. The control sub-sample consisted of schoolgirls of the primary school „ Sveti Sava " from Pirot, aged 12 to 14, average body height of 154cm and average body weight of 45kg. They did not have any organised physical activity apart from the physical education classes in school. All subjects voluntarily consented to testing during which they were clinically healthy.

Sample of measuring instruments

In this study the following tests were applied to estimate motor balance of dancers:

1. Standing on one leg with eyes closed (MSNNZ), static balance (Tkalčić, 1981);
2. Standing on one foot transversely on the balance beam with eyes open (MSPKO), static balance (Stanković, 2007);
3. Standing on one leg perpendicular on the balance beam with eyes closed (MSUKZ), static balance (Stanković, 2007);
4. Walking forward on low beam (MHODG), dynamic balance (Tkalčić, 1981);
5. Balance in turning (MROKR), dynamic balance (Heinß & Brzank, 1981).

Statistical analysis

In order to determine the existence of the statistically significant differences between the experimental and control groups, the *t*–test was applied, and basic descriptive statistical parameters were presented. Results were processed using the statistical program SPSS 17.0. Analyze of data in Table 1, shows the basic statistical parameters of the dancers and non-dancers, and it can be concluded that all applied tests have good sensitivity and variability because their standard deviation is contained approximately three to five times within the range.

RESULTS

Table 1. Descriptive statistical parameters of dancers and non–dancers

	N	„Disco Dance“ group			„Hip Hop“ group			Non–dancers group		
Variable	20	Range	Mean	Std. Dev.	Range	Mean	Std. Dev.	Range	Mean	Std. Dev.
MSNNZ	20	2.963	2.800	0.822	1.757	2.256	0.505	2.010	1.667	0.518
MSPKO	20	31.888	11.311	7.125	24.448	10.630	6.255	29.225	9.382	7.347
MSUKZ	20	22.535	11.127	6.694	33.990	15.963	9.943	34.270	12.684	7.539
MHODG	20	10.730	12.547	3.278	17.190	14.539	4.170	15.610	14.611	3.504
MROKR	20	7.950	13.273	2.187	25.730	15.286	6.045	24.240	17.124	5.310

Legend: N – number of subjects, **Std. Dev. –** standard deviation

Table 2. T-test for dancers of „Disco Dance“, „Hip Hop“ and non–dancers

	T – test „Disco Dance“and non - dancers				T – test „Hip Hop“ and non - dancers			
Variable	t	df	Sig.	Mean diff.	t	df	Sig.	Mean diff.
MSNNZ	5,212	38	**0,000**	1,133	3,641	38	**0,001**	0,589
MSPKO	0,843	38	0,405	1,929	0,578	38	0,567	1,247
MSUKZ	-0.691	38	0,494	-1,557	1,175	38	0,247	3,279
MHODG	-1,924	38	0,062	-2,065	-0,060	38	0,953	-0,073
MROKR	-2,999	38	**0,005**	0,005	-1,022	38	0,313	-1,838

Legend: **t** – *t*-test value, **df** – degrees of freedom**, Sig**. – p value ≤ 0.05, **Mean diff –** Mean difference

Table 2 shows that in the first test - Standing on one leg with eyes closed (MSNNZ), and in the last test - Balance in turning (MROKR), there is a statistically significant difference in favor of the "Disco Dance" dancers. By reviewing the values of the arithmetic mean we can observe higher values of "Disco Dance " dancers on the above mentioned tests, and based on that it can be concluded that they are better than non–dancers group.

The same Table shows statistically significant difference in the first test - Standing on one leg with eyes closed (MSNNZ) in the group of „Hip Hop“ dancers, which means that the dancers of "Hip Hop" are better than the non–dancers group in this test.

DISCUSSION

In order to successfully perform any given structure dancers, generally speaking, have to posess a sense of rhythm, spatial orientation, coordination of the performance of individual and movements in general. Dance and choreography, nowadays, require from a dancers high degree of connection, orientation, velocity and balance. Crotts, Thompson, Nahom, Ryan & Newton (1996) showed that there was statistically significant difference in average overall score of balance, in all of the six conditions that were investigated, among a group of dancers and the control group of non-dancers. In this study, the results are somewhat different.

Comparing the results of *t*-tests on the sample of "Hip-Hop" dancers and non–dancers, a statistically significant difference was diagnosed in the first test - Standing on one leg with eyes closed (MSNNZ). The technique of „Hip Hop“ dance structure implies the action of the whole body, where the isolations are performed on different sides and the movements of the torso and pelvis are performed separately. Head movements are very sharp, quick, and frequent, and in every subsequent movement dancers lose their field of view. Techniques of „Hip-Hop“ and all modern dances in general are extremelly physically demanding and require high level of control and concentration, achieved by increasing the motor balance to the higher level.

Correlation of dance technique and transformation of balance abilities, as well as the balance relations with success in dance sport are proven in the studies of Oreb (1984), Kostić (1996), Kostić and Dimova (1997), Uzunović (2004), Uzunović, Kostić, and Miletić (2009), etc. However, tests standing on one foot transversely on the balance beam with eyes open (MSPKO), standing on one leg perpendicular on the balance beam with eyes closed (MSUKZ), walking forward on low beam (MHODG) and balance in turning (MROKR) showed no statistically significant difference. The answer can be found in the fact that the „Hip Hop“ dancers train twice a week for one hour, which may be insufficient to achieve a high level of motor balance. The justification for these results can be found in the study of Petković (2008). He believes that, despite the large number of studies which were examining the balance, there is still an insufficient number of measuring instruments for reliable measurement. In previous studies, Momirović, Štalec, and Wolf (1975) encountered the unreliability of the tests for balance, whereas their research determined the reliability of the composite tests of motor skills. The results showed significantly lower values for the tests of balance than for other motor skills. Although the coefficient of generability was great, these tests in general had lower reliability than other motor tests.

Relation of motor balance among the "Disco Dance" dancers and non–dancers is not significantly different. The results of *t*-test showed that there was statistically significant difference between these two sub-samples in the following variables: Standing on one leg with eyes closed (MSNNZ) and Balance in turning (MROKR). In the analysis of the "Disco Dance" technique a basic technique of ballet prevails, specifically ballet jumps and turns. Emphasis is apparently given to the speed of movement, whereby for the performance of complex techniques explosive power is also required. In the first test- Standing on one leg with eyes closed (MSNNZ), "Disco Dance" dancers achieved statistically better results than non-dancers meaning that the static balance is necessary for this kind of dance, regardless of the fact that the dance is very dynamic and fast throughout the performance. In the fifth test- Balance in turning (MROKR) "Disco Dance" dancers achieved better results, which was expected. Choreography in "Disco Dance" is based on turns and pirouettes, leaps and jumps from turns, therefore, the result obtained is logical, which was proved by Travis (1945), who claims in his research, among other results, that the dynamic component of maintaining balance is not generally associated with the static component. Thus one could explain the results of the tests Standing on one foot transversely on the balance beam with eyes open (MSPKO),

Standing on one leg perpendicular on the balance beam with eyes closed (MSUKZ), and Walking forward on low beam (MHODG), indicating that there were no statistically significant differences. However, differences in the arithmetic means were very visible in favor of "Disco Dance" dancers, which may indicate that "Disco Dance", and modern dance in general, have positive impact on the development of balance and other motor skills. Statistically significant differences would likely be shown in this sample of subjects, over a certain period of time, if the dancers continued with the training process, with some modifications, increased the number of trainings and improved the dancing technique.

CONCLUSION

The results obtained investigating this sample showed that there is a difference between "Disco Dance" and "Hip-Hop" dancers and non-dancers, incurred probably under the influence of training and specificity of dances. Although the differences were observed in only two variables of "Disco Dance" dancers and in one variable of "Hip Hop" dancers, the authors believe that training of these two types of modern dances can contribute to the improvement of the dancers' motor balance. The limitation of this research reflects in a low frequency of training, therefore, the authors recommend additional research on a sample that will have higher frequency of training sessions per week and thus determine whether differences observed in the other studied variables would occur to a greater extent.

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INTERPERSONAL CHARACTERISTICS, SPORTSMANSHIP ORIENTATION, AND SUBJECTIVE EVALUATION OF THE SIGNIFICANCE OF BODY BUILDING

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SUMMARY

Introduction: The personal qualities that are formed and developed through sports have been hotly debated among sport communities. Another topic of numerous discussions has been the influence of body building on the development of human personality. Opinions differ and some of them are rather extreme. Extreme evaluations of body building arise from lack of knowledge about its essential characteristics, of its psychological features, and its specificities. This study sets out to examine the psychological fundaments of body building; its influence on the personality of the people who practice it; the personal characteristics of body builders and the application of these characteristics in sports and life in general.

Methods: The study involves groups of people of different age, different sports experience, and different sports qualifications. The total number of studied people is 60. Half of them are high-rank contestants.

Results: The results from the study confirm the hypothesis that a great part of the personal characteristics of body builders have been influenced by the nature of the sports they do. Body builders possess a whole range of positive personal and socio-psychological qualities, which renders body building as a sport suitable for various age groups.

Keywords: interpersonal characteristics, sportsmanship, subjective evaluation of the benefits of sport, bodybuilders, fitness enthusiasts

INTRODUCTION

Personal qualities that form and develop through sport are the subject of much discussion within the sports community. Controversial and debatable issue is the impact of bodybuilding on the development of personality. Opinions are varied and sometimes too extreme. The final estimates for bodybuilding are caused by misunderstanding of its nature and psychological characteristics as well as its specificity. The present study is aimed at detecting precisely the psychological nature of bodybuilding, its impact on the personality of practitioners to identify personal characteristics of athletes in bodybuilding and the extent of their use in sport and life in general.

STUDY HYPOTHESIS

Bodybuilding, as a sport, has a significant influence on the personality of its practitioners. Dealing with bodybuilding develops and forms specific personality characteristics. Components in a wide range of mental structure, Bodybuilding significantly impacts on the characteristics of interpersonal behavior implemented in the general social environment, as well as in specific sports. In sporting circles characteristics of interpersonal behavior can be defined as sportsmanlike or unsportsmanlike. We assume Bodybuilding conditioned building and shaping characteristics typify adequate, adaptive, nonconformity rough behavior and focus on sportsmanship.

AIM OF THE STUDY

To reveal the influence of bodybuilding on the characteristics of interpersonal behavior and sportsmanship of dealing with it.

TASKS OF STUDY

1. Expose peculiarities of interpersonal behavior bodybuilders.

2. Establish peculiarities in the structure of their orientation to sportsmanship.

3. Expose peculiarities of the subjective assessment of body builders on the benefits of the sport.

4. Expose the characteristics of the phenomena studied in bodybuilders with high and low skilled practitioners.

Object of the study were 60 individuals (30 athletes, bodybuilders and 30 fitness enthusiasts). Among those people were champions in elite sports competitions on global, European, Balkan and national championships. Respondents were aged 20 to 51 years.

METHODS

Research styles of interpersonal interactions are used with the tests of Timothy Leary, which measures 16 variables of interpersonal behavior. In the processing and interpretation of the results are grouped into eight dimensions (autocratic - humiliated, egocentric - conformal; aggressive - afiliativen; suspicious - protective) (P. Sobchik, 1990).

To assess the targeting of sportsmanship using the methodology The Multidimensional Sportsmanship Orientations Scale - MSOS (Vallerand, Brière, Blanchard, Provencher, 1997). The methodology contains 25 items and Likert-type scale with five possible responses. Sportsmanship is assessed in five key areas that define five subscales of the test:

- Respect for social conventions;
- Respect for the rules and the officials;
- Respect for one's full commitment toward sport participation;
- Respect and concern for the opponent;
- Negative approach toward the practice of sport.

The methodology was adapted to conditions of Bulgarian Mihail Georgiev and Dimitrina Fenerova (2014).

Test study on the subjective evaluation of the benefits of sport. The methodology consists of five- and 18 items Likert type scale (I. Tosheva, M. Georgiev, 2014). Contains four subscales:

- Self-knowledge and life experience;
- Public recognition (status) and social contacts;
- Self-improvement;
- Satisfaction and inner harmony.

RESULTS

The study group athlete in bodybuilding is characterized by varying degrees of expression and specific characteristics of the structure of interpersonal behavior. The results of the analysis of variance appear first as characteristics of autocratic personality typing (Table 1). Second, in rank order, is the protective characteristic of personality. The degree of markedness of these characteristics determines the subjects as responsible, rather than as a protective and overprotective. With almost the same degree of markedness is typing characteristics affiliation prone to association and interaction personality. Last place in the rank order occupies the characteristics of the humble, obedient, submissive personality.

Table 1. Results of the analysis of variance of characteristics of interpersonal behavior

	Min	Max	M	SD
PA - Managerial - Autocratic	5	16	11,46	2,38
NO - Responsible-Hypernormal	2	16	9.86	2,82
LM - Cooperative-Overconventional	2	14	9,85	2,88
BC - Competitive - Narcissistic	7	14	9,76	1,69
DE - Aggressive - Sadistic	3	14	8,66	2,24
JK - Docile-Dependent	4	13	8,48	1,92
FG - Rebellious - Distrustful	1	15	7,48	2,98
HI - Self-Effacing - Masochistic	1	13	6,36	2,39

The results obtained by the variational analysis of the characteristics of interpersonal behavior indicated that the respondents did not reveal pure types of interpersonal behavior. They have characteristics of different typological features (Fig. 1). To find a vector of central tendency were calculated components dominance (DOM) and affiliations (LOV) (T. Leary, 1957):

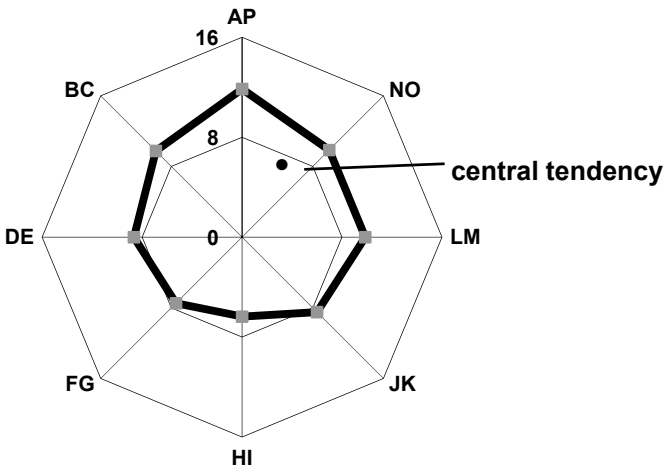

Fig. 1. Profile characteristics of interpersonal behavior for the entire group respondents

Central tendency of the characteristics of interpersonal behavior determines the respondents as overprotective. The values are in the area of adaptive behavior. Adaptive shape represents a positive and constructive social personality type. In the adaptive dimensions main the feature of interpersonal individual technique of this type is responsible and tactful behavior. Respondents are characterized as responsible, reasonable, prosperous, resourceful, mature. Independent and strong personalities, but uses his powers and independence of the judgments in afiliativen friendly way. Strive to be emotionally close to the other, to help, advise and to sympathize with them. They want others to see them as polite, reasonable and responsible. Evoke the impression of maturity and parental power.

When sentiment orientation to sportsmanship first attitude towards training and competition process. With similar values of the second and third place attitude towards rules and regulations and attitudes towards rules and officials. Fourth in rank order takes attitude towards opponents (Table 2).

Table 2. Results of analysis of variance of attitudes towards sportsmanship

	Min	Max	M	SD
Respect for one's full commitment toward sport participation	2	5	4,73	0,54
Respect for social conventions	1,6	5	4,3	0,87
Respect for the rules and the officials	1,8	5	4,21	0,76
Respect and concern for the opponent	2,2	5	3,96	0,81
Total score			4,3	

The results of variational analysis of attitudes towards sportsmanship are indicative. Respondents are characterized by pronounced levels of attitude towards training and competition process. High value is the attitude to rules and regulations. Bodybuilders and fitness bodybuilders are people who are known (to possess) positive principles and norms that are shared by almost everyone. These rules and regulations become controllers of their behavior. Attitude towards rules and officials is normally high. Bodybuilders and fitness bodybuilders are educated, serious and honest, and very rarely can lead to conflicts. Competition in bodybuilding is very large. Severe desire to win can lead to stress and improper relationships, which explains the relatively low value of the expressed attitude towards opponents.

Total score displayed as a resultant of the four main areas that determine attitudes to sporting behavior indicates that respondents have a strong

attitude of sportsmanship (M = 4.3 - the maximum score is 5).

The analysis of the results of the test used to detect the image of the respondents on the benefits of practicing sport, bringing the first in rank order associated with self-knowledge and personal improvement. To a lesser extent Bodybuilding binds public recognition and social contact (Table 3).

Table 3. Benefits of practicing sport

	Min	Max	M	SD
Self-knowledge and life experience	2,2	5	4,43	0,66
Personal self-improvement	2,0	5	4,43	0,73
Satisfaction and inner harmony	2,75	5	4,32	0,63
Public recognition (status) and social contacts	1,0	5	3,91	1,0

Analysis of the results for the group respondents, in general, does not provide sufficient information about the effects of bodybuilding on their interpersonal characteristics on their attitudes about sportsmanship and their subjective evaluation of benefits from practicing this sport. For a more precise detection of the influence of bodybuilding on practitioners, the results of the study to analyze the factors differentiated by age, sport experience and sports experience. Outlines the three grouping variables containing two subgroups:

- Age - first group - 20-29 years;
- Second group - 30-51 years;
- Sports experience - first group - from 1 to 10 years;
- Second group - 11 to 40 years;
- Sports rank - elite Group;
- Second group is not elite.

On the basis of the grouping variables was carried comparative analysis of the studied parameters (Mann-Whitne). At the age factor comparative analysis revealed statistically significant differences in the variables: respect for rules and officials; relation to competitors; self-knowledge and life experience. All three variables are more pronounced in the group of athletes older (older athletes). The two groups have very different views as to the bodybuilding sport and to life in general. Younger characterized as primary, impulsive, selfish, dynamic and very active. Whereas in the older are staid, wise, calm, purposeful, "arranged in thoughts and ambitions" respect established and non-established rules and regulations.

A comparative analysis of factors sporting experience revealed statistically significant differences in the variables: self-centeredness; respect to the regulations and officials; relation to competitors; self-knowledge and life experience.

More pronounced egocentricity, in the smaller sports experience can be explained by the orientation of those involved in bodybuilding in different periods of his athletic career. The initial development of the power options changing daily physics and growing self-esteem makes individuals from the group of smaller sports experience to seek expression through demonstration of skills and attributes permanently. Individuals in the group with more sporty experience long past in this "amateur period" and wish to compete primarily on the stage, and only with yourself.

Persons with little training experience and insufficient knowledge of the "sporting ideals" are able at times to not comply with the Rules and the decisions of the officials. For the group of people with great sports and sports internship experience the danger of improper behavior is minimal.

Less experienced are subject to spell "big muscles and slender figure" - do not respect anyone or anything (even less with a rival in the sport aspect). Experienced athletes educated in the ideals of bodybuilding, with due regard to its competitors (both on stage and beyond).

The larger life experience dictated by longstanding activities in bodybuilding is a prerequisite for successful social integration and social recognition.

Benchmarking factors sports rank shows significant differences in the variables: avtokratichnos leadership , dominance;

egocentricity; komformnost comfort ; protektivnost protectiveness; respect to training and competition process; relation to competitors; public recognition and social contacts.

Athletes with lower qualifications are characterized by pronounced avtokratichnost leadership. This can be explained by the presence of much more violent temper, with greater reactivity behavior with impatience to achieve significant success, with their focus on practicing bodybuilding and lasting purpose - a demonstration of power and strength.

More pronounced is the egocentrism in lower-skilled bodybuilders. These bodybuilders looking for fitness competition everywhere and constantly, while athletes highly correlate primarily with themselves and much less with others.

Highly bodybuilders emerge as much conformal compared to low-skilled. This result was expected and confirms our observations. Are highly grateful seek to avoid conflicts (fully overlap potential and human virtues among these respondents). In lower-skilled these virtues hardly reached such levels of development.

Highly bodybuilders have higher values in terms of protectiveness responsibility. Much more inclined to help others to counseling, to transmit their experience to comply with the training and educational opportunities for bodybuilding.

Statistically different between the two groups - and highly skilled bodybuilders - define as highly responsible and accurate in terms of training and competition. Positive qualities acquired purposeful long training contribute to the demonstration of respect for the opponent, unlike the highly skilled who are quite reserved in their attitude to other practitioners.

Highly bodybuilders are aware of the price you pay - many hardships and compromises (including health). They are aimed at the racing appearance to sports success, especially the battle with him, while skilled bodybuilders seeking public recognition is a priority. One means of entry into society is their own individual advantage, which often use even a little presumptuous.

Identified differences in the characteristics of interpersonal behavior and highly skilled bodybuilders warrant removal of differentiated profiles of interpersonal behavior. For this purpose, were calculated for both groups of parameters defining the central tendency - DOM and LOV:

Differentiated results for both groups bodybuilders show significant differences. At first glance profiles of drowning groups were similar (Fig. 2 and 3) but the central tendencies are different. Bodybuilders with lower qualifications are characterized by strong dominance autocratic while highly bodybuilders are characterized by a pronounced attitude of cooperation and helping others.

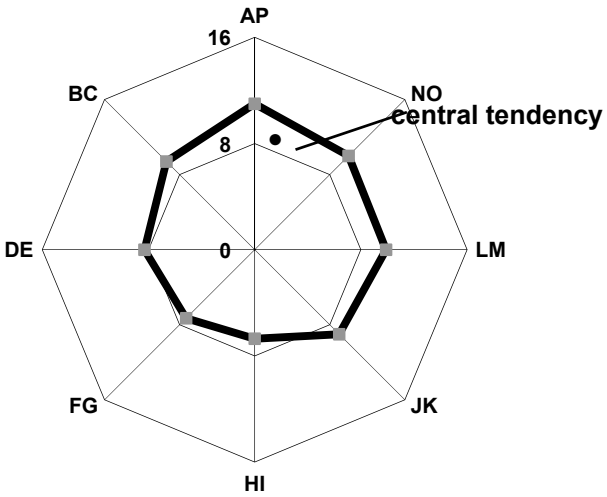

Fig. 2. Profile characteristics of interpersonal behavior of the elite bodybuilders

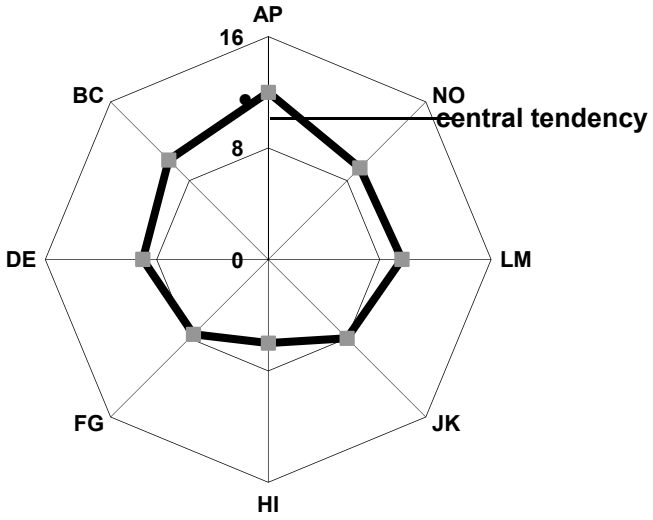

Fig. 3. Profile characteristics of interpersonal behavior of the group not elite bodybuilders

CONCLUSION

The results of the empirical study aimed at disclosing the personal characteristics of those involved in bodybuilding warrant removal of a summary evaluations. Bodybuilding is a sport that contains specific requirements for psychological practitioners. Undoubtedly, psychological characteristics should be developed and shaped by a wide range of factors - genetic and social. But as far as dealing with bodybuilding give the majority of their time and effort in training and competition process, we can assume that a significant majority of their mental characteristics are influenced by bodybuilding.

Established features of the phenomena studied in different groups of people - different ages, different backgrounds and different sports training support the findings.

Bodybuilders are carriers of positive mental qualities, accept and share the established social moral rules and norms of behavior. They are aimed at continuous self-development and self-improvement, not only of their physical properties, but purely mental. In the process of communication and interaction occur characteristics typify active, dominant personalities at the same time possess the characteristics of cooperating and supporting individuals. They have a highly developed sense of autonomy and independence, honesty and willingness to assistance. Sportsmanship, exhibit a wide range of areas related to the training and competition process is well developed and stable. Unsportsmanlike events are very rare. Occur primarily in terms of race, under the influence of strong competition and a great desire to succeed. But it is inherent in the sport, this is the essence of sport and unlike many other sports in bodybuilding is within the norm.

Bodybuilding leads to the formation of the most essential, the most human qualities and characteristics. It is suitable sport for all ages. For those involved in bodybuilding it's all he is - a way of life.

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SATISFACTION AND SUBJECTIVE IMPORTANCE OF PRACTICING BODYBUILDING AND FITNESS

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SUMMARY

Introduction: Athlete satisfaction is a prerequisite for participation in sport and a prerequisite for a successful and long career. Satisfaction is essential, regardless of the age of the athlete, regardless of sport training. Lack of satisfaction can lead to shifting of the athlete to other areas containing potential conditions for success and satisfaction.

Satisfaction with the activity of a sport is closely related to the subjective assessment of the athlete on the benefits of this activity. Benefits of the sport are found in three objective areas: self-awareness; life experience; physical and mental health; public recognition and social contacts; satisfaction and inner harmony; personal self-improvement. The report presented the results of a study of the characteristics of the subjective assessment of the benefits of exercise with bodybuilding and fitness level of satisfaction and the factors that define it.

Keywords: satisfaction, subjective evaluation of the benefits of sport, bodybuilders, fitness enthusiasts.

INTRODUCTION

Satisfaction of the athlete regarded as quality of life or attitude to the organization and management of the team. It is a prerequisite for participation in sport and a prerequisite for a successful and long career. Satisfaction is essential, regardless of the age of the athlete, regardless of sports training. Lack of satisfaction can lead to shifting of the athlete to other areas containing potential conditions for success and satisfaction.

Wide range of factors influences the satisfaction of the athlete. Chelladurai and Riemer offer a theoretical model containing the main aspects and components of satisfaction that connect and relevant factors that determine them: Individual presentation (satisfaction from their work, improvement, achieved personal goals); Team performance (satisfaction with the work of the team as a whole, achieved goals, the pursuit of continuous improvement); Capability Development (job satisfaction coach in the development of skills and talent of the athlete); Strategy (satisfaction with the strategic and tactical decisions of the coach); Personal relationship coach to athlete (satisfaction with social support and positive feedback); Training and Instructions (satisfaction with training, coaching and coach); Collective responsibility (satisfaction with the contribution of each team member to solve the tasks of the team); Social responsibility (satisfaction with the support and contribution of the team for the development of each of its members); Ethics (satisfaction with relationships in teams); Integrity Team (satisfaction with group integration, coordination and cooperation for the achievement of the team); Devotion (athlete satisfaction of his own devotion and contribution to the success of the team); Budget (satisfaction with financial conditions for the development team); medical staff(satisfaction with the medical staff of the team); Academic support (satisfaction with academic services and support to athletes); External agents (satisfaction with the support of external team and club organizations) (Riemer and Chelladurai, 2002, 1998).

Satisfaction with the activity of a sport is closely related to the subjective assessment of the athlete on the benefits of this activity. Benefits of the sport are found in several three objective areas: self-awareness; life experience; physical and mental health; public recognition and social contacts; satisfaction and inner harmony; personal self-improvement.

The aim of this study is to reveal the characteristics of the subjective assessment of the benefits of exercise with bodybuilding and fitness level of satisfaction and the factors that define it.

METHODS

Test study on the subjective evaluation of the benefits of sport. The methodology consists of five- and 18 aytema Likert type scale. Contains four subscales: "Self-awareness and life experience"; "Public recognition (status) and social contacts"; "Personal cultivation"; "Satisfaction and inner harmony" (I. Tosheva, M. Georgiev, 2014).

Test study of satisfaction athlete (Athlete Satisfaction Questionnaire - ASQ (Riemer, Chelladurai, 1998). Methodology is a multidimensional questionnaire. Original version of the test contains 56 items grouped into 15 subscales corresponding to the components of satisfaction and seven Likert-type scale estimate the level of markedness. wide format allows the method to the needs of specific studies to include those dimensions of the satisfaction, which are most significant. used in the present assay method is comprised of four subscales:

- Training and instruction;
- Team performance;
- Individual performance;
- Personal relationship coach to athlete.

Two subscales reflect satisfaction with the training process and the other two reflect the satisfaction of achievement. Total items methodology is 14. Methodology was adapted to conditions of Bulgarian Georgiev and others (Georgiev, 2011).

OBJECT OF STUDY

In the empirical study included 162 individuals. The majority of men - 159 women and 3. The number of bodybuilders is 75, while dealing with fitness - 87. Among bodybuilders are 60 Bulgarian and 15 foreign athletes.

RESULTS

Comparative analysis of variables factors bodybuilders / fitness enthusiasts

The comparative analysis shows that there are statistically significant differences in a large number of variables examined. Specifically, differences were observed in terms of:

- Satisfaction with the training season and coach - u=2,1; α=0,05;
- Satisfaction with the development team throughout the season - u=2,5; α=0,01;
- Satisfaction of individual development season - u=4,; α=0,001;
- Satisfaction with respect to coach me - u=5,3; α=0,001;
- Self-knowledge and life experience - u=2,4; α=0,05;
- Public recognition (status) and social contacts - u=2,08; α=0,05;
- Satisfaction and inner harmony - u=2,68; α=0,05;
- Personal self-improvement - u=2,69; α=0,05.

To reveal the characteristics of the variables and their degree of markedness in both groups experienced (bodybuilders and fitness enthusiasts) accounted variance analysis.

In terms of satisfaction of practicing bodybuilding and fitness chief factor that determines who puts it in bodybuilders is "the attitude of the coach towards me" (M = 3.95). With a very high factor is "training season and coach" (M = 3.88). The other two factors that determine satisfaction were also relatively high, "my individual development season" (M = 3.8) and 'development team during the season "(M = 3.7). These results are completely expected, taking into account the individual nature of the sport and the close connection athlete trainer. We have some reservations about the individual and team development, which is understandable justified major requirements that athletes put towards yourself and others.

In fitness enthusiasts factors are similar in structure to the satisfaction of markedness but different grades. The greatest impact on their satisfaction is the factor "attitude coach to me"

(M=4.45). With very high values and other factors "training season and coach" (M=3.4); "The development team / group during the season" (M=3.18). Finally, the factor "my individual development season" (M=3.2) (Fig. 1).

The comparative analysis of satisfaction with bodybuilders and fitness enthusiasts shows that fans are very happy with the attitude of their coach / instructor (perhaps because very often it is a paid service), while professionals have reservations in this regard (perhaps caused by the large requirements that put their coach). Elite athletes have high values for training during the season. This is justified considering racing objectives. They are pleased with the advice of their coach. Usually trainee account gaps the way in which the approach to training and also claim the instructions received.

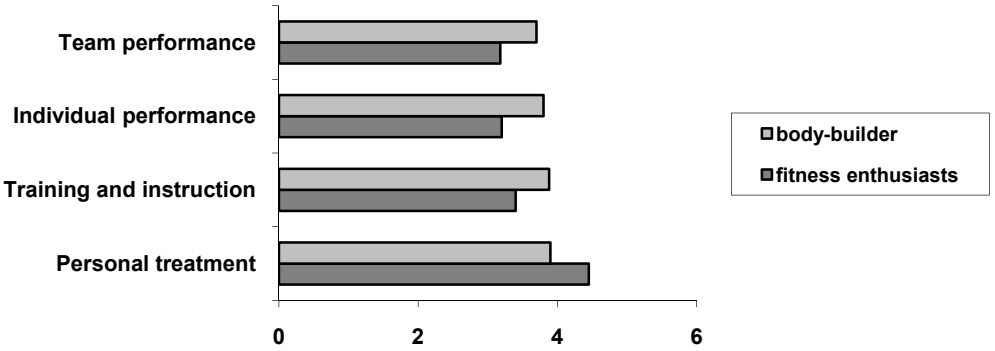

Fig. 1. Comparative analysis of the factors of satisfaction with bodybuilders and fitness enthusiasts

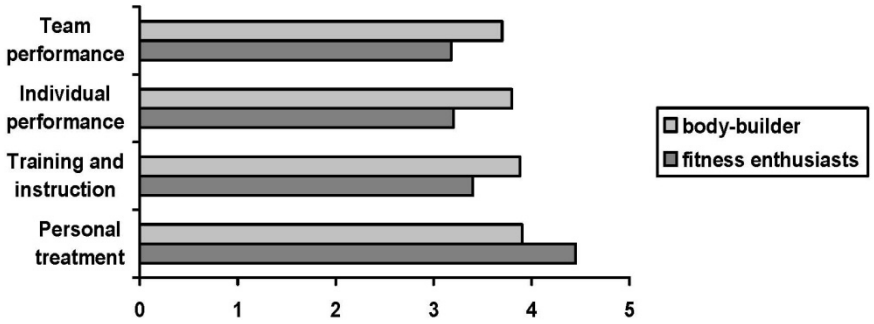

Fig. 2. Comparative analysis of subjective assessments of the benefits of the activity of bodybuilding and fitness

On individual development season elite athletes are more satisfied compared to neelitnite athletes - first they put all forces and means to win and improve as players and individuals, while the latter are not completely satisfied with the results (maybe thinking a secular, that the results in this sport can be achieved quickly and easily).

As regards the development of the team in the season bodybuilders have high values. This is quite understandable, knowing how serious their relationship to each racing season and their great desire to improve every year. Low values of lovers in the development of the team come from the fact that they have racing and not subject his life to training. Sport for their pleasure and enjoyment and do anything at any price.

Analysis of the results of the subjective assessment of the study on the importance of bodybuilders bodybuilding for them and benefit from its practice shows that leading to them opportunities for personal self-improvement (M = 4.52) and self-knowledge and life experience (M = 4.39) . It satisfaction and inner harmony (M = 4.25), while the lowest values is social recognition and social interaction (M = 3.48).

The results confirm that despite the outward manifestation of this sport, it is oriented in the deep interior and spiritual aspects that are indicative of highly intelligent and deeply conscious psychological and philosophical aspects present in the work of these athletes. Social media is not a leader in the

lifestyle of bodybuilders and they have other priorities, constructed largely of their own views.

The group of fitness enthusiasts reveals a different arrangement of subjective assessments of the benefits of the activity with the sport. Leading in them opportunities for personal self-improvement (M=4.13), self-knowledge and life experience (M=4.15). With lower values satisfaction and inner harmony (M=3.93) and the lowest value, as well as bodybuilders is social recognition and social contacts (M=3.13) (Fig. 2).

The analysis of the research on subjective assessments of the benefits of the activity of bodybuilding and fitness shows that both groups had very high levels of personal self-improvement, they expect to establish and develop a number of personal qualities through sports bodybuilding and fitness. Their attitudes are integrated development Psychosomatics them. Expectations for conscious and meaningful reinvention of personality, are higher in elite bodybuilders while fans have attitude to enter so deeply within yourself. This is understandable because of the great commitment of elite athletes who have made this sport into a way of life and it is logical to detect new and unknown things in themselves, thanks to its active and sebeotdadeno dedication practice.

On satisfaction and inner harmony is normal bodybuilders have higher values because they become sport in ideology and expect him to get all the spiritual needs that you need. Lower performance in lovers are associated with different priorities and limited commitment to the sport practiced. Lovers seeking harmony and satisfaction primarily in other, their personal pursuits.

In society often believes that people who engage in bodybuilding and fitness are directed to do so by the need to be liked, to attract and win the sympathy of representatives of the opposite sex to "drill" into society through their biceps muscle harmonious and well developed physique. But the results of this study show that the grounds of public recognition and social contacts have little relevance to the respondents.

CONCLUSION

Bodybuilders are characterized by a high degree of satisfaction from practicing this sport. All determinants of satisfaction are high. Bodybuilding is a sport and the satisfaction of his practice is a direct consequence of the achieved sporting success. Athletes participating in the European and World Championships are more satisfied than the participants of national and Balkan Championships.

Subjective assessments of the benefits of exercise with bodybuilding are associated with opportunities for personal self-improvement and self-knowledge, to achieve high satisfaction and inner harmony of physical and mental health. Public recognition and the possibility of more social contacts are in the background.

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SITUATIONAL SUCCESS IN WEIGHTLIFTING

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SUMMARY

Even though weightlifting is a sport that exists for a long period, there are few written and published papers related to this sport. The Russian and Bulgarian schools have extensive and long-standing experience in creating top competitors but their experience is not displayed through published papers and researches. Assumption is that their experts and coaches keep their knowledge for the next generation of weightlifters. Few papers that have been found and have been processed in this paper are mainly by Chinese authors. In the past 10 years China has become in the leading country in the Olympic weightlifting so their researches are very useful. As an experienced competitor and currently the weightlifting coach I want to publish this paper (although it doesn't contain sufficient research data) with the aim of resolving this problem. Paper includes 3 professional papers related to the situational success in weightlifting.

Keywords: weightlifting, tactics, technique, selection

INTRODUCTION

One of the basic features of sports is competition. Weightlifting is one big drama and the most important thing is to beat yourself. Weightlifting is one of the rare sports where referee cannot declare someone a winner unless he deserved it. Free referee's belief has a minor character, athlete has or has not lifted weights above his head and up to this day no big incident has been reported where wrong referee's decision influenced the weightlifter's result on major international competitions. Kilogram is a weightlifting symbol. Some results from the past are unachievable even today (Serbian weightlifting federation, 2006).

Experts for this sport still have not agreed upon where is the border between weightlifting as "power manifestation" and weightlifting as a sport. However, all agree that a modern weightlifting was created in the eighties of XIX century and the second century of modern weightlifting history can be discussed. The beginning of weightlifting, as a modern sport, is located in Austria, Russia, Germany and Uruguay. Weightlifting created two more sports branches: body-building and discipline of power (powerlifting). Weightlifting is on the program of Olympic Games since 1896. On first Olympic Games, 8 competitor from 5 countries participated in weightlifting.

Weightlifting is a sport in which competitors are trying to raise a large weight located on steel bar, for which a physical force, concentration, experience, power will, shape, technique, all in all mental and physical strength is necessary. The term "weightlifting" usually refers to only training for the competition; in the process of training the main muscular groups necessary for the competition are boosted, fitness is achieved and heart is preparing for great stress. Because of such results, many other athletes include similar exercises into their training. However, if they are not done properly these exercises can lead to serious disorders, so experienced coach and cautious and gradual practice is needed. Typical combination of muscular strength, of muscular force, flexibility, kinesthetic awareness, and weightlifting technique which is necessary for successful performances in weightlifting, results in a unique physiological profile of weightlifters (Kraemer and Koziris, 1994).

Technique is a crucial aspect of weightlifting, because without the technique weightlifter can get permanently injured and will not achieve the expected results. Rest is equally important.

The Olympic disciplines consist of two parts. In the first part the weight is lifted in one move from

the ground and above the head (gasp-snatch), and in the second part, mostly with heavier weights, weight is lifted above knee in one hitch wherein weight is usually put down on knees in order to make it easier then lifted on the shoulders, again bending down towards ground and practically lifting the weights with legs, and eventually up in the air once again by using your legs (clean and jerk). During execution of these two competition lifts, snatch and clean and jerk, weightlifters must generate extremely high force value and momentum of development force and, consequently, the high force value and contractile impulse (Garhammer, 1980; Garhammer 1982; Garhammer 1985; Garhammer 1991; Garhammer 1993); Storey, Wong, Smith, et al. 2012).

Three referees are overseeing the process. When competitor reaches the goal, each referee lights the white light. When at least two referees mark the successful lift, it is considered to be correct. If the referee considers that lift is not correct, it is marked with red light.

Weightlifting belongs to the group of base sports together with athletics and swimming. Weightlifting is a sport of dynamic force and explosiveness which use movements, two, more joints, or movement of the whole body in competition; snatch, clean and jerk. During the execution of these lifts, athletes have achieved one of the largest absolute and relative "peaks" of force found in literature. Structure of competitor's training is characterized by frequent use of highly intensive movements with resistance.

METHOD

In this paper as a method of research a descriptive method was used. Search of scientific literature relevant for this review paper was done by using bases of PubMed, SportDiscus and Google Scholar data base. Key terms that were used in search were weightlifting, tactics, technique, selection. Furthermore, literature was obtained by electronic searches of "connected articles" and by manual screening of referent lists of used studies. Criteria for including all texts were (I) that all articles were published in magazines in Serbian, English, Bulgarian, and Russian language and books from 1980 up to 2014; due to a small number of research as well as for the fact that the important facts were not changed during the years, older articles were used and (II) the terms "weightlifters" and "weightlifting" had to be in the context with competitive weightlifting unlike general trainings with weigh.

RESULTS

The Chinese team of weightlifters won many medals at the Olympic Games and world championships and has become a real "Dream Team". As a proven, strong province in this sport, Hunan province has enabled a great contribution to this sport and development of detailed training of weightlifters. This research (Gang An, 2013) contains documentary data, expert interviews, polls, and through comparative analyzes it investigates methods for training talented weightlifters in Hunan province.

Research says that the entire system of training is under constant leadership and management of state. There are three levels of training beginning with young people in schools over provincial team all up to national team. Especially during the Olympic Games 2000-2008 they increased the monetary investments in the preparation of the competitors. The aim of this province is to strengthen the monetary funds, and with the help of highly qualified coaches create the highest possible level of athlete representatives. A special attention must be directed to highly qualified coaches (for now there isn't a sufficient number), raising the level of tactical and technical skills, psychological training and only in this way they will ensure sustainable development of this sport.

The study of Süleyman CAN (2012) shows how activities during free time effect the result and the performance of 66 women and 120 men, weightlifters, from 40 clubs, who took part in the Turkish Weightlifting Championships held in Mugla province in 2008. Research results show that a greater portion of the weightlifting population has no permanent employment, thus have more time for training but on the other hand material satisfaction is at a low level. Men show better competitive results and greater progress and as a reason it is said that they use free time to educate themselves through weightlifting magazines. The conclusion says that with the help of planning the program scheme of training, professional education of competitors and planning their free time, the top level and a large number of major championships competitors can be reached.

Research Yang and June-Feng et al. (2011) claims that the tactics in weightlifting is contained in

registering and later changing the initial weight. The necessary elements of the so called tactics are information (weights of other competitors), quality, coach, and then the entire expert team, competitor's state and elaborated strategy that inevitably leads to success.

DISCUSSION

Selection in weightlifting is a very complex issue because one should measure and process data about all psychophysical qualities of a young organism in order to determine abilities for training and progress. For that purpose different criteria that help the selection are used. During selection of the beginners one should pay attention to their health because it is very important that there are no development deviations. One should pay attention to cardiovascular, respiratory and nervous system. Research done in previous years showed that with the right training process of weightlifting one can start in the period from 12 to 14 years. Doctors' analysis show that weightlifting benefits health and physical development of a young men and practice shows that those who started weightlifting in the earliest youth have good weightlifting results. In order to facilitate development and production of successful weightlifters, it is necessary to identify those individuals who possess some or all the features that contribute to top results in weightlifting (Fry et. al, 2006).

There is not a lot written data on tactics in weightlifting. Coaches of great Russian and Bulgarian schools are trying to preserve the most important details for their competitors. Still, by analyzing the previous competitions, some data that may be considered as rules was obtained. By analyzing variants of increasing the weight between the first and second, second and third attempt in and clean and jerk, certain coached state five variations (Bosco), other six (Vorobjov, Zemunik) variations of weight. They have established the tendency at highly trained participants at Olympic Games, World and European championships, that the first attempt in snatch and clean and jerk being with the smaller weight and is that followed by significant increase in weight. For example, there is an example of Bulgarian weightlifter V. Hristov who was the World's and European champion. Weight was distributed:

Snatch - I attempt 155.0 kg; II attempt 165.0 kg; III attempt 178.0 kg

Clean and jerk - I attempt 200.0 kg; II attempt 220.0 kg; III attempt 230.0 kg

As a rule, the operational plan of competition is made based on your own and opponent's possibilities. Beginning weight on a competition is usually 7.5 - 10 kg less than the maximum results. In the second attempt weightlifter should lift the weight that is within his limits, and in relation to the first attempt can be increase for 2.5 - 10 kg. If the second attempt fails, competitor tries to lift the same weight or to increase weight for 2.5 - 5 kg. Some German weightlifters, who have been European and World's champions several times, implemented confusing tactics and it is considered that because of this tactics they have become champions. Namely, they have often increased weight, between attempts for 20 - 30 kg.

Weightlifting is a form of sport in which the speed of muscle contraction is the most important moment. The technique is a factor which must ensure the most favorable conditions for the exploitation and manifestation of both power and speed. Weightlifting, a sport where power and speed have determining role, is characterized by maximum and short term muscle contraction. During training and competition knowing all dynamical structures of exercise is of great importance for technique acquisition. Power and speed are considered as basic dynamic characteristics. Power allows movement of weight and body. Details of technique may vary between weightlifters because they are dependent on their morphological and functional characteristics. This means that everybody has their individual technique which, in practice, is called a style. Both competitive weightlifting disciplines (snatch and clean & jerk) use techniques that typically have elements of similarity and difference. Techniques in both disciplines have identical versions of preparation that are used in taking the initial weightlifting position. A further common feature technique in weightlifting refers to the maintenance of security balance. Good equilibrium position allows good control weight lifter. Both competitive techniques use grip lock that represents covering the last joint of the thumb with other fingers of the same hand at the moment of grabbing the bar. Snatch and clean and jerk are complex movements of the entire body, which include a number of high-intensity muscle contractions. During these movements, weightlifters achieve the greatest force in relation to any other athletes (Garhammer J. 1980). In snatch as the most

important elements are initial position, the first phase of deadlift, the second stage of deadlift, sit and fixation, getting up and release. Improper execution of one of these components reduces the effect of performing all exercises or completely disables the execution of the exercise. In clean and jerk as the most important elements are the initial position, putting the weight on the breasts and lifting the weight of the breasts.

Competitors are classified into different weight categories with a maximum of two representatives in each category. The final application of competitors is done on a technical conference which is held one day before the event. Then detailed information about competitors and the result in the previous year are given. Name of participants cannot be changed, only weight categories could be changed and only in the case of transition from a lower to a higher category. If necessary, the contestants are divided into several groups. Order of measuring and time and sequence of performances during competition is determined at technical conference. Measuring the mass of an athlete is done two hours before the event. The competitor with the lowest weight is the first to perform. After each successful attempt weightlifter must increase the weight on the bar but the weight, most certainly cannot be decreased. Every competitor has 60 sec. between the call and the attempt. After the end of the competition in the snatch discipline, a brake of 10 min. is planned before the competition in discipline clean and jerk starts. Announcement of the winners is done by the comparing the best results in the snatch and clean and jerk. In case when two or more competitors have identical results, the competitor with the lover body weight wins.

Top weightlifters have proportionally shorter hand span and shorter tibia, bigger biacromial span and shorter (Carter JEL, Lindsay JE. 1984; Fry AC, Ciroslan D, Fry MD, et al 2006; Tittel K, Wutscherk H. 1992). Such anthropological characteristics have two mechanical advantages while lifting maximum load: mechanical torque which is necessary in order to lift the given weight is lower because of the shorter bar during art resistance; and size of muscular work needed for lifting the given weight is lower over reduction in vertical distance which the bar must overcome (Keogh JWL, Hume PA, Pearson SN, et al. 2007). Besides, shorter body dimensions match the bigger average surface of skeletal muscles cross-section, which is desirable for good result and performance in competition and practice (Ford LE, Detterline AJ, Ho KK, et al. 2000).

CONCLUSION

High intensity, explosive nature of weightlifting practice and competition results in great number of structural and functional adaptation of muscular and cardiovascular system. A special attention is directed towards the weightlifters' ability to quickly generate power and force and it's greater than that of other athletes who use power and force. As younger and older individuals of both genders are drown towards this sport with weights it is necessary to carry out as many researches as possible with this population in order to provide the development of efficient and safe training program. Special attention should be directed to acute reactions and long term adaptation with female weightlifters because the most of existing researches are carried out exclusively with male athletes.

Weightlifting offers many advantages for training athletes. While mechanical characteristics of weightlifting are well known, weightlifting training results in additional adaptations. Collection of physiological, neurological and mechanical adaptations suggests that weightlifting exercises and methods can be one of the most efficient trainings for athletic performances.

There are many weightlifters in Serbia, competing in Olympic and other weightlifting disciplines. On the other hand, according to the author's knowledge, there are too few scientific researches which would contribute to improving the results of weightlifters, improving the weightlifting training but more importantly improve the stability in certain categories. This paper can make a contribution to understanding this interesting and worldwide popular sport and can help couches in determining the training capacity and also in planning.

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THE IMPACT OF PHYSICAL ACTIVITY ON THE QUALITY OF LIFE OF ELDERLY PEOPLE

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SUMMARY

Introduction: Different characteristics of bodily activities (meaning intensity, frequency and the volume of activity) may variously influence certain aspects of the quality of life of elderly people

Methods: The research was conducted on a sample of 614 elderly women. Physical activity level was determined on the Serbian version of International Physical Activity Questionnaire (IPAQ) while quality of life was assessed with short version WHOQoL questionnaire.

Results: Quality of life parameters have showed statistically significant difference ($p < 0.01$) in most of the observed domains between low-, moderate-and high-active participants. Physical health is statistically different between participants with low and high physical activity and between participants with low and moderate physical activity. Social relations is statistically different ($p < 0.01$) in low-and high-active women. The only area where there was no statistically significant difference between low, moderate and high activity is the domain of and environment ($p = 0.21$). This study confirms our hypothesis that physically active women older than 60 years have better attitudes toward their quality of life.

Conclusion: Regular physical activity provides the opportunity for elderly women to be independent from each other in their everyday activities. Therefore, we can conclude that physical activity and active lifestyles affect better quality of life of older women.

Keywords: WHOQoL, physical activity, older adults, effect

INTRODUCTION

The concept of quality of life defines emotional, social and physical benefit of human beings as the ability to successfully perform everyday tasks (Warburton, Nicol, & Bredin, 2006). World Health Organisation describes the quality of life as an individual perception of a single person of their own position in life , in the context of the value system and the culture in which they live, then in relation to their own goals , expectations, standards and interests (Fayers & Machin, 2007).

Different characteristics of bodily activities (meaning intensity, frequency and the volume of activity) may variously influence certain aspects of the quality of life of elderly people. Significant improvements of quality of life have been observed among people involved in bodily activities of moderate intensity, higher frequency and volume(Guedes, Hatmann, Martini, Borges, & Bernardelli, 2012).Motivation is an extremely important component of integration of bodily activities programmes and the endurance of active life (Alexandre Tda, Cordeiro, & Ramos, 2009). It has been found that emphasizing the entertaining component of physical activities programmes of elderly people contributes to quality of life more significantly than focusing, for example on aesthetic goals like the decrease of body mass or the appearance change. This is of great importance for experts in this area.

However, we need to be aware that even though it was proven that the physical activity has a positive influence on the improvement of the quality of life component, predominantly psychophysical health category, there remains a great number of aspects of quality of life, on which, unfortunately physical activity has no or has a rather small amount of influence. So, necessary measures of other type are needed for their improvement. Nevertheless, the

research has shown that the regular bodily activity is of great importance since it represents one of the factors which can also improve the quality of life by influencing the psychosomatic status and the health level .

Recent studies which had a quality of life of elderly people as a topic were first of all a clinical type and related to the quality of life of patients in the post- operational or rehabilitation procedure (Drewnowski & Evans, 2001). On the other hand, quite a less amount of research has been done with aim of establishing the influence of physical activity on the quality of life of elderly people. Therefore, the aim of this research was to determine the difference in quality of life of elderly people in relation to their level of physical activity. We have assumed that the level of physical activity represents an important component of the life of people at the retirement age.

Table 1. Basic descriptive parameters

	Low active N=178	Moderately active N=282	Highly active N=154
Age	69.24±6.06	67.94±4.76	67.31±5.71
Height (cm)	164.59±6.70	166.06±6.30	166.14±32.57
Body mass (kg)	69.63±11.42	68.77±9.78	69.30±11.24
BMI (kg/m^2)	25.62±3.88	24.78±3.43	25.55±4.21

METHODS

The present study was conducted on a sample of 614 participants who were selected from a population of elderly women aged from 60 to 80. Descriptive statistic is shown in Table 1. Criteria for selecting participants were: age between 60 and 80 years, physically independent person - able to walk 20 feet without assistance or rest, lack of cognitive impairment and dementia, achieved 24 points for the educated and 18 points for the unqualified respondents in mini mental state evaluation (McDowell, 2006). Also, participants who recoved from an acute illness, then deaf and blind subjects were excluded from the study. Participation in the study was voluntary and each of the participants could redraw from the study in any moment. The study was approved by the Research Ethics Committee of the Faculty of Sport and Physical Education, University of Nis and according to Declaration of Helsinki. All participants were fully informed about risks and benefits that this research have on their age group.

IPAQ questionnaire

Self evaluation of participant's physical activity was conducted according to Serbian version of IPAQ questionnaire, which reliability was confirmed on the Serbian population over 60 years (Milanović, Pantelić, Trajkovic, Jorgic, & Sporiš, 2013). For the purpose of this study the long version of IPAQ questionnaire was used containing four domains of physical activity: work-related, transportation, housework/gardening and leisure-time activity. In each of the four domains in testing, participants have recorded the number of days and time spent during each day separately for vigorous and moderate intensity activities and also the time spent on walking. Then, calculation for each item was conducted separately (vigorous activity, moderate activity and walking) according to official IPAQ instruction so the period of the PA of participants could be determined. Moreover, the Metabolic Equivalent Task (MET) was calculated for each domain separately (work-related, transportation, housework/gardening and leisure-time activity). Total weekly PA level (MET-min/week) was calculated by separate collecting of MET values for each item. For calculating of MET values following coefficients were used: vigorous PA=8.0 METs, moderate PA=4.0 METs and walking PA=3.3 METs.

Quality of life

Quality of life was measured by WHOQoL instrument that comprises 26 items, which measure the following broad domains: physical health, psychological health, social relationships, and environment. The WHOQoL is a shorter version of the original instrument that may be more convenient for use in large research studies or clinical trials. (Berlim, Pavanello, Caldieraro, & Fleck, 2005).

WHOQOL offers the possibility of calculating the specific scores for each domain of quality of life , after standardization , which ranges from 0 (lowest value) to 100 points (the highest value) (Berlim et al., 2005).

Statistical analysis

The statistical Package for Social Sciences SPSS (v17.0, SPSS Inc., Chicago, IL) was used for the statistical analysis. Descriptive statistics were calculated for all experimental data. Kolmogorov-Smirnov test was used to test if data were normally distributed. Differences in the Quality of life between low, moderate and high active elderly women were determinated using one-way univariate analysis of variance (ANOVA). To determine more precisely the differences in relation to the level of physical activity Bonferroni correction was used. The statistical significant was set at $p < 0.05$.

RESULTS

The results of the research related to the physical health of subjects have indicated a significant difference between low, moderately and highly active elderly women (Table 2). In this area, it was not established any difference between moderately and highly active subjects ($p>0.05$).When it comes to the psychological health, there is a significant difference between low and highly active (54.33±11.51 vs. 59.44±11.97; $p<0.05$). As far as the area of social relationships is concerned, there has been stated a difference not only between low and highly active (54.69±14.73 vs. 59.75±15.33) but also between moderately and highly active elderly people (54.68±14.99 vs. 61.84±15.04).The only area in which there was not stated a statistically significant difference in relation to the level of physical activity was the area of environment.

Table 2. Differences in quality of life in relation to the level of physical activity (Mean±SD)

	Low active N=178	Moderately active N=282	Highly active N=154	F	p
Physical health	52.80±12.05*¶	56.86±9.63¶	58.70±10.12*	17.15	.00
Psychological health	54.33±11.51*	57.76±10.23	59.44±11.97*	10.74	.00
Social relationships	54.69±14.73*	54.68±14.99#	59.75±15.33*#	7.81	.00
Environment	59.62±13.88	59.64±14.41	61.84±15.04	1.59	.21

*- statistically significant difference between low and highly active ($p<0.05$), ¶- statistically significant difference between low and moderately active ($p<0.05$), #- statistically significant difference between moderately and highly active($p<0.05$)

DISCUSSION

The results of research have shown that the quality of life of elderly people greatly depends on their level of physical activity , which confirms our assumption. The results of this research are in accordance with the results gained so far from previous studies (Bicego et al., 2009). We have established that in comparison to low active, highly active people have a far better physical health , social relations and their attitude towards the environment. First of all, this comes as a consequence of their independence from other people and owing to their better physical activity and ability to provide for themselves basic life necessities.

Numerous section studies have confirmed the correlation between physical activity and the quality of life of elderly people (Brown et al., 2004; Vuillemin et al., 2005). However, a small number of studies have specifically done a research on which physical activity had the greatest influence on the health components correlated with the quality of life. Moreover, there is no connection between the recommendations of both, the World Health Organisation and the American College for sports medicine when it comes to physical activity or quality of life. So far, walking was the most acceptable form of physical activity of elderly people which influenced their quality of life (Bize, Johnson, & Plotnikoff, 2007). It is assumed that the strength practice could significantly contribute to the quality of life owing to the fact that with the aging process comes the decrease of the muscle strength and the increase in the risk of the injury appearance, which consequently leads not only to the greater dependence of elderly people but also to the reduction of the quality of life.

The drawback of this study represents the specimen which included only women older than 60. Moreover, it has not been specified which range of physical activity mostly contributes to the quality of life of elderly people. Further research should establish whether the level of physical activity specifies the quality of life of elderly men as well as the possible differences in relation to their residence area (rural-town).

CONCLUSION

Physical activity and active life style significantly contribute to the improvement of the quality of life of elderly women. These changes are mostly expressed through their physical health, psychological health and social relationships, while the field of environment indicates only insignificant differences in relation to the level of physical activity. In accordance with all the above stated, it is necessary to increase the level of physical activity of the people at the retirement age in order to simultaneously improve their quality of life in certain areas.

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SOME LIFESTYLE TRAITS OF NOVI SAD STUDENTS IN RELATION TO THE SUBJECTIVE PERCEPTION OF HEALTH

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SUMMARY

Introduction: The problem of presence of healthy lifestyle habits among the young population is one of the most commonly asked questions from the point of view of their life and work conditions. The research shows that there is a growing trend, especially among the student population, of young people having predominantly unhealthy lifestyle habits. Among occurrences that pose a risk to health especially prominent are: irregular and improper diet, lack of physical activity, sedentary lifestyle, smoking, alcohol consumption and use of narcotic drugs.

Methods: Within the sample of 103 students of the Novi Sad faculties (59 male and 44 female), some lifestyle traits important for evaluation of overall health were analysed. The data was obtained through surveys. The respondents gave subjective evaluations of their health and body status and shared information on the regularity of physical activity, smoking, alcohol consumption and daily number of meals. An objective evaluation of body composition was made through the (BMI). The statistic analysis reveals that the survey pool was dominated by the students with normal body weight.

Results: Body composition of respondents of different sexes was not statistically significantly different. The students did not have an objective perception of their body status. In all four groups with various BMIs, the majority was composed of those who evaluated their health as good, very good or excellent. Half the respondents diagnosed with undernourishment considers their health excellent and 80% of the obese considers it good. More than half of the students have said that they have regular physical activities, with no significant difference established in comparison with those of different body statuses. As many as 60% of the obese students stated that they had practiced 1-2 times for the previous three months, with 20% practicing every day. As for those overweight, half the respondents are active 1-2 times a week, a third of them 3-4 times and 16,7% every day. The smallest number of physically active students was unexpectedly found among those with normal body weight. Almost 2/3 of the respondents declared as non-smokers, while merely 13,6% have stated that they never consume alcohol.

Conclusion: Distribution of answers pertaining to smoking, alcohol consumption and daily number of meals in relation to the subjective health evaluation indicates an insufficient education of students on healthy life styles. They recognise only smoking as an immediate threat. Among those who rated their health as excellent majority are non-smokers, while smokers are predominant among those who rated it as poor or satisfactory. It could not be established whether those students who consume alcohol to a greater or lesser extent and those with regular or irregular diets actually feel healthier. It was established that the students who were physically active rated their own health as much more favourable. Higher ratings were present among those who practice every day, while the lowest were given by those rarely do so. This shows that the students predominantly treat exercise through affective states of mind and much less as a dosaged activity consciously directed towards better health.

Keywords: quality of life, active lifestyles, health habits, physical exercise, body composition

INTRODUCTION

Life habits are formed in the earliest stages of human development. Positive life habits, especially those directed towards health, such as proper diet, regular physical activity, avoidance of tobacco and alcohol, regular health check-ups, etc. are acquired and developed throughout the lifetime. Life habits can thus certainly be related to an adequate lifestyle. Numerous research (Godin & Kok, 1996; Piero,

Mannetti & Livi, 2003; Boot & Chakravaty, 2002; Sharkey & Gaskill, 2008) have dealt with the questions of healthy lifestyle. It is, for the most part, related to physical exercise, sport and recreation – in other words, a healthy lifestyle. A healthy (active) lifestyle should be seen as a multidimensional system of individual behaviour not determined exclusively by physical activities. It is also determined by other behaviour systems and health-related habits – proper diet, regular preventive medical and dentist check-ups, regular control of blood pressure, stress control, elimination of harmful life habits (alcohol consumption, smoking, etc).

More recent studies (Kvaak, Meyer, Tverdal, 2004; Myint et al., 2007; Međedović, Perić, Ahmetović, 2013) have found that the level of physical and work capability of a contemporary man is very low and that it affects his health in an unfavourable way. The main cause is mostly found in the so called "morbogenous triad", which includes three factors: hypokinesis, obesity and stressful overexertions. The acceptance of positive habits (healthy lifestyles) is being increasingly proposed as an important task of society for the preservation of public health. Active life style, thus, includes awareness and active struggle against the risk factors – fight for improvement of the quality of life. Increase of level of physical activity and adoption of proper nutritional habits are two of the most commonly apostrophised tasks in the recommendations of health and kinesiological institutions.

Research done so far that included the student population in Vojvodina, (Nešić & Kovačević, 2011; Nešić & Kuburović, 2011; Nešić, Fratrić & Ilić, 2010; Nešić, 2012; Međedović, Perić & Ahmetović, 2013; Ahmetović et al. 2014) indicate an insufficient presence of physical activity in the lives of students, the low values of indicators of functional capabilities and the presence of bad nutritional habits. The research on patterns of leisure time behaviour of young people in the Republic of Serbia. (Group of authors, 2007; Stepanović et al, 2009), identifies, as primary characteristics of some lifestyle habits related to sport, primarily passive activities, such as watching sports on various media and attendance of various sporting events, with a markedly lower propensity for practicing sports. Some research done by foreign authors (Aquatias, 2000; Dawson et al., 2004; Orford et al., 2004) indicate bad positioning of healthy lifestyle habits of the youth and their propensity towards risky behaviour with detrimental effects to health.

The problem of existence of healthy lifestyle habits of the young is one of most common questions in terms of life and work conditions of the school age youth. New research showed that there is a growing trend of the number of youth, especially high school and students whose lifestyle habits are characterised as unhealthy. Among occurrences deemed risky to health particularly present are irregular and improper diet, lack of physical activity, sedentary lifestyle, smoking, alcohol consumption and use of narcotic drugs (Lolić et al, 2012). Certain studies (Myint et al., 2007; Kvaak, et al., 2004) indicate that fight for adoption of good lifestyle habits should start with the elimination of the so-called quartet of bad habits – smoking, alcohol, bad diet and hypokinesis.

METHOD

The sample

The research was conducted on an adequate sample of 103 randomly chosen students from Novi Sad. Among respondents there were 59 persons of male and 44 persons of female gender aged between 20 and 22. The body of respondents was dominated by the students of the Faculty of Sport and Tourism, which significantly affected the possibility of generalisation of obtained results and had a limiting effect on the study.

Sample of measuring instruments

Surveying was used a basic research technique. A custom-made survey was employed to collect data on some forms of lifestyle that can be related to health and quality of life. By choosing one of several possible answers, the respondents gave information on subjective perception of their health and body composition, the scope of their physical activities on a weekly basis, giving personal data on smoking, alcohol consumption and daily number of meals during the studying.

Apart from these subjective estimates, a height and weight measurement with a Tanita-type scales in standard conditions. Based on these elementary anthropometric data a body mass index (BMI) was calculated that was used for an objective estimate of

body composition. Based on BMI values, the respondents were divided into four groups in accordance with standards prescribed by ACSM (Pecatello, Arena, Reibe, Thompson, 2014). That is how four groups of respondents were formed: (1) with a deficient body weight (*Underweigh*; BMI < 18.5), (2) with a normal weight (*Normal weight*; BMI = 18.5-24.9), (3) with an excess body weight (*Overweigh*; BMI = 25-29.9) and (4) obese (*Obesity*; BMI > 30). Objective body composition indicators thus obtained were compared with subjective estimates of own body weight.

Statistical analysis of data

Collected data was processed by means of descriptive and comparative statistics, using the SPSS statistical software. From the domain of comparative statistics, representative central and dispersion parameters were calculated for those variables whose results were minimally represented as ordinal scales (anthropometric variables), while frequency distribution was determined for all questionnaire items from which only nominal scales were formed. Considering the nature of data obtained through the survey, a χ^2–test for testing of differences between empirical frequencies was used for a comparative analysis of the statistical series that could be logically related.

RESULTS

The body of respondents was dominated by the students with normal body weight, as indicated by data referring to anthropometric dimensions (Tables 1 and 2). Among the students of both sexes, prevalent were the ones whose BMI was within the range of normal weight. Although male and female students did not differ significantly in terms of body composition, it was noted that among females there were more underweight individuals, which affected the decrease of the number of students with normal body weight. Male students tended to be somewhat more overweight, in comparison, while obesity was equally present in both sexes.

Table 1 – Descriptive parameters of anthropometric variables for students of different sex

Variable	Sex	N	Mean	Std. Deviation	Std. Error Mean
Body height (m)	Male	59	**1.818**	.0828	.0108
	Female	44	**1.699**	.0572	.0086
Body mass (kg)	Male	59	**78.71**	9.638	1.255
	Female	44	**62.27**	8.804	1.327
BMI (kg/m^2)	Male	59	**23.783**	2.2154	.2884
	Female	44	**21.545**	2.5134	.3789

Table 2 – Distribution of data pertaining to body composition of students of both sexes

Body status	Male students	Female students	Entire sample
Underweight	1.7%	11.4%	**5.8%**
Normal weight	86.4%	79.5%	**83.5%**
Overweight	6.8%	4.5%	**5.8%**
Obese	5.1%	4.5%	**4.9%**
Total	100%	100%	100%

$\chi^2 = 4.419$ *Sig.* = .220

By comparing the distribution of answers of respondents with various BMIs (objectively measured) to the question in which they were asked to self-evaluate their body composition by choosing one of four offered options (underweight, normal weight, overweight and obese), statistically significant differences were established (Table 3). Out of 10 respondents with an objectively established undernourishment, only three of them appear to be so, while as many as seven of them consider themselves to have normal body weight. Out of 20 overweight respondents as many as 12 of them thinks that they belong to the group of people with normal weight. Unlike those who created a more favourable image of themselves, five respondents were too harsh and declared themselves obese. At the same time, no respondent that was objectively categorised as obese saw

themselves as such, but deemed oneself merely overweight instead.

Table 3 – Distribution of data pertaining to a subjective estimate and objective indicators of body composition of surveyed students

Self-evaluation / Objective Indicators	Self-perceived as underweight	Self-perceived as normal weight	Self-perceived as overweight	Self-perceived as obese	Σ
Undernourishment	3	7	0	0	**10**
Normal weight	3	67	1	0	**71**
Overweight	0	12	3	5	**20**
Obese	0	0	2	0	**2**
Σ	**6**	**86**	**6**	**5**	***103***

$\chi^2 = 72.891^*$ *Sig.* = .**000**

All of this data indicate that the surveyed students do not perceive their body status objectively, which is, probably, a consequence of the need to create a more favourable image of oneself, but also insufficient knowledge on objective indicators of body composition. Thus a large number of respondents with an insufficient body weight considers it normal (and healthy), most likely due to influence of the media and current fashion trends. On the other hand, objectively obese students do not think of their state as pathological and attempt to mitigate it with the fact that they just have several extra kilograms.

The presumption about the students being insufficiently informed on exact indicators of their body status is also supported by the answers to question about self-evaluation of their general health. In comparing empirical frequencies of the answers among respondents with objectively diagnosed body status, no statistically significant difference was established (Table 4). Among the underweight, the obese and those with normal or excessive body weight, the more numerous ones were those who rated their knowledge as good, very good or excellent. Half the respondents diagnosed with undernourishment consider their health excellent and as many as 80% of those obese claims their health status is good.

Table 4 – Distribution of data referring to subjective health evaluation among the respondents with various body compositions

Health self-evaluation / Body composition (objective)	Poor	Satisfactory	Good	Very good	Excellent
Underweight	0	16.7%	16.7%	16.7%	50.0%
Normal weight	2.3%	7.0%	34.9%	29.1%	26.7%
Overweight	16.7%	16.7%	33.3%	33.3%	0
Obese	0	20.0%	80.0%	0	0
Ukupno	**2.9%**	**8.7%**	**35.9%**	**27.2%**	**25.2%**

$\chi^2 = 15.684$ *Sig.* = .206

The knowledge deficit regarding proper physical practice was indicated by answers to question in which the respondents described the frequency of their activities on a weekly (Table 5). Although more than half of the students surveyed have stated that they practice regular physical activities (25.2% exercising 3-4 times per week and 27.2% every day), this has not proved to be significant for the distribution of their body composition. Among the four categories of respondents, (underweight, those with normal weight, overweight and obese) no statistically significant difference compared to the

weekly scope and frequency of physical activity was established. Thus 60% of obese students have stated that they had been exercising once or twice per week during the previous three months, with as many as a fifth of them exercising every day. Half of the overweight persons are active 1-2 times per week, a third of them 3-4 times per week, while 16.7% are active every day. It is interesting that the least number of inactive students (those who exercise rarely and occasionally), was present among those with body weight. These empirical distributions can lead one to conclusion that the scope of weekly physical activities has no greater impact on body composition of students, which goes against the findings of latest scientific research. Most likely, the absence of impact of extent of physical activities again indicates an insufficient level of education of students on choice and proper dosage of physical activities. It seems that the students, under the influence of daily marketing, by physical exercise primarily mean visiting a fitness centre or a gym, where, as a rule, there is a serious shortage of well-dosed aerobic activities that have the greatest impact on metabolic functions of the organism and, consequentially, the decrease of fat tissue. Although this research did not explicitly deal with that, the students were, most probably, predominantly exposed to activities in which anaerobic exercises are prevalent, such as weight lifting, five-a-side football, street basketball or some of the latest fitness high intensity programmes that seem attractive, but have no favourable impact on energy mechanisms of an average person.

Table 5 – Distribution of data pertaining to subjective evaluation of weekly physical activities among the respondents with different body compositions

Activity / Body composition	Rarely	Occasionally	1-2 times	3-4 times	Every day
Undernourishment	0	0	50.0%	0	50.0%
Normal weight	12.8%	8.1%	24.4%	27.9%	26.7%
Overweight	0	0	50.0%	33.3%	16.7%
Obesity	0	20.0%	60.0%	0	20.0%
Total	**10.7%**	**7.8%**	**29.1%**	**25.2%**	**27.2%**

$\chi^2 = 15.684$ *Sig.* = .206

Apart from the represented physical activities, health-related variables monitored in this study (relevant in terms of indicators of students' lifestyle) were smoking, alcohol consumption and frequency of daily meals. Answer analysis shows that alcohol consumption among students was more present than smoking. Almost 2/3 of the respondents have declared as non-smokers (Table 6), while only 13.6% of them have declared that they never consume alcohol (Table 7). Regardless of the higher number of smokers, the state is still worrying, seeing as a third of the students smoke regularly and over a half occasionally consumes alcohol. Insight into the number of daily meals (Table 8) can give a somewhat more favourable image, seeing as almost a half of those surveyed has three or more meals on a regular basis. Naturally, missing there are data on the composition of those meals, that is the choice and balance of nutrients, which would probably disrupt the image of nutritional habits of students, seeing as they are prone to consuming fast food and carbonated beverages, the harmful effects of which have undeniably been proven.

Analysis of distribution of smoking-related answers, alcohol consumption and daily number of meals conducted in relation to subjective health assessment has additionally corroborated the observation about the insufficient education of students on the notion of health and healthy lifestyles. It occurred that students recognised smoking as a threat to health, thus answers of respondents with different subjective assessments of health were significantly different only in relation to smoking as a lifestyle habit (Table 6). Thus, among those students who have rated their health as excellent, non-smokers were an overwhelming majority (73.1%), while smokers represented a majority among those who rated it as poor (33.3%) or satisfactory (44.44% in total). When alcohol consumption (Table 7) and regularity of diet (Table 8) were analysed in terms of subjective health assessment, significant differences between the

empirical frequencies were inexistent, i.e. it was not possible to observe whether those students who consume alcohol to a greater or lesser extent or those who have a regular or irregular diet feel healthier.

Table 6 – Distribution of data referring to presence of smoking among respondents with differing subjective assessments of health

Health / Smoking	Poor	Satisfactory	Good	Very good	Excellent	*Total*
Over 20 cigarettes	0	0	5.4%	3.6%	3.8%	**3.9%**
10-20 cigarettes per day	33.3%	22.2%	18.9%	3.6%	0	**10.7%**
Up to 10 per day	0	22.2%	8.1%	7.1%	15.4%	**10.7%**
5-10 cigarettes per week	0	0	0	28.6%	7.7%	**9.7%**
Non-smoker	66.7%	55.6%	67.6%	57.1%	73.1%	**65.0%**

$\chi^2 = 28.067^*$ *Sig.* = **.031**

Table 7 – Distribution of data referring to presence of alcohol consumption among respondents with differing subjective assessments of health

Health / Alcohol	Poor	Satisfactory	Good	Very good	Excellent	*Total*
Daily	0	0	0	0	3.8%	**1.0%**
3-4 times per week	0	0	8.1%	7.1%	0	**4.9%**
Occasionally	33.3%	66.7%	48.6%	42.9%	34.6%	**44.7%**
Very rarely	0	22.2%	40.5%	35.7%	38.5%	**35.9%**
Never	66.7%	11.1%	2.7%	14.3%	23.1%	**13.6%**

$\chi^2 = 20.748$ *Sig.* = .188

Tabela 8 – Distribution of data referring to frequency of daily meals among respondents with differing subjective assessments of health

Zdravlje / Broj obroka	Poor	Satisfactory	Good	Very good	Excellent	*Total*
One	0	0	2.7%	0	0	**1.0%**
Two	33.3%	11.1%	16.2%	14.3%	11.5%	**14.6%**
Mostly three	0	44.4%	43.2%	35.7%	26.9%	**35.9%**
Regularly three	66.7%	33.3%	18.9%	14.3%	23.1%	**21.4%**
4-5 meals	0	11.1%	18.9%	35.7%	38.5%	**27.2%**

$\chi^2 = 14.064$ *Sig.* = .594

When answers of respondents with different subjective assessments of health were analysed in relation to extent and regularity of their daily physical activities, a statistically significant difference between those inactive and physically active was unequivocally established, naturally, in favour of the latter ones (Table 9). The highest subjective estimates of health were among those who exercised every day, with the lowest among those who did it rarely. Insight into relative frequencies calculated within every health category (poor, satisfactory, good, very good and excellent), makes obvious a tendency of growth of health assessment with an increase of extent of physical activities and vice-versa – a decrease of subjective health assessment with the decrease of frequency of physical activities. This data indicate that the students primarily perceive the merit of exercise through affectionate states, i.e. as a feeling of pleasure derived from physical activity and far less as a conscious, dosed activity related to health improvement. This, naturally, does not diminish the worth of physical activities of students, but indicates their importance for getting a positive image about their quality of life. Absence of awareness and knowledge on the use of physical exercise as a tool

for health improvement definitely confirms earlier observation about education of students as the most efficient means of forming healthy lifestyles.

Table 9 – Distribution of data referring to frequency of weekly physical activities among the respondents with differing subjective estimates of health

Health / Physical activity	Poor	Satisfactory	Good	Very good	Excellent	*Total*
Rarely	33.3%	11.1%	10.8%	10.7%	7.7%	**10.7%**
Occasionally	0	44.4%	2.7%	3.6%	7.7%	**7.8%**
1-2 times a week	66.7%	33.3%	35.1%	28.6%	15.4%	**29.1%**
3-4 times a week	0	0	35.1%	25.0%	23.1%	**25.2%**
Every day	0	11.1%	16.2%	32.1%	46.2%	**27.2%**

$\chi^2 = 34.508$ *Sig.* = **.005**

DISCUSSION

Results of this research should be considered in the context of physical (in) activity of the young people who live in the times of highly developed information technology and an increasing alienation. Many of them are subject to extreme hypokinesis, often with thoughts revolving around the virtual world. Extensive research has shown (Lazarević & Janjetović, 2003; Group of authors, 2007; Grandić & Letić, 2009; Stepanović, Videnović & Plut, 2009) that the young people are increasingly spending more time with the mass communication media, where an intensive development of social networks has created prerequisites for a dominant virtual communication and an increasing sedentary lifestyle. In this context, the problem of physical (in)activity of the young people has opened an essential question – how to preserve and develop healthy lifestyles and not fall "victim" to technological innovations? Sport and physical exercises, namely, become increasingly less competitive in comparison with the "benefits" offered by the virtual world of information technologies. Some research have shown (Lazarević & Janjetović, 2003; Grandić & Letić, 2009; Nešić, 2012) that the dominant lifestyle of the youth today is that of hedonism, in which sport and physical exercise are set aside in favour of the more passive pleasures (internet, social networks, television, cafes, etc.). This, of course, directly influences their health, quality of life and forming of healthy lifestyle habits (Grozdanov et al, 2007). Although even today a part of the young population does some forms of physical education, the dominant tendency is that it is more stimulated by fashion trends in the environment than the awareness of importance of physical activities and their influence on health and development of healthy lifestyle habits. The results of this study conducted with Novi Sad students speak in favour of this observation.

University student population, as an increasingly numerous part of society, may be the most exposed one to the various social occurrences. This problem has been particularly prominent in recent years after universities in Serbia abolished physical exercise. Unlike university students, elementary and high school students attend obligatory classes of physical education. The number of domestic research studies dealing with the problem of physical exercise of the university student population (especially within campuses) is still relatively low. Some of them (Nešić & Kuburović, 2010; Nešić & Kovačević, 2011; Međedović, Perić, Ahmetović, 2013; Ahmetović et al., 2014) indicate an insufficient level of physical activity of the student youth, but also a very low level of knowledge on healthy lifestyles. Thus authors of this study in their previous similar research (Ahmetović et al., 2014) have established that there is a higher level of knowledge on healthy lifestyles in students of the so called faculties of sport in comparison with the students of other faculties. The authors also found that, despite the higher level of informedness, the students of the faculties of sport had no significantly higher functional capabilities nor nutritional habits. This has apostrophied the need that this study insists on – raising awareness of young people on the importance of preventional health-related activivities. This initiative becomes more important in the light of some results that included various aspect of the free time of the young people (Group of authors, 2007; Stepanović et al., 2009; Grandić & Letić, 2009), that indicate that sporting activities and active physical exercise are not highly positioned in

the life of the young people, especially the student population.

Base on the results of this and previous similar studies, it is possible to recommend that the practice focus on three following directions:

1) Permanent and intensive educaiton of the young (especially the university students) on the impact and value of physical exercise in terms of health and developing of healthy lifestyle habits;

2) Creation of a purposeful and developmentally sustainable university sport system, conceived in the form of a regular physical exercise of the broad student population, not just as competitive sport (which is the case at the moment) in which only active young athletes take part, which also "happen to be" the students of some faculty; and

3) Reaffirmation of sport in the university through the context of revival of the ancient Greek ideal of *kalokagathia*. University sport should fulfil its task through a multidimensional system in which there are mutually complementing (paedagogical/educational), ethical, aesthetic and socially responsible aspects necessary for forming of young people as whole persons. University sport, using all potentials of the sporting science (primarily in the area of kinesiologic-functional structures), should contribute to the attainment of balance between the physical and other dimensions of man.

CONCLUSION

By analysing some lifestyle forms that can be related to health, as well as an objective assessment of body composition (based on the BMI index) on a sample of 103 university students of Novi Sad, it was found that, among the students of both sexes, prevalent were the whose BMI was within the range of normal weight. Data obtained showed that the students do not perceive their body status objectively, which is, probably, a consequence not only of the need to create a more favourable image of oneself, but also of the insufficient informedness on objective indicators of body composition. A large number of underweight respondents considers it to be normal (and healthy), most likely due to the influence of the media and the current fashion trends. On the other hand, objectively obese students do not think of their state as being pathologic. A presumption about students being insufficiently informed on exact indicators of their body status is also corroborated by the answers to questions about self-evaluating their general health. Among the underweight, obese and those with normal or excessive body weight, dominant were the ones who rated their health as good, very good or excellent. Half the respondents that were diagnosed as underweight considered their health excellent and as many as 80% of the obese claimed that their health status was good.

More than half the surveyed students have stated that they regularly engage in physical activities, with no significant difference established between those with different body statuses. Practically, a subjective feeling of health could not be related to the level of physical activities. This was, most likely, influenced by the respondents' age. Seeing as the respondents were students, young people in full strength, it is obvious that a large number of them easily compensates for all objective body and functional. If this is also complemented by the fact that the students evaluate physical (sport) activities primarily from the aspect of personal pleasure, i.e. the feeling of pleasantness, not the awareness of value of dosed aerobic exercise, it is easy to conclude that it is necessary to work much more on education on healthy lifestyles. The need for a more intensive educational work is also supported by the findings of this study that shows how university students do not take unhealthy life habits, such as smoking, alcohol consumption and irregular diet seriously enough. Practically, only smoking is recognised as a serious threat to health, while it remained unclear if the subjective perception of health is more favourable in those students who drink alcohol more or less and in those with regular or irregular diets.

The least physically active students were, unexpectedly, the most numerous among those with normal body weight, which again speaks in favour of insufficient knowledge of students on the proper choice of physical activities. Apparently, students mostly choose anaerobic activities like high-intensity fitness programmes or collective sports (five-a-side football, street basketball, etc.) instead of the aerobic exercises that are more beneficial from the health point of view, such as walks, bicycle rides, swimming, etc. Thus the higher educational level of students is additionally recognised as the most efficient tool for improvement of the quality of life and creation of healthy lifestyles among the students. For this very reason WHO emphasizes education and informing of people as the most efficient and least expensive form of preventional activity directed at preservation of health.

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IMMUNOHISTOCHEMICAL AND MORPHOMETRICAL ANALYSIS OF MUSCLE FIBERS OF THE PSOAS MUSCLE IN THE PROCESS OF AGING OF MEN

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SUMMARY

Introduction: The process of aging is common for every living creature and every tissue, including the skeletal muscle system. In more advanced ages, muscle changes are more intense and progress into a disease termed sarcopenia, which represents the loss of muscle mass leading to muscle weakness and inability for independent living. Literature data indicate that the loss of muscle fibers in sarcopenia is selective and that changes are more intense in type II, compared to type I fibers. This study aims to review and quantify muscle changes during aging in both type I and II fibers of the psoas muscle.

Methods: Our study material consisted of tissue samples from the psoas muscle from 30 cadavers of both genders, aged 30 to 90 years. The samples were processed using routine histological techniques, and type II fibers were stained using the immunohistochemical method ultravision LP.HRP polymer detection technique. Histological analysis of the stained sections was done using the Olympus CHK2 light microscope, with which the photos of individual sections were taken (30 per individual case) at 400X magnification and analyzed in the ImageJ digital program. In order to determine volume density (VV), we made use of a multipurpose test system M168 and with „cell counter" and „point" selections we determined the number of points of the test system covering the structures of interest, and VV of these was determined afterwards in a MS Office Excel spreadsheet. The quantification data were processed in the digital statistical program NCSS-PASS2007.

Results: The results showed that VV was statistically significantly reduced in type II muscle fibers going from 30 to 90 years of age (32% in group I; 27% in group II; and 24% in group III). Volume density of type I fibers was also reduced, although never reaching statistical significance. Immunohistochemical analysis on light microscopy demonstrated that in more advanced age muscle fibers became disorganized, muscle fibers lost their angularity, the space between them increased, and they became interspersed with connective tissue.

Conclusion: Based on the obtained results, the quantification data showed that with aging type II fibers in the psoas muscle became statistically significantly changed i.e. reduced. Volume density of type I fibers was also reduced, but not in a statistically significant way.

Keywords: sarcopenia, type II muscle fibers, type I muscle fibers, volume density.

INTRODUCTION

The process of aging is characteristic for all living beings and cannot be viewed separately from life. It is more intense with time the changes become irreversible and inevitably lead to death (Franceschi, Bonafè, Valensin, Olivieri, de Luca, Ottaviani, & de Benedictis, 2000; Weinert & Timiras, 2003; Kirkwood, 2005). The research of the process of aging has been and still is in the focus of interest in the scientific community in our country and worldwide. The processes of aging involve all tissues, and thus the muscle system is involved too. In more advanced age of life in a number of people, muscular changes are more intense and are transformed into a disease termed sarcopenia, presented as a loss of muscle mass, functionally leading to kratopenia and dynapenia (Borst, 2004; Manini & Clark, 2011), then to muscle weakness and inability for independent self-care. Studies of total

skeletal muscle mass using magnetic resonance imaging (MRI) in men and women aged from 18 to 88 years have demonstrated more pronounced loss of muscle volume in men, especially in lower limbs (Janssen, Heymsfield, Wang, & Ross, 2000). Rosenberg (1997) has termed the status sarcopenia (flesh deficiency), and it should be differentiated from similar states in starvation, malnutrition, and cachexia as the consequence of other diseases (Thomas, 2007). Sarcopenia is thought of as a „new epidemic", since epidemiological data indicate that in the USA at present there are 13% of individuals over 65 years of age, with the percentage rising to 20% in 2030; in health and social care institutions 33% of such individuals are admitted for total disability and inability to perform regular daily activities (Thomas, 2007). Sarcopenia is present in 5-13% of people aged 60 to 70, and in 11-50% of those over 80 years of age; it is estimated that there are 3.6 million individuals with sarcopenia in the USA, and that the number will rapidly grow in the future (Morley, 2012).

Literature data have shown that the loss of muscle fibers in sarcopenia is selective, with the changes being more pronounced in type II compared to type I fibers; that the reduction can reach 50% with simultaneous loss of motor neurons and motor unit remodeling. The causes of sarcopenia have not been completely elucidated; it is most probably the result of interaction of multiple factors (Kamel, Mass, & Duthie, 2002). As the possible causes, the following factors can be emphasized: reduced physical activity, anorexia, and protein deficiency, vitamin D deficiency, proinflammatory cytokines (TNF – tumor necrosis factor, and IL-6 – interleukin 6), reduction of CNTF (ciliary neurotrophic factor) leading to the reduction of number of motor units, reduction of growth factor and IGF-1, reduction of synthesis of muscle nitrooxidants (leading to reduced capillary blood flow), prolonged glucocorticoid treatment, and most importantly drop of testosteron and estrogen levels (Morley, 2012; Solomon & Bouloux, 2006).

The psoas muscle is a specific muscle in that it connects the trunk with lower limbs (Lippert, 2006), and since it is attached to spinal vertebrae, together with other muscles it is responsible for the upright posture and walk (Cael, 2010). Computerized tomography has demonstrated a reduction of the psoas muscle cross section during aging (Imamura, Ashida, Ishikawa, & Fujii, 1983) and the same in quadriceps and plantar flexors (Klitgaard, Mantoni, Schiaffino, Ausoni, Gorza, Laurent-Winter, Schnohr, & Saltin, 1990; Rice, Cunningham, Paterson, & Lefcoe, 1989). Histopathological analysis of the iliopsoas muscle on autopsy material has also shown extensive changes during aging. Studies with stereological analysis have been conducted mostly on animal models (Eisenberg, Kuda, & Peter, 1974), and we were unable to evidence morphometrical analysis of the psoas muscle fibers and somatotropic cells of the adenohypophysis in the process of aging in humans.

This study aims to review and quantify muscle changes during aging in both type I and II fibers of the psoas muscle.

WORK METHODOLOGY

The study was conducted at the Institutes of Anatomy, Histology, Pathological Anatomy, and Forensic Medicine, all of them constituting the teaching and research basis of the Faculty of Medicine, University of Niš.

Material

Our research material consisted of tissue samples from adult cadavers autopsied at the Institute of Forensic Medicine, Faculty of Medicine in Niš, in the period from January to April 2013. The samples of psoas muscle were taken from 30 cadavers of both genders, 18 male and 12 female, aged 30 to 90 years. For the sampled cadavers, it was established based on autopsy results, that the causes of death were not the diseases or injuries of the psoas muscle. Based on the available medical documentation it was also established for the cadavers used that there were no diagnoses of muscular system diseases. The period of time from the moment of death to sampling did not exceed 24 hours. The material was divided into three age groups: first, from 30 to 49 years; second, from 50 to 69 years; and third, over 70 years of age; there were 10 individual cases of both genders in each age group.

Methods

From the cadavers, using the method of dissection, the psoas muscle was sampled, i.e. the portion at the middle distance between the upper border of the 12th thoracic, and lower border of the 5th lumbar vertebra; the cut was made perpendicular

to the muscle and the sample size was 5 x 5 x 5 mm. The samples were fixed in 10% buffered formalin for 24 hours and routinely processed and embedded in paraffin.

On a Leica 2245 (for psoas muscle) sections 5 μm thick were made and hematoxyllin-eosin (HE) stained. Muscle sections were stained using the immunohistochemical method UltraVision LP Detection System HRP Polymer (Cat. No. TL-125HL) detection technique (Shi, Guo, Cote, Young, Hawes, Shi, Thu, & Taylor, 1999; Kamel, Mass, & Duthie, 2002), using anti-myosin antibodies (anti-myosin, Skeletal Muscle, Ready to Use, Thermo Scientific Lab Vision, USA) for muscle fibers type II.

Morphological analysis

Morphological, i.e. histological analysis of the stained sections was performed using the Olympus CHK2 light microscope, involving histochemical and immunohistochemical analysis of the changes of type I and type II fibers of the psoas muscle.

Morphometric analysis

Morphometric analysis involved determination of volume density of type I (V_VI) and type II (V_VII) muscle fibresas a stereological parameters. Measurement of volume density was performed by digital program ImageJ (http://imagej.nih.gov/ij/). Morphometric analysis involved 28 of all 30 evaluated cases. Firstly, digital imagesof the tissue sectionswere captured on Olympus CHK2 microscope, 30 per each individual case (900 in total) with 400x magnification, placed on the computer desktop. ImageJ system calibration was done using an objective micrometer 1:100, photographed at 400x magnification. In order to determine volume density, the multipurpose test system M168 was overlaid on analyzed images of the tissue sections. Micrometer and test system images were placed on computer desktop. ImageJ was calibrated using the micrometer before volume density and area determination. Vv values were determined in an Excell spreadsheet.

Statistical analysis

Morphometric parameters were analyzed using the NCSS-PASS 2007 statistical package (http://www.ncss.com/). The results of morphometric and statistical analyses were presented as tables and graphs in MS Office Excell.

RESULTS

Our study results involved immunohistochemical and morphometric analysis of type I and II muscle fibers of the psoas muscle.

Histological and immunohistohemical analysis

In the first age group type I and II muscle fibers were predominant compared to other fibers. With aging, muscle fiber network dysregulation occurs, as well as infiltration with fatty and connective tissue, filling the extended spaces between individual fibers. Interstitial nuclei accumulate, fibers lose their polygonality, become rounded and their surface becomes uneven. Vacuolar degeneration and balloonization of the fibers (especially type I fibers) can be observed too.

Morphometric analysis of muscle fibers

Linear regression analysis indicated that volume density of type I muscle fibers did not change in a statistically significant manner in the process of aging ($F(1.25) = 0$; $p = 0.998$) (Fig. 1). In contrast to the above type I fibers, volume density of type II muscle fibers statistically significantly declined with advancing age ($F(1.25) = 9.22$; $p = 0.006$), as described using the following model: V_VII = 38.97 – 0.19 x age. According to the model, age of an individual was a significant predictor of volume density of type II muscle fibers and was able to explain 24% of its total variance, representing a considerable magnitude effect ($R^2 = 0.24$).

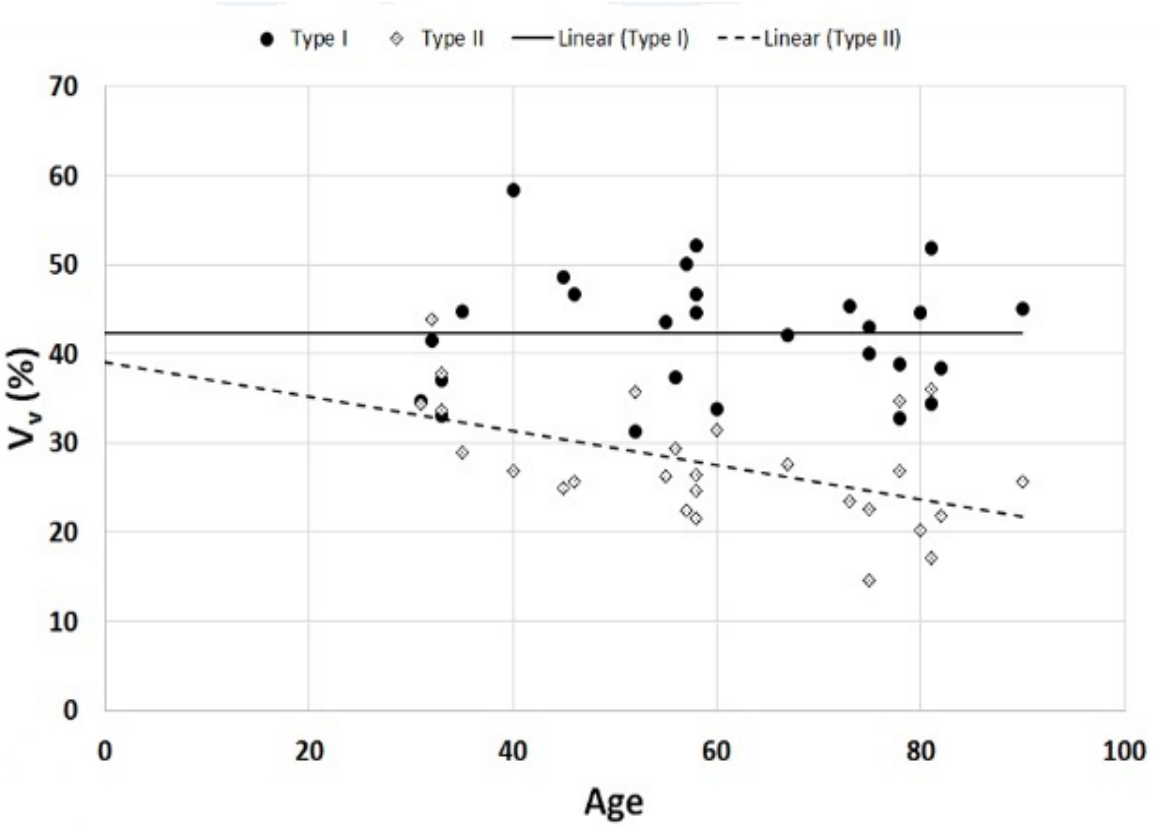

Figure 1. Correlation between volume density of type I and type II muscle fibers of the psoas muscle and age of the studied cases

Table 1. Average values of morphometric parameters in type I and II muscle fibers of the psoas muscle in the studied age groups.

Parameter	Group	N	Mean	SD
V_vI (%)	I	8	43.10	8.36
	II	9	42.41	7.09
	III	10	41.45	5.70
V_vII (%)	I	8	32.13	6.62
	II	9	27.22	4.44
	III	10	24.50	6.88

One Way ANOVA test results pointed out a statistically significant decline of average volume density of type II muscle fibers ($F(2.24)=3.52$; $p=0.046$), while the value for type I muscle fibers did not differ significantly between the analyzed age groups ($F(2.24)=0,13$; $p=0,883$) (Fig. 4C). Tukey-Kramer post hoc test additionally indicated that the values of average volume density of type II muscle fibers in age group I were statistically significantly higher compared to age group III values ($p<0.05$). Values of the above parameter in age group I were higher compared to age group II, while the values of average volume density of type II fibers in age group II were higher compared to age group III, but the differences were not statistically significant ($p>0.05$).T test for two dependent samples indicated that average volume density values in type I muscle fibers in age group I were higher compared to type II fibers, but the difference was not statistically significant ($p>0.05$) (Fig. 2). In age group II, the values of average volume density of type I muscle fibers were statistically significantly higher ($T=3.99$;

DF=8, p=0.004) compared to type II fibers (Fig. 2). Finally, in the age group III, average volume density (T=4.81; DF=9, p=0.001) of type I and II muscle fibers demonstrated the tendency identical to that observed i age group II, with statistically higher values of the above parameters in type I compared to type II muscle fibers (Fig. 2).

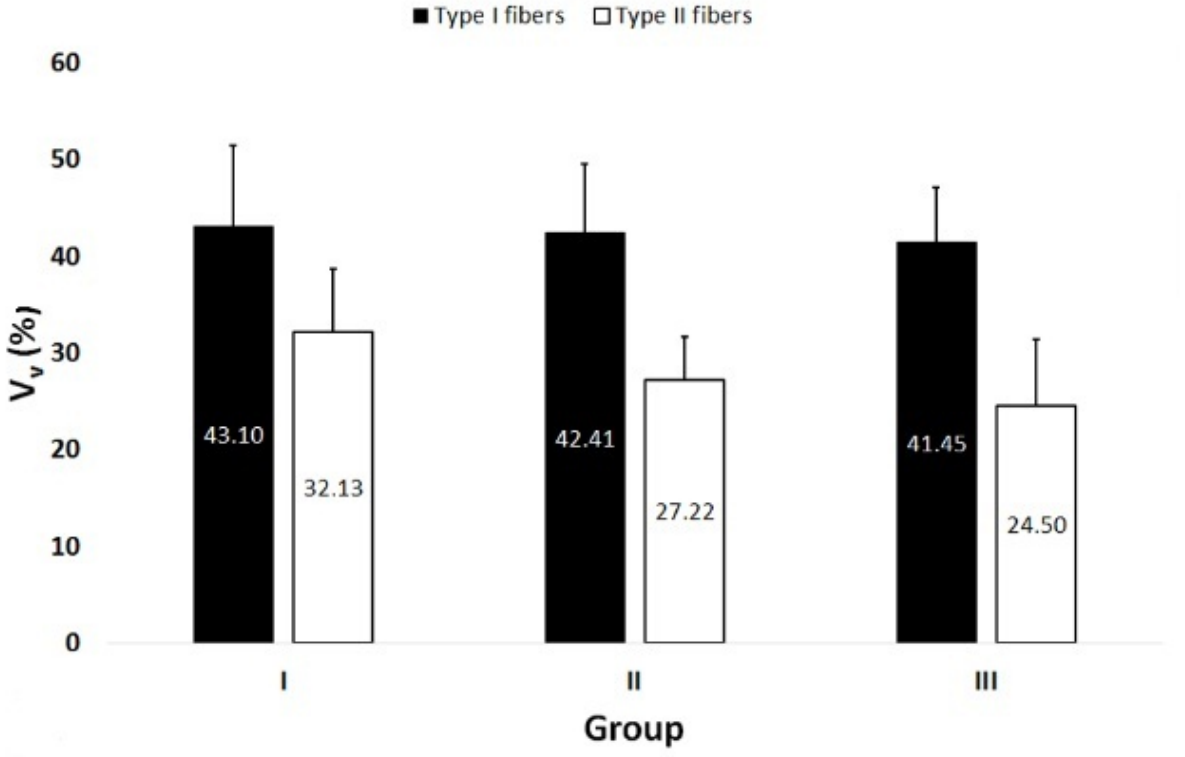

Figure 2. Average volume density area of type I and type II muscle fibers of the psoas muscle of the studied age groups

DISSCUSION

The human psoas muscle, constituting a part of the iliopsoas muscle (m. Iliopsoas), was the object of our study. As it has been emphasized in the literature compared to other lower limb muscles, it belongs to the muscles with relatively lower number and smaller average area of muscle fibers. In our research, using the morphometric, stereological, objective methodology, it was established that with advancing age the changes in the psoas muscled fibers evidently occurred. From 70 years of age onwards, volume density statistically significantly declines, with a positive correlation with aging of type II fibers, as corroborated by other authors' findings (Kamel, Mass, & Duthie, 2002; Thomas, 2007). Volume density reduction of type I fibers is present too, however without statistical significance. Since volume density represents the percentage of a component, phase, in a tissue volume unit, in order to establish whether fiber size was reduced, we determined the average area of type I and II fibers, and the results indicated a statistically significant reduction with advancing age. The paper of Nilwik, Snijders, Leenders, Groen, van Kranenburg, Verdijk, & van Loon (2013), demonstrated that the size of type II fibers was reduced with age in the musculus quadriceps femoris, and that after a 6 months' intense training program, type II fibers increased in their size; physical activity could thus be regarded as a natural cause of hypertrophy of type II fibers in older individuals.

For the disease of advanced age of life, sarcopenia, which represents the loss of muscle mass, the above changes are characteristic, and they are associated, in addition to morphological and functional changes, with a loss of strength (kratopenia), muscle power and velocity (dynapenia), general weakness, leading to the inability of an individual for independent life and self-care (Janssen et al., 2000; Morley, 2012). The European Working Group for Sarcopenia and International Association for Sarcopenia have defined the disease as the loss of muscle mass and

muscle function, and Society for Sarcopenia and Cachexia has defined it as the condition of limited mobility. In the group of people over 70 years of age in the USA, 5-13% of them have sarcopenia, while the percentage is 11-15% for those over 80 years, and the affected are unable to lead independent life (Morley, 2012). Since in the future, there will be more and more of older people, the percentage of sarcopenic individuals will rise as well, so a deeper insight into the disease is necessary. There is a link between aging and sarcopenia, in both animal experimental models and in human population, with lower growth hormone (GH) secretion. Literature data have shown that with aging the secretion of GH is reduced by even 60% in men aged 40-65 years compared to younger populations, so we may speak of GH-deficient patients (Solomon & Bouloux, 2006; Lačković, Nikolić, & Todorović, 2012). GH effects are mediated by GH-dependent insulin-like growth factor (IGF-I), the concentration of which is reduced with advancing age – in the 7th decade of life it is approximately half of the value measured in the third decade of life.

Hormone replacement therapy with GH, testosteron, and estrogen in sarcopenic patients produces increases of muscle and reductions of fatty body component, i.e. body composition changes, but it cannot produce significant positive effects on muscle strength and function. If positive muscular effects, modest as they are in the literature (Borst, 2004), are weighted against potential risks, hormone replacement therapy cannot be recommended as a treatment approach in sarcopenia. In contrast, GH replacement therapy in the elderly does not induce increased muscle strength, and numerous adverse effects are present too. Failure of hormone replacement therapy with GH suggests that GH is not the sole cause and not among the essential causes of sarcopenia; instead, sarcopenia is a disease with multiple causes, as suggested by numerous authors. One of the possible causes is also a loss of neuromuscular junctions in the anterior horns of the spinal cord.

The literature has not recommended adequate therapy for the prevention and treatment of sarcopenia, but all agree that regular exercise physical activity reduces symptoms and even prevent the occurrence of this disease in elderly individuals. Physical inactivity and sedentary lifestyle are certainly one of the causes of sarcopenia, and regular physical activity is considered to be the most reliable method of its prevention and treatment.

CONSLUSION

The volume density of muscle fibers of the psoas muscle were gradually declined for both type I and type II muscle fibers, and most intensely after 70 years of age. A statistically significant Vv reduction was observed only for type II muscle fibers, in correlation with advancing age.

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DIFFERENCES IN HEALTH EQ-5D PARAMETERS IN TERMS OF FORM OF PHYSICAL ACTIVITY IN ELDERLY PEOPLE

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UDC 796,799

SUMMARY

Introduction: Demographic data on accelerated aging show that age and disease that follows, they become not only health, but also socio-economic problem. This fact increases the need for research in this area. The aim of the study was to determine the differences in some health parameters in relation to the application forms of physical activity.

Methods: Our research survey was conducted on a sample of 102 elderly subjects aged from 60 to 80 years. As a measuring instrument used is standardized survey EQ5D questionnaire on health, as well as a set of questions about the physical exercise (criterion variables).

Results: The results of our study further proof initial hypotheses about the usefulness of physical exercise in various forms of implementation for almost all the observed parameters. Statistically significant differences in health eq5d parameters did not exist in the variable mobility in relation to practicing physical activity/not practicing in fitness center. Also, there was no statistically significant difference in the variable depression in relation to training alone/in group.

Conclusion: Research results generally confirm the hypotheses about the effects of physical exercise on the observed health parameters. A statistically significant difference does not exist only in two cases. That can be explained with the fact that mobility does not depend greatly on whether the exercise is performed at home or in fitness center. Also, depression does not depend gradually on the form of physical activity. More likely it depends on whether respondents are exercising at all or not.

Keywords: eq5d surveys, physical activity, elderly people.

INTRODUCTION

Lack of physical activity is a common condition in older age residing in industrialized countries. The level of physical inactivity is growing in many countries, significantly increasing prevalence of noncommunicable diseases worldwide (Guilbert, 2000). Physical inactivity has been identified as a risk factor for the development of a number of chronic diseases, including: coronary heart disease, stroke, hypertension, type 2 diabetes mellitus, osteoporosis, breast cancer and colon cancer (Spirduso & Cronin, 2001; Simonsick, Lafferty, Phillips, Mendes, Kasl & Seeman, 1993). Physical inactivity is associated with numerous adverse health effects, including increased total mortality, cardiovascular mortality, and acute ischemic stroke (By Lee, Folsom & Blair, 2003; Wendel-Vos, Schuit, Boshuizen, Verschuren & Saris, 2004). There is evidence that regular physical activity can prevent stroke (PAG Committee, 2008). This effect is complex and in part can be achieved through the reduction of arterial blood pressure, for better control of other vascular risk factors, diabetes, in the first place, through the reduction of body weight, but also the reduction of fibrinogen levels, reduction in platelet activation, to increase the activity of tissue plasminogen activator plazminskog and HDL cholesterol (Goldstein, Bushnell, Adams, Appel, Braun & Chaturvedi, 2000). At the global level, the World Health Organization estimates that physical inactivity causes two million premature deaths each year (Sui, LaMonte, Laditka, Hardin, Chase & Hooker, 2007).

The population of Serbia is one of the oldest populations in the world. According to the census of 2002, over 1.2 million people in Serbia (without Kosovo) had 65 or more years, which is one sixth of the total population. In 102 out of 161 municipalities in Serbia, the population is in the stage of profound demographic age, and in 38 municipalities reached the last stage of demographic age. From a total of 4697 villages, in less than 181 village has no person under the age of 20 years, 701 settlement, more than half of the population is people over the age of 60 years and 947 thousand households with persons older than 65 years, which is 37.5% total number of households.

Also, the majority of single-person households in Serbia are elderly households, so that in 52.8% of persons older than 65 years, and 23.9% aged between 50 and 64 years. Life expectancy at birth in Serbia has increased in the period 1950-1951. until 2001-2002., for men from 53.5 years to 70.1 years and for women from 56 to 75.1 years, while the population in cities is demographically younger than the population in rural areas. It is anticipated that the tendency of the aging population will continue to be the mid-21st century, the number of people over age 65 will increase by one-third, so that Serbia will live as much as 41% of older age. At the same time, there are clear weaknesses in the institutional and instrumental to meeting the needs of older persons, as well as weaknesses in the entire social organization (National Strategy on Ageing: 2006-2015). Every person, regardless of age, is capable of a certain type of physical activity. Age does not represent a limiting factor for exercise.

The aim of the study was to determine differences in health eq5d parameters in relation to the application forms of physical activity in elderly people (60 to 80 years).

METHODS

The study included 102 patients, residents of Niš and Kruševac, which are selected at random. Criteria for inclusion in the study were that the respondents are over 60 and under 80 years of age. Criteria for exclusion from the study were that the subjects were not suffering from some of noncommunicable diseases (cardiovascular and cerebrovascular disease), chronic infectious and degenerative diseases, as well as malignant diseases. The study respected standards of good scientific practice and ethics examination and that is - that patients are aware of the objectives of the study, they gave willful consent that the personal data will be protected.

Standardized survey EQ-5D questionnaire is used as a measuring instrument on health, as well as a set of questions about the physical exercise (criterion variable). The EuroQOL five dimensions questionnaire (EQ-5D) is one of the most commonly used generic questionnaires to measure health-related quality of life (HRQOL). The conceptual basis of the EQ-5D is the holistic view of health, which includes the medical definition, as well as the fundamental importance of independent physical, emotional and social functioning. The concept of health in EQ-5D also encompasses both positive aspects (well-being) and negative aspects (illness). The self-assessment questionnaire is self-reported description of the subject's current health in 5 dimensions i.e., mobility, self-care, usual activities, pain/discomfort and anxiety/depression. The subject is asked to grade their own current level of function in each dimension into one of three degrees of disability (severe, moderate or none).There were three criterion variables related to the physical exercise: exercise/ not exercise, going to the fitness center, whether respondents practicing alone.

For the statistical analysis and interpretation of the results, the statistical package SPSS version 21.0 was in use. Results were expressed by descriptive statistics. Nonparametric Mann-Whitney u test is used as a statistical method in aim to calculate statistically significant difference in the studied parameters.

RESULTS

The study included 102 subjects, of which there were 55 men, average age 66.49 years and 47 women, mean age 63.83 years. The average age of the sample was 65.26 years. The youngest respondent was 60 and the oldest was 80 years old. On the question of mobility on a scale of 1 to 5, where a rating of 1 meant a complete immobility and score 5 excellent maneuverability, the mean value was 3.97. When asked about the ability to take care of themselves, where a score of 1 meant the utter impossibility of taking care of themselves, and mark 5 excellent ability to care about themselves, the average score was 4.23. When asked about their daily activities, where a score of 1 meant an inability to perform daily activities, and grade 5 full ability to perform the same, the average score was 4:09.

Question relating to the presence of physical pain in everyday life had an average rating of 3.64. Grade 1 is included absence of pain, while a score of 5 meant the presence of pain in the degree that it interferes with daily activities. Question number five is related to the existence of worry or depression in daily life. The average score was 4:05, on a scale that goes from number 1, which implies the absence of worry and depression, the number 5, which indicates the presence of a large degree of worry and depression in subjects.

Regarding marital status, the majority of respondents, 55 (53.9%), falls into the category of married, unmarried 15 (14.7%), divorced 12 (11.8%) and widowers/widows 20 (19.6%. Questions relating to the level of practicing physical activity, respondents gave the following answers: physically active were 83 respondents (81.4%) and the inactive 19 (18.6%). Fitness center visits 17 subjects (16.7%) of which 10 female and 7 male. The question of whether there is an organized form of exercise in which they could include, 28 (27.5%) of the respondents answered "yes" and 74 (72.5%) with a "no," which may mean that they there is an organized form of exercise for the observed population, but also that they are not informed about it. The question of whether exercise alone, 71 (69.6%) respondents answered with "yes" and 31 (30.4%) with "no".

Table 1: Differences in health eq5d parameters in relation to forms of physical activity, Mann-Whitney U Test

Variable	exercise/ not exercise	exercising in fitness center/ not exercising in FC	exercise alone/ in group
MOBILITY	.000	**.062**	.011
SELF-CARE	.000	.001	.019
PERFORM ACTIVITIES	.000	.000	.029
PHYSICAL PAIN	.006	.028	.012
DEPRESSION	.011	.002	**.287**

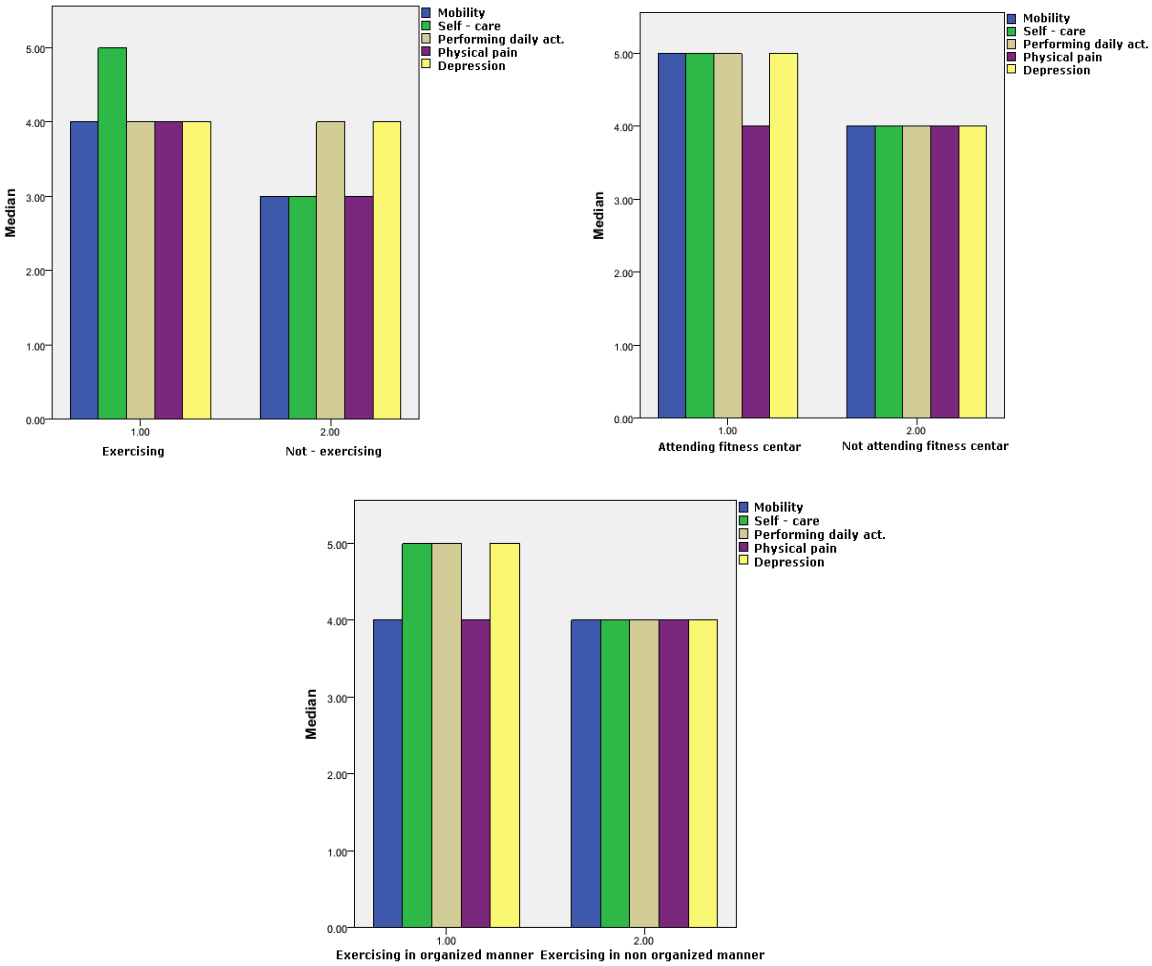
Table 1 shows the results of non-parametric Mann-Whitney U test, which indicates that there is a statistically significant difference between the groups that were exercised and which were not, in any given parameter. When we look at the criterion exercising in fitness center/not exercising in fitness center, it can be find that there is a statistically significant difference between groups in any given parameter, except in parameter mobility. Also, while analyzing parameters on criterion whether subjects exercise in group, there is no statistically significant difference between groups in parameter depression.

Research results generally confirm the hypotheses about the effects of physical exercise on the observed health parameters. A statistically significant difference does not exist only in two cases:

- organized physical exercise and mobility and
- exercising alone/in group and depression.

That can be explained with the fact that mobility does not depend greatly on whether the exercise is performed at home or in fitness center. Also, depression does not depend gradually on the form of physical activity. More likely it depends on whether respondents are exercising at all or not.

Figures 1-3. Influence of practicing physical exercise on indicators of health status



Graphs 1-4 is graphically shows the effect of each of the criterion variables on analyzed five variables indicators of health condition.

DISCUSSION

Starting from the fact that the Serbia is among the oldest countries in Europe and the world, it is necessary to implement a priority strategic actions relating to the requirements of the quality, otherwise, more versatile and more engaged approach to issues of aging population (National Strategy on Ageing: 2006-2015). Life expectancy of the population is a representative model of success of modern medicine and technology, but carries with it the need for a separate activation of social and community support for this particular vulnerable population, developing models of development which will contribute more to improving the health of people of older age. Demographic data on the accelerated aging of the population suggests that age and disease that accompanied become not only health, but also the socio-economic problems, which in the context of limited resources, a need for a special approach to this vulnerable group, with a view to the good of preventive strategies and physical activity of older people age as long as you keep in good condition (Spirduso & Cronin , 2001).

Most of the papers that were using EQ-5D questionnaire as a measuring instrument had respondents who were suffering from some of the most common chronic diseases. Our study had healthy elderly people as respondents. In future research, this questionnaire can be used for analyzing how physical activity affects the on quality of life of people with specific chronic disease.

CONCLUSIONS

This approach requires new forms and types of specialized programs of physical activity for people

of older age. To achieve this requires a multidisciplinary collaboration of health, social and for sports facilities, with the maximum intergenerational solidarity and involvement of volunteers, which would be returned to its original, core role and importance of linking physical activity, companionship, connection with nature and strengthen mental and physical performance. Bearing in mind the results of the research, in order to raise awareness about the importance of physical activity for health in the future is necessary:

- create new forms and types of specialized programs of physical activity for people of older age,
- educate specialized coaches, volunteers and educators to practice with the elderly,
- organize group exercises outdoors in a green area, where the elderly recreate and socialize,
- educate people of older age on the importance of healthy lifestyles and the adequate, for that time, customized sets of exercises,
- raise awareness about the importance of physical activity promptly initiated the subsequent quality of life and disease prevention, connect the efforts of medical, social, educational and for sports facilities in order to improve health care for people of older age.

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ASSESSMENT OF BALANCE IN ELDERLY PEOPLE

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SUMMARY

Introduction: Essentially, aging is a physiological state of an organism that poses a great threat of dementia, falling, incontinence, weight loss, feeling of weakness and mobility difficulties. Factors of falling that can be influenced on include balance and muscle strength, which are strongly associated. Balance can be described as capability of maintaining a certain body or body part position in contact with the base that is either still or moving. The effect of strength training with the aim of improving balance and prevention of falling is modest, although there is a significant correlation between strength and balance, which is caused by the mechanism of maintaining balance. It is a compound set consisting of various processes which requires a successful integration of multiple components, including sensor systems such as visual, vestibular and somato-sensory which cannot be stimulated by strength training. The main goal of the research is to differentiate the subsamples of elderly people within motorical tests of balance in standing position, using stability tests.

Methods: The sample of respondents in this research consisted of 55 women spanning from 56 to 69 years and from 70 to 85 years of age. All respondents that were included in the research agreed to voluntarily participate in the measurement. The research was conducted in a way that the respondents were divided into 2 subsamples considering the chronological age. In the first sample 27 respondents were included spanning from 56 to 69 years of age. In the second sample 28 respondents were included spanning from 70 to 85 years of age. For estimation of static balance, the Footscan system (RsScan, Inc., UK) was used. The respondents were tested through 6 Romberg balance tests. The tests restricted any leg motion; otherwise the test would be stopped. The same restrictions were conducted in tests with eyes closed – in case the eyes had opened or the other leg, which had to remain lifted, touched the ground. For confirming the main hypothesis of this research, analysis of variance was used.

Results: Results of the research have shown that in average, sample considering the chronological age spanning from 70 to 85 years has a weaker balance in general, than the sample considering the chronological age spanning from 56 to 69 years, especially regarding tests in which the supporting surface is reduced, as well as tests in which the visual system is deprived.

Conclusion: The data of this study encourage further researches in terms of elderly people studies and making their lives easier.

Keywords: Romberg tests, posturography, balance

INTRODUCTION

Essentially, aging is a physiological state of an organism that poses a great threat of dementia, falling, incontinence, weight loss, feeling of weakness and mobility difficulties. Causes of falling are mostly connected to habits and behaviors of the elderly. Some are overly active, as they were used to be in their youth, and some tend to get depressed if they cannot reach that state again. Most of them live alone and are not able to be realistic and self-critical (Mojović, 2007.). Generally, causes of falling can be divided in physical state and environmental conditions. A lack of regular physical activity has a consequence of a weak muscle tonus and balance, slower reflexes, changed posture, reduced bone mass, joint flexibility and lung capacity. This physical state is also represented by poor eyesight and hearing, that decrease the feeling of perception and the ability to move in space. All of this contributes to falling and affects the consequences of injuries caused by falls.

Period of disability is a period calculated from the moment when a person stops leading a quality life (due to an illness) until the moment of death, where the difference between a „healthy age“ and a life

expectancy is established. In the healthy age, person is functional and able to complete all of his/her everyday tasks. In other words, this high functionality enables a person to rely on him/herself so he/she can live independently in his/her surroundings. On the contrary, period of disability is a time (10-15 years) that occurs close to the ending of life, when a person depends on the help of other people (Evans et al, 1991)

The ability of maintaining balance is closely related to safety and functionality. It is of particular importance to the elderly people because their balance can become reduced due to an illness or the aging process. Situations which require balance can be divided into 3 general classifications: maintaining a position, postural adaptation of voluntary motions and reactions to external stresses (Berg, 1989).

Furthermore, group physical activity of elderly people can prevent falling in a way that the motoric balance competence improves (Lord et al, 2003).

Main goal of the research was to establish differences between the subsamples of elderly people spanning from 56 to 69 years and 70 to 85 years of age within test of balance competence while standing.

METHODS

Sample of respondents

Population of respondents in this research consisted of 55 women spanning from 56 to 69 years and from 70 to 85 years of age. All respondents that were included in the research agreed to voluntarily participate in the measurement. The research was conducted in a way that the respondents were divided into 2 subsamples considering the chronological age of the women in the Center for the elderly "Golden age", Split. In the first sample 27 respondents were included spanning from 56 to 69 years of age. In the second sample 28 respondents were included spanning from 70 to 85 years of age.

Sample of measuring instruments

For estimation of static balance, the Footscan system (RsScan, Inc., UK) was used, with a computer program Footscan Balance (RsScn Inc, UK). All test used are by Romberg (Agrawal et al, 2011). TEST 1 : Respondent is placed on the center of the balance board, and his legs are closed in a way that both of his heels and toes are touching. Posture is upright, head straight, hands on hips and eyes opened. The test lasts 33 seconds. TEST 2: Respondent is placed on the center of the balance board, and his legs are closed in a way that both of his heels and toes are touching. Posture is upright, head straight, hands on hips and eyes closed. The test lasts 33 seconds. TEST 3: Respondent is placed lengthwise on the board, so that his feet are completely on the board, one feet in front of the other, toes of one leg touching the other's heel. Posture is upright, head straight, hands on hips and eyes opened. The test lasts 33 seconds. TEST 4: Respondent is placed lengthwise on the board, so that his feet are completely on the board, one feet in front of the other, toes of one leg touching the other's heel. Posture is upright, head straight, hands on hips and eyes closed. The test lasts 33 seconds. TEST 5: Respondent is placed on the board, with his one dominant leg on the center of the board, and the other one lifted in the air. Posture is upright, head straight, hands on hips and eyes opened. The test lasts 33 seconds. TEST 6: Respondent is placed on the board, with his one dominant leg on the center of the board, and the other one lifted in the air. Posture is upright, head straight, hands on hips and eyes closed. The test lasts 33 seconds. For all tests, the results are taken in a period of 33 seconds without any leg movement. The value of the length of the path traveled by the projection of COP was taken (mm).

Statistical data processing

For the purpose of analyzing the research objective – determining sensitivity of each individual variable, descriptive parameters have been calculated. For confirming the main hypothesis of this research, analysis of variance was used. Processing has been executed in the statistical package Statistica 11 (StatSoft, Inc, USA).

RESULTS AND DISCUSSION

In tables 1 -2 descriptive data of the subsamples of elderly people, spanning from 56 to 69 years and from 70 to 85 years of age, are shown. From the following tables, it is evaluated that the candidates have shown better stability in less demanding body positions, as expected. Considering the difficulty of tests 5 and 6, most of the candidates couldn't

complete the tests, so the results weren't statistically workable.

Table 1. Descriptive indicators in variables of the tests T1, T2, T3 and T4 within the subsamples of persons aged 56 do 59

56-69 age	n	AS	Min	Max	SD
T1	27	150,33	84,00	266,00	52,88
T2	27	223,81	95,00	519,00	103,90
T3	25	466,32	241,00	763,00	134,02
T4	16	945,68	531,00	1694,00	310,65

In the starting test, which was also the easiest one (T1), the average path traveled by the weight focus point was 150,33mm, which was also a very good result for persons aged 56 to 69. The surface of the support is large and the candidates were allowed to use the visual system, which is significantly facilitating. By restricting the usage of the visual system the average shift increases up to 223,81 mm (T2). The average result is growing, as expected, since the visual system is also the most important orientational system in movement, as in with most motorical actions, such as balance. In the next factor (T3) the aggravating factor was the reduction of the support surface, while the candidates were allowed to use the visual system. The average shift doubled, which indicates the difficulty and complexity of the performance of this test. In the fourth test (T4), the significantly high shift (945, 69 mm) is caused by the restricted usage of the visual system combined with the reduced support surface.

Table 2. Descriptive indicators in the variables of tests T1, T2, T3 and T4 in the subsamples of candidates aged 70 to 85

66-85 age	n	AS	Min	Max	SD
T1	28	169,17	62,00	358,00	75,97
T2	28	263,21	83,00	1021,00	180,60
T3	23	531,73	265,00	1056,00	203,78
T4	11	1281,90	550,00	2186,00	460,59

In the second subsample, it is evident that all of the average values are higher than in the previous subsample. It is visible that, in average, a chronologically older sample, in regards to its age, maintains balance with less success in the tests with reduced support surface, and restricted usage of visual systems. To confirm the previous conclusion and to determine the set hypothesis founded upon statistical processing, the variance analysis vas used.

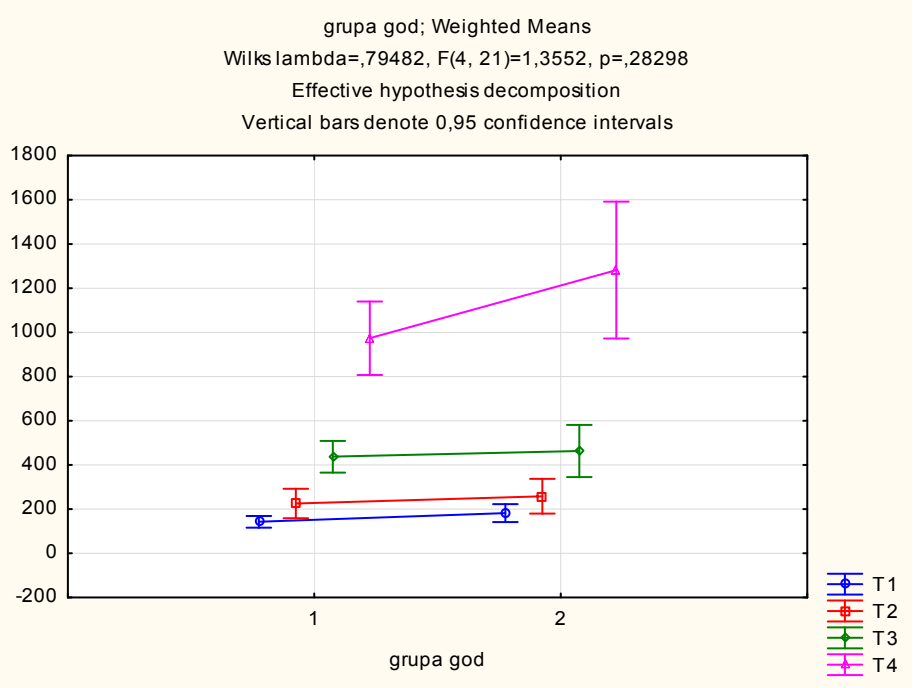
Table 3. Variance analysis in tests T1, T2, T3 and T4

ANOVA	F	P
T1	1,13	0,29
T2	0,97	0,32
T3	1,75	0,19
T4	5,16	0,03

While observing Table 3, the statistically significant difference (p) in the variable T4 between the subsamples of elderly persons, where the support surface is reduced and the usage of the visual system is reduced, is clearly visible. It is also visible from tables 1 and 2 in terms of average value of the subsamples in the test. In the variables of T1, T2 and T3, there is no statistically significant difference.

The aforementioned results are also visible under the graph 1 which indicate that by increasing the difficulty of the balance tests, the shift of the weight focus point also increases. The least significant difference is in the test 1 (T1), while the most significant is in the test 4 (T4), which confirms the assumptions that elderly persons have lower test performance, more significantly emphasized in more

difficult tests (support surface reducing, and restricting of the visual system).



Graph 1. Projection of the weight centre of elderly people in tests T1, T2, T3 and T4

The given significant differences between the subsamples in the mentioned static balance tests are very important. They indicate that disruption of balance between ages 56 to 85 is evident. Many have been dealing with differences in parameters of static and dynamic balance, although with bigger difference between the ages of the candidates, Maeda at al (2007) have established the differences between an average 22.5 year-old and an average 72.5 year-old. Such significant difference is highly expected, but it also provides us with the acknowledgement of the disruption of balance during the aging process. Given results of this research point to the same fact but in the elderly age, between the two groups of similar age.

These kind of results indicate a need of including the elderly people into a programmed physical activity and recreation in which there will be increased focus on balance, kinesiologic (physical) activities with reduced support surface, and activities with restricted use of some sensormotoric systems (squats with chair supporting, walking in a straight line etc.).

CONCLUSION

In the conducted research significant differences have been established between subsamples of elderly people in the chronological age from 56-69 and from 70-85. Results of the tests with aggravating factors such as reduced supporting surface and inability of using the visual system, have emphasized the importance of exercising. For prevention of falling, programmes of physical activity should be based on a multidimensional aspect of maintaining balance, such as the musculo-skeletal, visual, vestibular and somato-sensory system. The data of this study encourage further researches in terms of elderly people studies and making the golden age of the elderly people easier.

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THE HISTORY OF RHYTHMIC GYMNASTICS IN NIŠ

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SUMMARY

The beginnings of rhythmic gymnastics in Niš are related to the arrival of a Belgrade gymnast Ljiljana Pantić to this city. She was a versatile coach and a professor at the Faculty of Physical Education in Niš, who, in her youth, had trained ballet and artistic gymnastics only to fall in love with rhythmic gymnastics. As the leading professional in the rhythmic-sportive gymnastics club "Niš", as well as the organizer-in-chief of many rhythmic gymnastics sections within numerous elementary schools in Niš, she was the person whose choreographies made all the city events more appealing. Furthermore, she managed to achieve envious results in competitions with her trainees, who, in turn, became successful rhythmic gymnastics coaches themselves, and continued to create history of this sport in Niš. Some of the most successful rhythmic gymnasts were Jadranka Kocić, Mirjana Nikolić and Milena Savić. Apart from such active competitors, there were the ones who trained gymnastics recreationally. One of them was Marija Veličković. Mirijana Nikolić and Marija Veličković were the first ladies to open rhythmic gymnastics clubs in Niš ("Ritmik" and "Fokica") after a long absence of this sport from the city, whereas Milena Savić opened a club in Novi Sad ("Ritmix"). Owing to a Russian-Serbian marriage, girls from Niš got the opportunity to train rhythmic gymnastics with the ex-world champion from Russia, Natalia Puusep. She started the third rhythmic gymnastics club in Niš - "Gracia". Close cooperation between rhythmic-sportive gymnastics and artistic gymnastics clubs very often resulted in gymnasts' transfers from one gymnastic discipline to the other. Dragana Aleksić, a multiple champion of Serbia in artistic gymnastics, after bringing her successful sports career to an end, devoted herself to rhythmic gymnastics and has been an outstanding leader and owner of the gymnastic club "Gimnastix" for six years. The city of Niš is indebted to these ladies for creating and recreating the chance for young girls to take part in this sport and for placing the trainees' health and well-being before sports results. The least we can do is to remind ourselves of these facts thus keeping them safe from oblivion.

Keywords: Rhythmic-sportive gymnastics, Artistic gymnastics, club, sport section

INTRODUCTION

Rhythmic gymnastics (RG) has always been regarded as women's sport, which evolved from various related disciplines in 1800 and which incorporated German insistence on apparatus and Swedish approach to exercising into the elements of classical ballet. This sport actually represents a merger of ballet, gymnastics, dance and apparatus handling; it is a combination of sports and art, in which impressive motor structures are defined by beauty, elegance and harmony of movements (Miletić, 2005, 51). Rhythmic gymnastics is a relatively novel sports discipline, which as such appeared after the World War II (Kocić, Aleksić, & Tošić, 2009). Namely, competitive rhythmic-sportive gymnastics was created in 1947 in the Soviet Union, and the International Gymnastics Federation (FIG - Fédération International de Gymnastique) officially recognized this discipline in 1961, first as *modern gymnastics*, then as *rhythmic-sportive gymnastics* (from 1975 to 2000), and finally as *rhythmic gymnastics* (Wolf-Cvitak, 2004, 35). The first World Championship (only at individual level of competition) was held in Budapest (Hungary) in 1963; group competitions were first introduced in the World Championship in Copenhagen (Denmark) in 1967. It became an Olympic discipline in 1984, at the 23rd Olympic Games in Los Angeles (USA), first at individual level of competition and then finally in 1996 (Olympic Games, Atlanta, USA) the group competition was introduced as well.

In our country Rhythmics, in its various forms, has had a long-lasting and fruitfull tradition.

However, Rhythmic gymnastics as an individual sport discipline, started developing in 1961 (Ilić, 1998). The First World Championship held in Budapest in 1963 saw the participation of the Yugoslav National Team (headed by the coach, Anka Drinić). From that competition onwards, this sport has been increasingly developing, resulting in adequate successfulness (Sanader, 2005). The First Yugoslav Championship in Rhythmic-sportive gymnastics (RSG) was held in Belgrade in 1965 (Radisavljević, 1992). Apart from the participation and the success in European and World Championships, outstanding results were achieved at the 23rd and 24th Olympic Games. Namely, during Olympic Games in Los Angeles in 1984, our competitors were ranked fifth and tenth (Milena Reljin and Danijela Simić, respectively). Even Yugoslav Gymnastics Association (GA) was functioning perfectly which led, consequently, to our country being recognized as the leading force in gymnastics along with Bulgaria, Russia and Hungary. Nevertheless, the destruction and warfare in the Balkans that ensued had a detrimental effect on anything in general, sport included. The lack of financial means and technical support in GA and clubs made it impossible for once competitors and now coaches (Jasna Tomin, Nada Pisić, Dara Terzić and Milena Reljin-Tatić) to give their best at that time. Unfortunately, after an extremely successful period of a few decades, RG was close to non-existent in Serbia. From 2000 to 2010 our National Team did not participate in any of international competitions.

In 2002 Milena Reljin-Tatić founded a RG club "Ritam" in Belgrade. Her greatest ambition was to restore the Rhythmic Gymnastics Association so she assisted in founding RG clubs nationwide. By 2006 there were six RG clubs in Serbia in the following cities: Belgrade, Kragujevac, Niš, Novi Sad, Paraćin, and Užice. Until then there had not been any RG competitions and in December 2006 the first competition (in which all six clubs took part competing among themselves in mass group exercising) was held in Novi Sad. Today, there are 24 rhythmic gymnastics clubs in our country, four of which operating in Niš.

The very first rhythmic-sportive gymnastics club in Niš was founded in the 80s of the previous century but the difficult economic and social situation in the country at that time forced its closure, leaving the city without this wonderful sport. After many years, Niš has got four RG clubs, all of which have achieved outstanding results so it is our firm belief that this new history of rhythmic gymnastics in Niš should be recorded.

The aim of this research was to save and retrieve the history of rhythmic gymnastics in the city of Niš (Serbia) since there has not been any academic research into this grand true story of the people who brought back this sport and their constant and passionate fight to keep it here and make it successful. To achieve the aim, a historical method was used requiring field research supported by the interviews with ex-coaches, ex-gymnasts, and current coaches as well as by the evidence in the form of documents and photographs from the private collections of the interviewees.

THE BEGINNINGS OF RHYTHMIC GYMNASTICS IN NIŠ

Rhythmic and esthetic exercising was an indispensable part of the tradition of the 'Soko' organization and of the 'Partizan' organization, as well. It was much later that it became an independent discipline within gymnastics societies and clubs. The interest in RSG in Yugoslavia and Niš started growing in 1965. That year the World Championship in RSG held in Prague was televised, so many girls, who had already started training in the 'Partizan' organization, began moving to the music thus developing interest in this particular sport. In some schools in Niš, enthusiastic teachers introduced certain elements of RSG into the physical education (PE) curriculum (Ilić, 1998, 173).

The pioneer work of Ljiljana Pantić

All the effort to make RSG a more popular and respected sport in the city of Niš can be ascribed to the work and dedication of the professor Ljiljana Pantić. Ljiljana Pantić was born in 1935. As a child she trained artistic gymnastics (AG) within the Society for Bodily Exercising (DTV) 'Partizan'. For two consecutive years (1951 and 1952) she was the champion of Serbia in free style discipline for young cadets. Along with being a competitor, she was also a coach-sergeant. She finished the High School for Pre-School Educators, because she loved working with children. In 1954, she entered the Institute for Physical Education in Belgrade and became a member of the Yugoslav National Team. However, she did not go to the competition. She left AG at the third year of her studies and focused on RSG, for

these two sports have a lot in common. As a member of DTV 'Partizan' she participated in numerous competitions. The competition programme involved Multi-sport events and Exercises with apparatus (Artistic gymnastics). The multi-sport events were comprised of athletics and basic exercises[1]. Those basic exercises were the precursors of RSG. And then, following the Russian example, artistic gymnastics was separated from the rhythmic-sportive gymnastics since the two were completely different disciplines.

Not long afterwards, the marriage to Mihajlo Pantić took her from Belgrade to Niš in 1959. At the end of 1960, Ljiljana graduated from the Institute and had given birth to her first child. Around this period she was actively looking for a job within her own profession. Having seen many schools and grammar schools, she understood that they did not have any adequate place for exercising within PE classes. The Secondary School of Economics offered her their glass-walled ceremony hall with a balcony, specifically asking of her not to use props in her work with children. The only PE teacher in the school at that time, Radović Krsta, had adapted the school yard perfectly to suit the needs of PE classes. However, this yard did not suit Ljiljana's requirements because of too much dust. To satisfy the needs of his soon-to-be colleague, the PE teacher adapted a part of the yard near school, turning it into grass-covered space, where athletics could be trained. Ljiljana accepted this opportunity and while she was working with female classes, her colleague was working with male. In each class she taught her students body-shaping exercises to the music. She was involved in preparing a New Year's Day celebration programme (to the music of Johann Strauss's "Trish Trash Polka")[2]. Ljiljana was working in this school for six years. In the meantime, a vacant post had appeared at the Preschool Teacher Training College, which she viewed as an excellent chance for her professional development. She applied for this vacant post and soon began teaching there. Unfortunately, it was not long before she realized that she could not work with few students in just negligible number of classes a month. She wanted to return to the Secondary School of Economics but her post had already been taken. She was forced to turn to elementary schools, working at the Preschool Teacher Training College at the same time. After two or three years of existing in Niš, the Preschool Teacher Training College had to be closed. From that moment on (it was the end of 1972), Ljiljana decided to start working on founding RSG sections within schools, and this idea received the greatest interest from the teachers of the following elementary schools: "Ivo Andrić", "Vuk Karadžić" and "Dositej Obradović". Soon afterwards, PE teachers in other elementary schools introduced some elements of RSG into their curricula, which made it possible for a school championship to be organized. Ljiljana Pantić had a task to teach all the enthusiastic PE teachers an obligatory exercise, which, in turn, they had to teach their students in their classes. Those organized competitions did not receive any public attention, but a large number of schoolgirls became interested in this sport (finally there was a 'girls only' sport discipline).

Rhythmic gymnastics slowly gained more and more supporters and fans, not only for being 'girls only' sport but also for being visually appealing. The RSG club held its training sessions in rented gym halls and in some schools RSG groups were formed. The interest of the girls was great, and the leadership team has been relentlessly and ambitious. Girls were allowed to use the gym halls and the apparatus of the following schools: "Ivo Andrić", "Vuk Karadžić" and "Ćele Kula". However, the drawback of all these gyms was the low ceiling they had so the apparatus (ball, rope, hoop, ribbon, and clubs) throwing was hampered by it. The need for a gym hall with the ceiling high enough was grave. In time, some club members started participating in competitions (group exercises) and in public appearances[3] (the performance by gymnasts was something to be expected in all the city celebrations; the use of apparatus such as rims, hoops, ribbons, and balls was a novelty in their performances). The most prominent club members were: Jadranka Kocić, Slavica Dinić- Čavče, Mirjana Nikolić, Milena Savić, Milena Stefanović, Marija Spasić, etc.

[1] Those basic exercises were performed within groups and implied the use of all the apparatus commonly related to RG, apart from the ribbon.

[2] In 1963, she used the same exercise in the High School Championship and won.

[3] The first academic composition was "The exercise of modern gymnastics and polka", in which 36 schoolgirls did hoop exercise. This composition was prepared and organized by Ljiljana Pantić and its premiere happened at the closing ceremony of "The revue of physical education exercises of the Republic of Serbia", held in Belgrade on June 23rd and 24th in 1972. It won one of the prizes (Ilić, 1998, 115). On May 25th 1987, DTV "Partizan" organized its 30th anniversary celebration in Niš. One of the most praised acts was the ribbon exercise performed by the RSG club members (the exercise was the work of Ljiljana Pantić and Jadranka Kocić) (Ilić, 1998, 117).

The RSG club "Niš" was a sport organization, focused not only on the competitive part of the work (successfulness in competitions was not the most important goal) but also on the educational part. Such an attitude contributed to the club functioning as a big harmonious family, which was greatly appreciated by the members' parents who donated the means for the apparatus provision[4]. The existence of the club was never an issue (Ilić, 1998, 175).

Even though the club was mostly focused on educating the members, there certainly was a wish for participation in the Championship of Yugoslavia, before which the Championship of Serbia had to be won. It was a serious undertaking with the fierce competitors from Belgrade (the best gymnasts in both Serbia and Yugoslavia). Nevertheless, the cooperation with Olivera Grušovnik, the leading person of a club in Belgrade, resulted in a substantial progress of the gymnasts from Niš.

The sports center "Čair" provided the adequate space for training sessions, which gymnasts had to share with basketball and volleyball players. The gymnasts slowly made progress, which was awarded by success. Junior and senior competitors were successful in the Republic and then in the National competition, as well. For example, Slavica Dinić was ranked fourth at the National Competition held in Tuzla in 1988 (Ilić, 1998, 176).

At the end of her career, Ljiljana Pantić got a successor, Jadranka Kocić, an ex member of the club, who became the leading person of the RSG club "Niš" in 1987. The management of the club was trying really hard to provide adequate training and working conditions but the club, unfortunately, started stagnating. Older and more experienced gymnasts gradually left the club and the younger members, who were supposed to keep up with the good work, could not cope with such a difficult task. The club has always been a model and successful organization, awarded the October Sports' Prize by the city of Niš. However, it has always been on the margins of all sports events in the city.

[4] The apparatus were obtained from Germany, Sweden, Italy and Bulgaria.

Jadranka Kocić – Ljiljana Pantić's protégé

Jadranka Kocić was born in August 1962. At the age of 10, when she was a third grade pupil, she started training RSG in a section within the elementary school "Ratko Vukićević"[5]. After 1977 they moved from this elementary school to the other one, "Vuk Karadžić", with some training sessions held at the elementary school "Ivo Andrić", but only for a short period of time. Very soon their club was joined to the gymnastic club (GC) "Niš" (1978) which, at that time, meant having training sessions in different places. The gym hall of the GC "Niš" was the gym hall of the elementary school "Maršal Tito" (today's "Radoje Domanović"), which was being renovated at that time (the old building had been torn down, a new small gym had been built outside the school, and then a new big gym was built at the same spot). From 1979 to 1981, Artistic gymnastics was practiced in the small gym and Rhythmic-sportive in the big one[6]. This kind of cooperation is not surprising, since all the championships in both sports, the Republic and the National ones, were realized as joint competitions. Consequently, it often happened that rhythmic gymnasts competed late at night, even though the competition had begun early in the morning (for the competition schedule was as follows: male artistic gymnasts, female artistic gymnasts and then rhythmic-sportive gymnasts[7]). All this led to the decision that the Gymnastics Association should be divided into two associations, the on for AG and the other one for RSG. It all happened in 1983. In that same year the RSG club "Niš" was founded and it meant leaving the big gym hall of the "Maršal Tito" elementary school and moving to the sports center "Čair" in the following year.

The club needed the manager (president). Taking into consideration that Minja Stefanović, the daughter of the manager of the GC "Niš", Budimir Stefanović, was training RSG at that time, Budimir Stefanović decided to become the manager of the

[5] [5]At that time mini selections- auditions were held: two or three girls would perform and dance to the music any way they wanted to and they could repeat their performance for a few times.

[6] Even though each sport had its own gym hall, it happened that artistic gymnasts would come to the big gym hall to practise vault and rhythmic gymnasts would go to the small gym hall to use the trampoline. All of them remember this period as the one of nice fiendship and cooperation.

[7] At the National Championship in Subotica held in 1981, Jadranka Kocić performed after midnight.

RSG club "Niš". The leading person became Ljiljana Pantić, and the board members were the parents of the most active club members. During that period some girls transferred from AG to RSG, so the club had 15 members in all categories[8]. In those days, all the competitions were individual and group exercises were performed in public ceremonies[9].

The club received substantial funding from the city for going to competitions while the leotards had to be provided for by the gymnasts themselves[10] (from their relatives or friends who lived in Germany or the USA or Bulgaria, thanks to the cooperation with NSA from Sofia). As far as music was concerned, it was piano music at first, then the piano accompanied by some other instrument (percussions) and finally orchestra music. Each club had its accompanist, a person educated in music, whose task was to play the music gymnasts had chosen for them to dance to. Within a time span of an obligatory minute to a minute and a half, an accompanist could combine three different pieces of music into one, to the request of a gymnast.

In the 1980s a competition in all sports for schoolboys and -girls was held and it was known as the Olympic Games of Schoolchildren of Serbia (OSIŠOS). The competition was organized in different levels, the first one being the school level, then municipality, town, region, after which came the Republic and National levels. Jadranka Kocić had the task to teach all the interested and enthusiastic PE teachers of the schools in Niš RSG exercises intended for younger juniors (exercises without apparatus, exercises with a rope and a ball) and juniors (exercises with a ribbon and clubs).

In 1981 she entered the Department of Physical Education at the Faculty of Philosophy in Niš. She still trained RSG actively, but at the third year of studies she decided to give up her competitor career (her last competition was a 'duel' between two cities Skoplje and Niš that was held in the sports center "Čair" n Niš in 1984)[11]. She did not leave the club, though. She was still working with young children and studying at the same time. In 1986 she graduated from the Faculty of Philosophy and in 1987 she started working as a professional coach (her first position was with the RSG club "Niš", which started on September 10th, 1987). She passed gymnastics judge examination and became the Republic judge for RSG. From 1983 to 1988, she was a member of the Sports Association Board (SOFK) of the Niš Municipality, and from 1987 to 1991 she was the member of the Yugoslav Gymnastics Association, RSG department.

All the training sessions of the RSG club "Niš" were held at the sports center "Čair"; ballet exercises and the ones without apparatus in the small gym halls and the central hall (its sides) was used for exercising with apparatus, while basketball and volleyball players were using the middle part of the central hall simultaneously with the gymnasts. The club used the sports center without any charges and the membership fee to the club did not exist. All the funding, which was the case with all the other sports as well, came from the city budget. That covered the fees of accompanists, going to competitions, etc. And then, in 1991 a war began.

From November 1991 to 1997 she was a teaching assistant for RSG at the Faculty of Physical Education of the University in Priština. In March 2005, she became an assistant professor of Rhythmic gymnastics and dance at the Faculty of Physical Education of the University in Novi Sad, and in 2012 she became an associate professor of RSG at the Faculty of Physical Education in Leposavić, University of Priština.

RHYTHMIC GYMNASTICS IN NIŠ TODAY

In 2001 a small number of girls were interested in this sport and there were only a few gymnastics coaches, as well, and only two RG clubs existed in the whole country. One of those two clubs was the RG club "Ritam", founded in Belgrade in 2002 (founder and the manager is Milena Reljin-Tatić). In 2005 the RG club "Ritam" began its project "Rhythmic Serbia"

[8] Numerous girls joined and left the club, but Jadranka was persistent.

[9] Not a single ceremony in the city could be imagined without the performance of rhythmic gymnasts. The club's biggest success was the performance at the opening of the sports center "Čair" (October 14th, 1974) when the members did two group exercises (the one without apparatus and the other with hoops) to the "Waterloo" song by Abba.

[10] Each competitor had to have four different leotards for exercises that could not be golden, silver or bronze in colour. Those leotards had long or semi-long sleeves and apart from them the competitors could perform barefoot or wear leather footware or white socks; make-up was allowed; hair had to be in a bun and only descrete flowers could be placed in the hair as accessories.

[11] Jadranka Kocić was by far the most successful competitor of the RSG club "Niš". She had made it to the finals of all National Championships (ranked first to eight, depending on the competition). The most notable successes achieved were the one at the National competition in RSG in Skoplje in 1979 (her team was ranked third) and in 1981 (as a senior, she was ranked third in both categories, with clubs and without apparatus).

with the aim to promote this sport, to draw the attention of as many girls as possible and to start clubs throughout the country. Milena helped opening the clubs in Kragujevac, Paraćin and Niš. In 2006 there were six rhythmic gymnastics clubs in Serbia operating in the following cities: Belgrade, Kragujevac, Niš, Novi Sad, Paraćin, and Užice. There had not been any competitions up to that year so the first one was organized in Novi Sad in December 2006 (mass group exercising) in which all six clubs participated. In 2006 and 2007 the Ministry of Youth and Sports of Serbia gave its support to the project and in 2008 the project was funded from its own financial means. Today there are 24 rhythmic gymnastics clubs in Serbia, four of which operating in Niš.

Rhythmic gymnastics club "Ritmik"

Founder, manager and coach: **Mirjana Nikolić**

Date of foundation: February 17th, 2007 (the club started working in September 2006 and participated in the competition held in Novi Sad in December 2006); it became the member of the Serbian Gymnastics Association (GSS) in January 2014.

Location: "Sveti Sava" elementary school, and since the beginning of September 2014 the training sessions have been held in "Ćele Kula" elementary school.

Number of members: the total number of members is unknown, and currently there are 30 members of this club.

At the age of eight (in 1975) Mirjana Nikolić encountered this sport in the RG section of "Vuk Karadžić" elementary school. Placing a lot of work, talent and willingness to succeed in this sport, she managed to become one of 15 most successful gymnasts of the RG club "Niš". In 1984, towards the end of her secondary school education, she decided to end her competitor career. Not so long afterwards the war and the economic crisis began. These factors caused a several-year-long break for this sport in Niš.

For 18 years there was not any sign of rhythmic gymnastics in Niš, and then an enormous love for this sport and immense respect for the coach Ljiljana Pantić motivated Mirjana to bring back this sport to the city. With the help and support from Milena Reljin-Tatić, she unofficially started the RG club "Ritmik" in September 2006 and held training sessions at the gym hall of "Sveti Sava" elementary school. The club received the official recognition on February 17th, 2007 (The official document proving the foundation of the RG club "Ritmik", no 661-02-94/2007-11) and has been operating for seven years. The focus is on 'C' and 'B' programmes with the girls as well as on health prevention, i.e., the prevention and correction of minor bodily deformities with the aid from this wonderful sport. Many girls have been the members of this club, but since there are no official data regarding the exact number of the members, we are not able of presenting them in this paper. So far the club has changed the location and since the beginning of September 2014 the training sessions of RG club "Ritmik" have been held in "Ćele Kula" elementary school.

Rhythmic gymnastics club "Fokica"

Founder, manager and coach: **Marija Veličković**

Assistant coach: Verica Veličković

Date of foundation: March 28th, 2007 (the club started working in 2006 and participated in the competition in Kragujevac in 2007)

Location: the first location was a small gym hall of the elementary school "Bubanjski Heroji" (it was used for six years); the second location was the gym hall of the elementary school "Ratko Vukićević" (used for two year along with the first location); the third location was the gym hall of the elementary school "Sveti Sava"; the fourth location has been a gym hall of the local community building "Božidar Adžije".

Number of members: the total number of members is unknown, and at the moment, there are 20 permanent members.

Marija Veličković grew up in a modest family of four children. Growing up with her brothers, she learned to love sports and when she entered the elementary school "Vuk Karadžić" she started training Artistic gymnastics (at that time, the coach was Gordana Šulović) and rhythmic gymnastics as well (the coach was Ljiljana Pantić), and was active for eight years, until she started secondary education. As a mother of two daughters, her dream was for her girls to train RG too, but at that time there were no clubs in Niš. That was her biggest motivation to start her coach career. Her decision to bring back rhythmic gymnastics to Niš coincided with the decision of her younger ex-team mate, Mirjana Nikolić, to do the same. In 2006, Marija unofficially started the RG club "Fokica" and held training sessions at a small gym hall of the

elementary school "Bubanjski Heroji". The club received the official recognition on March 28th, 2007 (The official document proving the foundation of the RG club "Fokica", no 661-02-345/2007-11), only a month after the first RG club "Ritmik" started working. From that moment, after a two-decade-long break, Niš got two rhythmic gymnastics clubs. The first competition for the club "Fokica" was the one held in Kragujevac on April 1st, 2007. Otherwise, the club focuses on the 'B' and 'C' programmes with girls.

One year after the club was founded and started working, Marija organized the first "Naissa" rhythmic gymnastics tournament in Niš in April 2008. The location was the brand new gym hall of the elementary school "Mika Antić". The response was great – 17 clubs, and over 700 competitors from the whole country. From that year onwards, the RG club "Fokica" has traditionally organized this tournament in April, which changed its name to "Fokica Cup" three years ago. The participants are not only from Serbia, but from Bosnia and Herzegovina (BiH) and Bulgaria, as well. The main aim of this tournament is to popularize RG in Niš and to provide both parents and children with the opportunity to get to know and understand this wonderful sport.

The RG club "Fokica" took part at many international and national tournaments, and at almost every National Championships ('B' programme – individual and group routines). In 2008 at National Championship (NC) in Belgrade, Jana Menković, a young junior, was ranked sixth, Ana Veličković was eighth, and Verica Veličković (a cadet) was at 12th place. At second "Naissa Cup" in 2009, RG club "Fokica" won all of the first three places with three groups of different age categories. The same year, at Region Cup in Paraćin, cadets Verica Veličković, Jana Menković and Ana Veličković won the first three ranks, respectively, and at Championship of Serbia in Belgrade, 2009, Verica i Jana shared eighth place, and Ana Veličković was 11th (as team they were third). At "Ritmix Cup" in Novi Sad 2010, Anđela Stojanović (novice) was ranked second, while Luna Urso (a young junior) and Ana Veličković (a cadet) were third, and Verica Veličković won the gold medal. In 2011 at Region Cup in Ćuprija, young junior Jovana Ristić won silver and senior Verica Veličković won the gold medal (the next year, at the same competition in Paraćin, she was ranked second). In 2012, at "Ritmix Cup" in Novi Sad, Jovana Nešić (a cadet) won gold, and in 2013 silver medal.

Rhythmic gymnastics club "Gracia"

Founders: Dragan and Natalija Mitrović

Manager: **Natalija Mitrović**

Coaches: Natalija Mitrović, Ivana Slijepčević and Milica Jovanović

Date of foundation: July 15th, 2008 (the club started working in September 2007 and participated in the first "Naissa Cup" in Niš, in April 2008)

Location: for a short period of time the first location was the gym hall of the elementary school "Stefan Nemanja", and afterwards it was located at the gym hall of the elementary school "Radoje Domanović".

Number of members: the club has had more than 100 members (10 of which from the first day of the club up to date, 20 have been the permanent members in the last four years and 40 members who have been regularly attending training sessions in 2014). At the moment, there are 50 members.

Natalia Puusep (her married surname is Mitrović) was born in Omsk (the Russian Federation) in 1973. She was only five when she started training rhythmic gymnastics[12]. After a year spent at her first sport school, having shown interest and enthusiasm, her coach sent her to a better one. She began as an individual and group competitor, and from the age of 16 she continued as a group competitor only. In 1987 (at the age of 14), she received the National Scholarship and became a member of the Russian National Team and later on of the Soviet National Team. In that year she was ranked 25th at the Soviet Union State Championship and second as Russian cadet. She was the World Champion in group routines: at the World Cup in Brussels (Belgium) in 1990 her group won three gold medals, in both multi- and single-sport events (they were ranked first in clubs routine, and second in routine with balls and ropes). In the same year at the European Championship in Stockholm (Sweden) they were ranked third in clubs routine, and first in routine with balls and ropes. They were ranked second at the World Championship in Athens (Greece) in 1991, and individually each won a gold medal for both

[12] In the USSR there were no clubs but specialized sport school, each nourishing a particular sport. The whole organization and development of athletes was completely different from the ones in Serbia. Apart from age categories, there were classes within each category (the first, the second and the third class) and for a trainee to go from one class to another, she had to pass an exam (comprised of some obligatory exercises to the identical music, with six girls taking the exam at the same time and the performance of each being separately evaluated).

routines (with ribbon and with balls and ropes). At the end of 1991, she received a prestigious title from the Soviet Union, the *Accomplished Master of Sports*, and in 1992 she ended her competitor career.

During her career, she also worked as a coach in Russia, and even in the USA on two occasions (in Detroit and Chicago) when she was 18 and 19. On one of her journeys she met her husband, Serbian nationality, and arrived in Belgrade in 1996. She married him in 1999 and continued living in the capital until 2007. Then they decided to move to Niš and open a rhythmic gymnastics club, which finally happened in 2008 (The official document proving the foundation of the RG club "Gracia", no 661-02-1006/2008-03).

The RG club "Gracia" became a member of the Serbian Gymnastics Association in 2008 and in March 2010 got registered at the Sports Association of the City of Niš. The focus is on the 'B' and 'C' programmes with girls and the first competition that the members of this club took part in was the first "Naissa Cup" in April 2008. Since then, the members of this club have actively participated in numerous tournaments and National competitions, and they have always been ranked first to third in their categories. The club can also boast of a large number of permanent members, devoted to it from the first day onwards.

Gymnastics club "Gimnastix"

Founders: Saša and Dragana Aleksić

Manager, board chairperson and head coach: **Dragana Aleksić**

Assistant coach: Andrea Aleksić

Date of foundation: July 2nd, 2009 (the club started working in August 2008); the club has been the member of the Serbian Gymnastics Association since January 2010.

Location: a gym hall in a privately-owned house in Durlan (Crnogorska 4 Street); from 2008 a small hall (10.5x6 m) was used, and since 2012 a bigger hall (13x9 m) has been used.

Number of members: the club has had more than 400 members, and at the moment, there are 80 members.

Dragana Aleksić (born in September 1969) was a member of the GC "Niš" and an active artistic gymnast since she was 16. During her sport career, she achieved certain results. She was the Champion of Serbia for three consecutive years (1983, 1984 and 1985) when she was ranked first at the Championship of Serbia in Artistic Gymnastics for individuals, and in 1984 her team was ranked third at the Yugoslav Championship in Artistic Gymnastics for seniors (held in Belgrade), in the National rank category. After a successful competitor career, from 1986 to 1988 she worked as a gymnastics judge and an amateur coach of the youngest members of the GC "Niš". She graduated from the Faculty of Phylosophy, Department of Physical Education, University in Niš, in 1993. In January 2005, she started training female team of the gymnastics section of the sports organization "Pionir" at "Bubanjski Heroji" elementary school in Niš. During one period, the RG club "Fokica" held its training sessions at the same time in the same gym hall as Dragana, and those drew attention of the artistic gymnasts[13]. Since many of her trainees showed interest in RG, Dragana decided to change her professional orientation and perfect her rhythmic gymnastics skills. In 2008 she unofficially founded the GC "Gimnastix" in Niš, and has successfully participated with the members of her club in many national and international championships in both individual ('B' programme) and group competitions ('B' and 'C' programmes). Since 2010, she has been the member of the Serbian Gymnastics Association for Rhythmic Gymnastics. She is also one of the national judges for RG in the 2013-2017 Olympic cycle and currently the only judge from Niš, and also a licensed coach for 2014.

She took the members of her club to two important seminars for coaches and the RG camps in Varna (Bulgaria) in 2011 and 2012. The lecturers in those seminars and camps were the World Champions of the 1990s: Maria Petrova and Lili Ignatova from Bulgaria; Beijing Olympic Games 2008 golden medalists: Ana Bessonova (Ukraine), Simona Peycheva (Bulgaria), and Natalia Godunko (Ukraine), so as Elizabeth Paiseva (Bulgaria). Besides, the GC "Gimnastix" had organized seven-day-long summer camps ever since it was founded (the first three years, the camps were organized in Divljana, and the last four at Vlasina Lake, where training sessions have been held in a big hall which suits the height standards necessary for the apparatus throwing).

Since the club started working, 400 girls have been its members, and currently there are 80. After

[13] Since that once there was a RSG section within the GC "Niš", it was not a surprise that an artistic gymnast, following their own wishes or their coaches', switches to RSG, which was the case with Slavica Dinić- Čavče, who changed her discipline at the suggestion of her coach Dragoljub Petković.

the first year of working, this club had its own individual competitors. Today, there are seven registered: two young juniors, two cadets, two juniors and one senior (Dorotea Rančić[14]).

The club has had a lot of success. In 2010 at the "Akademik Cup" tournament in Bulgaria, Nikolina Pejić, then aged seven, was ranked first among the competitors from ten states. In 2012 at the third "Gimnastix Cup", Tatjana Jelenković was ranked third in her category; she was ranked fourth at the NC held in Svilajnac in 2014, and was ranked third at the "Trakia Cup" in Plovdiv, Bulgaria. Minja Ignjatović, as cadet was ranked third at the "CSKA Cup" in Bulgaria in 2012 and the same year Dorotea Rančić, as junior, won the gold medal at the tournament in Tuzla. The most successful competition for the club to date has been the tournament in Mladenovac (Serbia), which happened in March this year. Maja Cvetković, a junior, was ranked first in two apparatus categories, and was ranked second in the overall score; Tatjana Jelenković (a cadet) was ranked first in the overall score, whereas Minja Ignjatović was third; Jovana Jović (a young junior, and by far the most talented girl in Dragana Aleksić's coaching career) was ranked first and Nikolina Pejić was ranked third; Dorotea Rančić, a senior, was ranked third, as well. Apart from numerous achievements in individual categories, the club has had admirable success in group routines too: the second and third place at the NC in 2010 and 2011; gold, silver and bronze medals at the tournaments in Budva (Montenegro) in 2010, at "Gimnastix Cup" in Niš in 2010 and 2011, and at the tournament in Novi Sad, from 2008 to 2012. In 2011 the club was ranked first at the "Akademik Cup" in Sofia (Bulgaria), then first and second at the tournament in Budva (Montenegro) and third in Sarajevo (BiH). In 2012, the club won first places at the tournament in Paraćin (Serbia) and Tuzla (BiH), and third place at "Akademik Cup" and "CSKA Cup" in Sofia (Bulgaria).

Since 2010, the club has organized the international RG competition - "Gimnastix Cup", for "C" (group) and "B" (individual) programmes. It traditionally takes place at the first weekend in November, at the new gym hall of the elementary school "Mika Antić" in Niš. The very first "Gimnastix Cup" was held in 2010, and apart from competitors from Serbia, there were also competitors from BiH and Montenegro. In 2011, the second competition was held. It was much more important and bigger than the previous one, with competitors coming from Serbia, BiH, Montenegro and Bulgaria (20 of them from the RG club "Akademik", which has got World Champions this year), and the panel of judges from our country helped by a judge from Japan. At this tournament, Tatjana Jelenković, a member of the GC "Gimnastix" was ranked third in her category among 19 competitors. Two more big Bulgarian clubs ("Velbujd" from Kyustendil and "CSKA" from Sofia) participated in the third "Gimnastix Cup" that was held on November 11th, 2012. The fourth "Gimnastix Cup" will be held in November 2014, with one important novelty: competitions will be held for all the three programmes ('A', 'B', and 'C').

[14] After Jadranka Kocić, Dorotea Rančić is the only senior competitor in RG from Niš (since January 2013). She is the permanent member of the GC "Gimnastix".

CONCLUSION

The RG clubs "Ritmik", "Fokica", "Gracia" and the GC "Gymnastix" are the new reality and the new leaders of rhythmic gymnastics in Niš, the sport which finally has its rightful place in our city. The city ends this year with four important and appreciated rhythmic gymnastics clubs, which have a bright future ahead, judging by the interest that girls have got in them. It will, in turn, bring about the further and unhindered rise of this sport in the city. This research can only be ended in the most positive and optimistic way. It was an honour to write this story, about people who have taken part in shaping and reshaping the history of rhythmic gymnastics in Niš always following their dreams: six wonderful people who have left their mark on not only the history of rhythmic gymnastics in this city but on the history of rhythmic gymnastics in Serbia; six people who have saved this wonderful and fascinating sport from oblivion in Niš. Having witnessed the enthusiasm that both girls and their coaches have when it comes to this sport, we can only predict further growth of and development in this sport. We also believe that this story will soon be written on many more pages and that its writing will virtually never end.

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risking everything when founding rhythmic gymnastics clubs in Niš out of pure love for this sport. Luckily enough, the risk has been proved worth taking and has brought benefits to them, the girls they have trained and the city of Niš.

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PHYSICAL ACTIVITY IMPACT ON LIPID PROFILE PARAMETARS IN CHILDREN WITH CENTRAL OBESITY

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SUMMARY

Introduction: Physical activity is one of the most efficient ways to improve metabolic profile in obese individuals. there are still many insufficient data explaining the background of what is really happening during phisical activity , simple weight loss or some favorable metabolic and neurohumoral changes. Aim of this study was evaluate relationship between lipid profile parameters and abdominal adiposity in relation to physical activity.

Methods: We investigate 67 obese adolescents with BMI 27,8 ± 0,3 kg/m^2. Every enrolled participant fill in the questionnaire about physical activity . Children were divided in two groups. Group practiced physical activity at least three times a week, 60 minutes duration and group didn't meet these requirements.

Results: Statistical analysis showed that HDL levels was significantly higher in the physicaly active group of children independently of central obesity determined by waist circumference. There were not sig difference in other lipid profile parametars . Trigliceridi (1,45 SG 0,23: 1,46 SG 0,31) i LDL holesterol (2,7 SG 0,3 : 2,6 SG 0,41).

Conclusion: Results of our investigation demostrate that increasing physical activity is associated with better lipid profile and boost of HDL /good holesterole/ apart from type and the degree of obesity.

Keywords: Physical activity, lipid profile, central obesity, children

INTRODUCTION

Childhood obesity is one of the major public health problems worldwide (National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel II, 2002). Recent epidemiological data on Serbian adolescent obesity prevalence revealed that 16% are obese and 30% overweight(Kisić-Tepavcević et al., 2008; Rakic et al., 2011). Of them only a few are metabolically healthy, and majority have one or more risk factors for developing KVS disease (Twig et al., 2014). Visceral obesity, frequently accompanied with insulin resistency is an indicator used in the diagnosis of metabolic syndrome, and is more closely related to cardiovascular diseases (D'Agostino et al. 2014). It is followed by dislipidemia , hypertension, insulin resistance and independent risk factors for KVS disease. Measuring waist circumference is useful tool in everyday medical practice for evaluation visceral obesity. First atherosclerotic changes begin in early childhood and one of the most important undererlying pathogenethic mechanism is dislipidemia. Early screenin, identification and controlling childhood obesity is most important target in prevention CVS morbidity and mortality (Genest et al., 1992). Measuring waist circumference is practical and simple way to examine degree of abdominal fatness. Numerous studies point out to negative correlation and waist circumference and level of HDL. It has been shown unequivocally that physical activity increase HDL holesterol levels also in healthy and obese persons(Nesan et al., 2014; Lloyd-Jones et al.,2014). There are still many insufficient data explaining the background of what is really happening during phisical activity, simple weight loss or some favorable metabolic and neurohumoral changes. To date there aren't similar studies who estimate relationship between parametars of lipide profile in physically active and physically inactive

adolescents in relate to waist circumference what was the aim of this study.

METHODS

Reaserch was conducted in 2012 at Children's hospital, Klinical Centar, Nis.We examined 67 obese adolescents(BMI)>95% age 14,6 ±3,5 (rang 12 - 18 age) BMI average 27,8 ± 0,3 kg/m^2.They are visit pediatrician because obesity and obesity related health problem. Weight was measured also, body weight was measured using electronic scale with precision to 0.1 kg following a standardized procedure (lightly dressed, without shoes). Height was measured to the nearest 0.1 cm using a stadiometer, with the shoulders in a relaxed position. Body mass index was calculated by dividing weight (kg) by height (m^2). Waist circumference was measured using a flexible non-elastic tape with subjects standing at the smallest abdominal position between the iliac crest and the lower rib margin at the end of normal expiration. . The measurements were recorded to the nearest 0.5 cm. Lipid profile was determed total cholesterol, triglycerides, high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C) were determined as a valuable biochemical parameters.

STATISTICS

Descriptive data were presented as a mean values with standard deviation (SD) and range. Student's two-sample t-test for independent groups was used to compare BMI and ag between groups and ANCOVA test was used to compare lipid profile parameter. The value $p<0.05$ was considered statistically significant. All statistics were done using the SPSS statistical software version 13 (SPSS, Chicago, IL, USA) and statistical software MedCalc version 9.0.1.

RESULTS

In the physicaly active group 33% examiners were metabolicaly healthy vs 15 % examiners in metabolicaly healthy in sedentary group. There was no statistically significant difference in age (14,6 ± 3,2 : 15,1 ± 2,7), BMI (25,7 ± 2,3 : 26,9 ± 2,2) and gender between groups p<0,05 HDL was significantly higher in physicaly active group regardless of waist circumference (1,34 SG 0,045:1,218 SG 0,085), There was no significant difference in trigliceride (1,45 SG 0,23: 1,46 SG 0,31) as well as LDL (2,7 SG 0,3:2,6 SG 0,41).

Table 1. HDL levels adjusted and unjusted for physical activity and waist circumference as a covariable

N		HDL ("unadjusted")		HDL ("adjusted")	
		M	SD	M	SG
phisicaly active	20	**1,41**	0,31	**1,34**	0,045
phisicaly inactive	47	**1,19**	0,19	**1,22**	0,085

Table 2. Covariance analysis for HDL levels in physical active group with waist circumference as a covariable.

	dF	MS	F	P	Eta^2
waist circumference	1	0,194	4,132	0,05	0,121
physical activity	1	0,064	1,372	0,251	0,044
Standard erorr		0,047			

Table 3. LDL holesterol levels unadjusted and adjusted for physical activity with waist circumference as a covariable.

N		HDL ("unadjusted")		HDL ("adjusted")	
		M	SD	M	SG
phisicaly active	20	2,74	0,27	2,67	0,3
phisicaly inactive	47	2,9	0,29	2,7	0,41

Table 4. Covariance analysis for LDL levels in physical activity group with and waist circumference as a covariable.

	dF	MS	F	P	Eta^2
waist circumference	1	0,194	2,132	0,089	0,09
physical activity	1	0,083	2,472	0,561	0,023
Standard erorr		0,067			

Table 5. Trigliceride levels adjusted and unjusted for physical activity with waist circumference as a covariable.

N		HDL ("unadjusted")		HDL ("adjusted")	
		M	SD	M	SG
phisicaly active	20	1,55	0,33	1,45	0,23
phisicaly inactive	47	1,66	0,29	1,46	0,31

Table 6. Covariance analysis for LDL levels in physically active group with waist circumference as a covariable.

	dF	MS	F	p	Eta^2
waist circumference	1	0,189	1,132	0,069	0,04
physical activity	1	0,033	0,972	0,61	0,013
error		0,077			

DISCUSION

Our results show that enhanced physical activity is associated with better metabolic profile increasing HDL /good cholesterol/ levels apart from type as well as obesity degree. There are two obesity types (gynoid and abdominal or android obesity type) of which abdominal type is more severely and independently associated with cardiovascular risk (Ahmadi et al., 2014).

Waist circumference is very useful clinical measure showing a very good correlation with visceral fat tissue amount. Enlarged waist circumference is independent predictor of future adverse cardiovascular events. Currently, most weigh loss treatment strategies failed to demonstrate satisfactory effects when treating obese individuals (Stein et al.,2014). Crucial part in obesity treatment is physical activity which is best mode not only to reduce weight but also to improve metabolic profile in obese individuals. There are still many controversies regarding the background of what is really happening during physical activity (Esteban-Cornejo et al.,2014). Physical activity not only improves HDL levels but also exibit a longstanding beneficial effect on cardiovascular system, what we can't say for pharmacologically induced HDL. There is also a few published paper suggesting undesirable effects of physical activity on cardiovascular health this necessitating to determine potential beneficial or side effects physical activity might impose in obese children (Waters et al.,2011).

Our results demonstrate favorable effects of physical activity on HDL levels in obese children apart of the type as well as obesity degree but not on LDL and triglyceride levels. This is in accordance with novel data showing that increase in physical activity gous side by side with complex HDL metabolism including posttranslational HDL changes together with HDL modulators alterations. This potential effects are not translated on triglyceride and LDL levels(Salazar et al., 2014).

CONCLUSION

Childhood obesity is one of the most serious public health challenges of the 21st century. Its prevalence has increased to an alarming rate in many parts of the world. According to the latest definition of the American medical association, obesity is defined as a disease what with most recent facts enlighten his seriousness. Is very interesting fact that only one third obese children is metabolically healthy which indirectly emphasizes the need of early identification and controlling childhood obesity . Important goal is prevention of asymptomatic target organ damage which is likely to progress to morbid cardiovascular events in adulthood. Our finding of significant positive correlation between activity and HDL regardless of type and degree of obesity activity straighten the

importance of this therapeutic measure. Further study are needed to investigate whether the higher levels of HDL in physically active obese children represent markers of good metabolic profile or there are other potential HDL modulators and neurohumoral changes physical activity per se brings about.

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Corrective gymnastics

THERAPUTIC HORESBACK RIDING IN CHILDREN WITH AUTISTIC SPECTRUM DISORDES

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SUMMARY

Introduction: The hippotherapy and the therapeutic horseback riding are considered by many specialists as alternative therapy like dolphin therapy, sand therapy, music therapy, drum therapy, art therapy etc. The aim of this study is to find out the impact of a therapeutic horseback riding program on the balance, coordination, posture and possibilities for independent non routine motor activity without help in children with autistic spectrum disorders.

Methods: The study took place in horseback riding center "Han Asparuh" in Sofia for a period of 5 months (from March to July, 2012). The study consisted of 40 sessions with 6 children which age was 7,33 years old, diagnosed as autistic spectrum disorders.

Results: The change in the balance stability was examined. We used the Bertoti's test (1988) to evaluate the posture during horseback riding and Danzinger Test (2000) to study the degree of horseback riding dependence. The program for Therapeutic horseback riding includes: get used to the horse as a vivid element of the new environment, forming new motor habits and establishing the correct horseback and riding sitting.

Conclusion: The five-months pilot study which was held on horseback riding center "Han Asparuh" in Sofia with six children with autistic spectrum disorders proved that the therapeutic horseback riding course has a positive effect on the body posture, the balance and the control of the body in the space

Keywords: autism, posture, equilibrium, horseback riding independence

INTRODUCTION

It is well known the application of the therapeutic horseback riding children with autistic spectrum disorders The hippotherapy and the therapeutic horseback riding are considered by many specialists as alternative therapy like dolphin therapy, sand therapy, music therapy, drum therapy, art therapy etc. The horses give the possibility to the children to create emotional relations and special relationships; it has an impact on all kinds of sensor integration as tactile, vestibular, visual, proprioceptive stimulation and smell perception (Smith, 2010); it helps the development of their cognitive abilities and stimulates the motor function. Every minute on the horse back stimulates the child's brain with more than 1000 neural impulses, which could not be achieved in clinical conditions. (Doucette,2011). The child is concentrated and analyzes the information better when he/she has different tasks to focus. The elementary task as giving the direction "Forward!" is an efficient way to create communication abilities. The children gain confidence and strength that they can control and communicate with so big animal. This environment makes the learning atmosphere more amusing than the clinic's, so the children become more open for learning. This is not environment which breaks the routine activities. (Smith,2010). The therapeutic riding gives many possibilities for gaining new knowledge as the horse riding guide when it changes the direction, distinguishing the colors, the form, the size of the balls, which are used during the horseback riding, learning the commands and etc. (Gencheva, 2007).

This study aims to establish the impact of a therapeutic horseback riding program on the balance, coordination, posture and the possibilities to form independent non routine motor activity without help in children with autistic spectrum disorders.

METHODS

Organization of the study

The study took place in horseback riding center "Han Asparuh" for period of 5 months (March-July 2012). The study consists of 40 sessions. The object of the study are 6 children (three boys and three girls) which average age is 7,33 years old who have the diagnose "disorders in autistic spectrum".

The psychological status of the children was done by a clinical psychologist. In the study participated 2 preschool children. One of them goes to public kindergarten but with the help of resource teacher. The other child grows at home with his mother who is special pedagogue. The child in the kindergarten adapts better to the environment but it is harder for him to participate in all activities and do not participates in the celebration festivals and the outdoor activities. The speech which he uses is with many mistakes in the pronunciation and it is with poor vocabulary considering his age. There are graphomotor difficulties which show the problem to learn the writing. The child likes to isolates himself from the other children. The child who stays at home is frightened by strangers. Avoids them or he is acting like he doesn't notice them. He does not make a social contact. Emotionally he shows increased anxiety, which is connected strongly with the mother and needs more time to adapt.

The other 4 children are in school age. They study in public schools. One of them is working with resource teacher. These children are with good mechanical memory, which is close to the norms for their age but with poor vocabulary. They get tired very quickly, distract easily, usually walk in the classroom. The communication with their coevals is difficult; they rarely join in collective games with rules. They often hurry up with the responses which are usually wrong because of the problems with the concentration and the stability of the attention. At home they are impulsive, sometimes aggressive; hardly obey the rules and the restrictions. They resort to self-harming as a negative response to an unpleasant task or activity they have to do.

The gait of the children is clumsy. Two of the younger children need support to walk. One of the 4 years old girls is toe walking. The favorite positions of the children for doing different activities are sitting on a flat surface (for example on the floor) with crossed legs, with head and shoulders bent forward. When they are writing on a desk or play lying on their abdomen they rest their head on their hand. All children have disorders in the balance and the coordination of the movements.

Methodology of the Study

1. We examined the change in the balance stability in children as a result of the therapeutic horseback riding course using balance test standing on one leg for 30 sec. with open eyes.

2. We used the Bertoti test (Bertoti 1988) for evaluating the posture during horseback riding. The posture and the symmetry of 5 parts of the body are controlled by the therapist or the coach. The 5 parts are head and neck, shoulders and scapula, trunk, vertebral column and pelvis. They are evaluating with points from 0 to 3. The final result is formed by the sum of the points of each part of the body during the riding. The maximum result is 15 points.

3. Study of the level of horseback riding dependence according to Danzinger, B. (2000) while getting over a special horse riding manege. We used specialized test for evaluating the dependence during the execution of some riding exercises conformable to the level of the disorder. All six children had the same test routs and exercises taking in mind the level of their dependency according to Danzinger test (2000). They could do the exercises with or without help.

Therapeutic horseback riding Program

The therapeutic horseback riding sessions were held in horseback riding center "Han Asparuh" in Sofia for a period of 5 months – two/three times per week. In the structure of each session were included preparatory, main and closing stages. Their total duration is 25-30 minutes.

Preparatory Stage. The first therapeutic horseback riding session coincides with the first meeting of the children with so big animal. Some of them are frightened, the others are curious. Firstly the children should get use to the horse as live element of the environment. That is why during this first session they have to caress the mane of the horse, to learn its anatomic characteristics: eyes, head, nostrils, hooves, etc. The patients learn how to take care for the horse – to clean the horse in the

stable, to feed it, to comb it. During this experiment at the beginning the children only watched because it is hard to overcome immediately the resistance to the routine activities in children with autistic spectrum disorders. During the second and the third session all children ventured to take active part in the care of the animal. The above mentioned activities aim children to adapt and start working in the new environment, build trust in the team and the horse. These activities engage the children not only emotionally but physically.

Main Stage. It begins with putting the children on the horse back for 3-4 minute until they get used to the direct contact with the horse . The session continues with slow pace – slow walking in a line. While the children are moving together with the horse they are manually helped and corrected to take the right sitting position on the horse back with lifted head and shoulders, without bending the trunk. Also they are helped by giving instructions and by encouraging them. In the next sessions the speed of horse' walk rises and different exercises are included. Firstly these exercises are done in a "relaxed mood" when the horse stopped, after a while the exercise should be done while the horse is walking. To improve the balance are used different start positions and special exercises for balance and coordination with alternative moving of the hands in different directions. Balls with different sizes, colors and surfaces are used. The children pass the ball or shoot with the ball in a target. This helps them to overcome the stereotype movements .

Imitation exercises are better to be included in the program because the children with Autism have problems with keeping their attention. The counting method could be used with children in school age because this allows them to be engage directly with the activity they have to do.

After the 10th week of therapeutic horseback riding sessions the program enriches with walking with turns, serpentines and little hurdles on the ground. e children actively use the warmth of the horse as a method for relaxation. Using strict and clear verbal instructions the team engages children's attention, encourages them to use and enrich their speech, to make new friendships.

The closing stage of the program ends with a walking tour around the riding manege on the horse back. During this experiment after the end of each session the children feed and hug the horse with such enthusiasm.

RESULTS

Changes in balance stability

The results from the study (fig.1) show that the balance stability of the children has really improved. At the end of the therapeutic horseback riding course the children could stay on one leg 10 sec. At the beginning they could stay on one leg only for 6 sec.

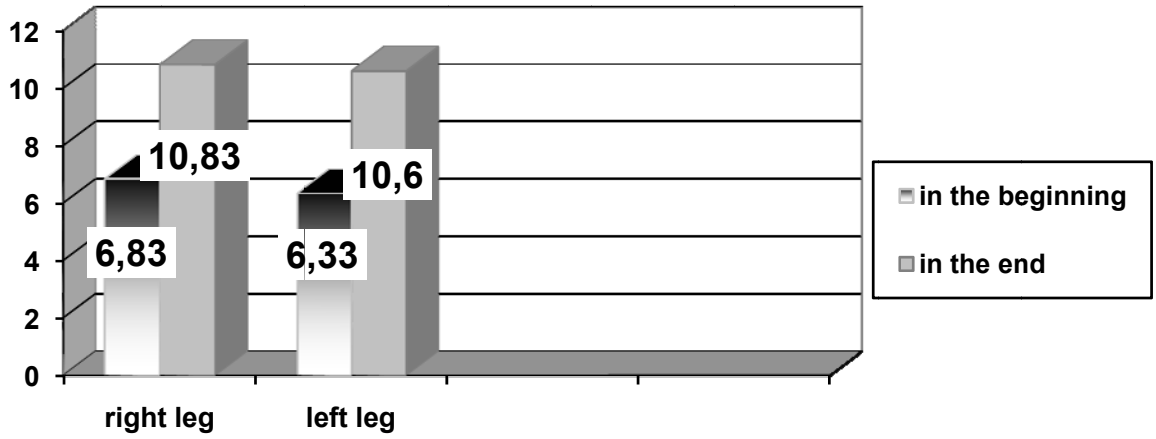

Fig. 1 Changes in the balance stability on left and right leg

Results from the study of the riding dependence level

In the beginning of the therapeutic horseback riding course the children needed side walkers. In the end of the treatment course 3 of the children had maximal assessment 8 points which means total independence during horseback riding. The other 3 children had 7 points which means they need a little help. The results are shown in fig. 2.

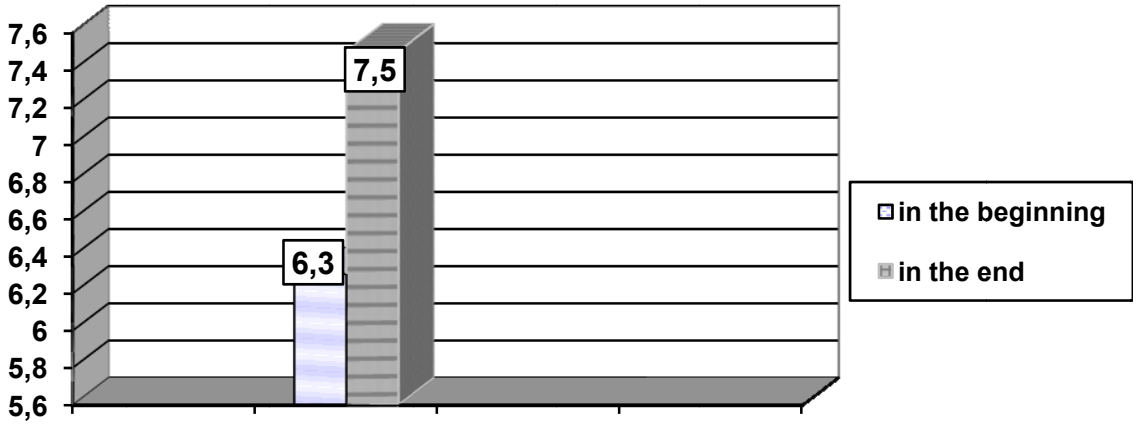

Fig. 2 Changes in the level of riding dependence

Results from the study of the posture during horseback riding

In comparison of the initial and the final data from Bertoti test (fig.3) we found out that there is positive improvement in the posture of the children during the horseback riding.

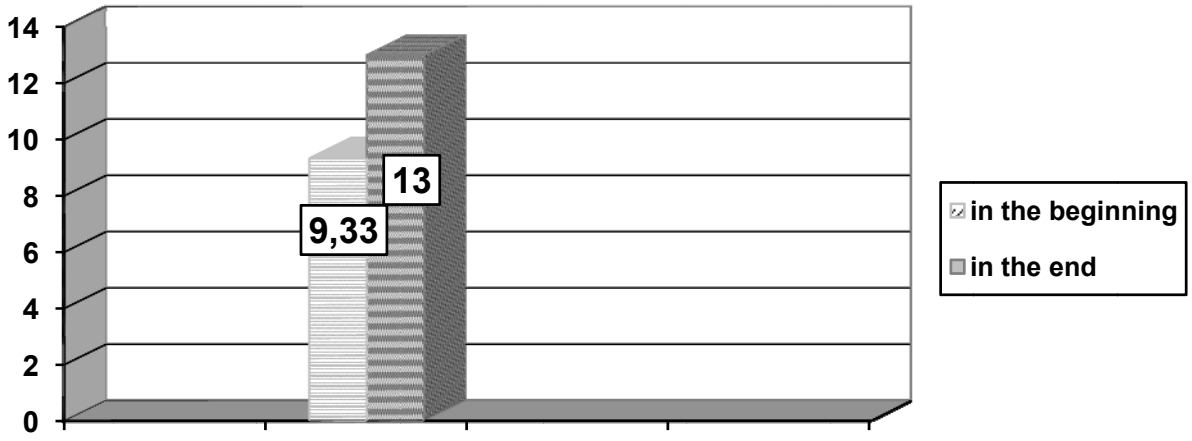

Fig. 3 Changes in the posture during the horseback riding

DISCUSSION

As a result of the rhythmic moves on the horse back and the adopted habit for right riding sitting at the end of the therapeutic horseback riding course the children could stay on one leg longer. During the program they were stimulated and corrected to take right riding position and the stereotype motor models were suppressed. Gradually the children adopted the habit to have good body posture which gave them the scene for better stability and confidence. This motivates them to be independent.

The autistic children have improved the position of the head and have lifted the trunk. One of the reasons is the need the patients to keep on the horse back without falling. This has mobilized different muscle groups in the whole body, especially on the neck and the back and has contributed for their hypotonia. The flowing and rhythmic vibrations during the therapeutic sessions caused stabilization of the pelvis.

CONCLUSION

In conclusion the five-months pilot study which was held on horseback riding center "Han Asparuh" in Sofia with six children with autistic spectrum disorders proved that the therapeutic horseback riding course has a positive effect on the body posture, the balance and the control of the body in the space. In future it will be very interesting to examine how the gait changes after therapeutic horseback sessions, what are the changes in the adaptation processes, verbal communication, etc. We consider that our methodology could be helpful for enriching the complex of rehabilitation of children with autistic spectrum disorders in Bulgaria.

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MORPHOLOGICAL CHARACTERISTICS OF TABLE TENNIS PLAYERS WITH SPINAL CORD INJURY

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SUMMARY

Introduction: Including persons with disabilities in the programmed physical activity positively encourages healthy lifestyle, on the other hand, additional kinesiology treatments (additional exercise) can be applied in order to prevent injuries that can be caused by inadequate or undesirable overwork. Table tennis is the most common form of organized physical activity that is carried out through recreational or sports activities and is particularly popular with people with spinal cord injury (paraplegia, quadriplegia). Sports training provides the opportunity, through repetition of certain activities, for structural and metabolic adaptations which affect the increase of the functional abilities of the body. In addition to the opportunities provided by sports training, the quantification of morphological characteristics is of elite athletes can be crucial when it comes to sports performances.

Training process of table tennis players with spinal cord injury, especially players in wheelchairs, in our current practice involves the insufficient application of physical fitness of players and a bad concept training (preliminary and final part of training). Players usually access a table tennis table without any prior preparation, warming exercises. Therefore, the aim of this study was to include into training process additional kinesiology treatments, and to determine its influence on morphological characteristics in elite table tennis players with spinal cord injury.

Methods: The sample consisted of seven table tennis players with spinal cord injury, 3 females and 4 males. Measures of longitudinal skeleton dimensionality, volume and body mass, subcutaneous adipose tissue and body mass index were analyzed. To determine the effects of kinesiology treatments, Student's t-test was used, and the results were analyzed by statistical package SPSS, version 14.0. The values were evaluated on a level of significance of $p < 0.05$.

Results: In male subjects, there was a statistically significant change in biceps skinfold ($p=0.05$). For females, no statistically significant differences was found in anthropometric space.

Conclusion: Implemented kinesiology treatment indicates a downward trend in the volume and body weight among the respondents of both sexes, but not to a statistically significant level.

Keywords: table tennis, spinal cord

INTRODUCTION

It has been proved that persons with disabilities who are engaged in habitual physical activities have manifold benefits, since exercises reduce fatigue, pain, weakness in locomotor apparatus and the initial neurological deficit that accompanies the state of disability (Nash, 2005; Tawashy, Eng, Lin, Tang & Hung, 2009). Including persons with disabilities in programmed physical activities positively influences not only a healthy way of life (Hicks, Martin, Ditor, Latimer, Craven, Bugaresti & McCartney, 2003), but additional kinesiology programs could be used for preventing injuries which might be caused by undesired excessive workout (Ide, Ogata, Kobayashi, Tajima & Hatada, 1994).

In the case of people with spinal cord injuries and with a decreased level of locomotor functionality of an organism, there has been an increase in their nourishment level. This precisely implies the need to engage persons who were diagnosed with the state of reduced functionality upon completed medical rehabilitation in recreational or sports activities in order to adjust their kinetic activity to both medical and sports demands. Sport training provides the opportunity, through repetition of certain activities, for a structural and metabolic adaptations that influence the increase in the functional capacity of the body (Arsić, Radovanović & Arsić, 2011).

Table tennis is the most common form of organized physical activity implemented through recreational or sports content, and is particularly popular with the persons who sustained spinal cord injuries (paraplegia, quadriplegia) (Taktak, 1997). As a proof of this, there is a number of countries who participate in the world (50) and European (35) table tennis contests for persons with disabilities. In our country, this popularity can be identified by the number of medals won at major competitions and at the Paralympic games (Šolc-Pervan et al, 2009). The advantage that is given in table tennis game in relation to the other sports in which persons with spinal cord injury participate, is characterized by the possibility of adaptation where persons in the wheelchair and those using aids, orthotic and prosthetic devices can participate in the game (International Paralympic Table Tennis Committee, 1992).

Physical condition is one of the key factors that significantly affects the sport and competition results. Physical condition, as a particularly important segment focuses on (Keul, 1984., according to Milanović 1997): development and maintenance of motor and functional abilities and morphological characteristics, delaying the response to fatigue, speeding up the recovery process and reducing the number and severity of injuries in athletes. When it comes to sports results, of table tennis players with spinal cord injury, they are conditioned by the level of their functionality with respect to the degree of spinal cord lesions. However, the application of adequate training process that includes continuous physical preparation and proper structure of a training session in these athletes influences on the development of morpho-functional capabilities aiming for more efficient implementation of technical and tactical elements of the game.

Training process of table tennis players with spinal cord injury, especially of a player in a wheelchair, in our current practice insufficiently involves the application of physical fitness of players and a bad conception of training. Players usually approach the table-tennis table without any prior preparation or warming. They start the training process by performing and practicing the elements of technique and tactics of table tennis game, neglecting the warming of the body in order to increase working capacity, exercises to increase range of motion, flexibility, reducing the volume and weight of the body, and strengthening muscle groups and the development of a comprehensive physical training. Thus, the aim of the study was to apply an additional kinesiology treatment and determine its effects on the morphological characteristics of top table tennis players with spinal cord injury. As far as the recent literature is concerned, such researches on table tennis players with disabilities have not been done neither in our country nor anywhere in the world, which makes it impossible for the authors to provide a more detailed primary literature.

METHODS

A pre-experimental draft with a group of respondents was used in the study, in the case of which a pretest – posttest was used.

Program design of additional kinesiology treatment was made and implemented in accordance with the competition calendar in the year when the European Championship was the most important competition. The program was implemented in the open and closed sports fields in Novi Sad and Banja Kanjiža (Serbia) and Handlova (Slovakia). Additional kinesiology treatment included exercises to strengthen, stretch and balance the trunk and was implemented in the regular training process. This treatment was applied for a period of nine months or three cycles. Each cycle lasted for ninety days, and began with a ten-day physical preparations where only the program of additional kinesiology treatment was realized twice a day for 90 - 120 minutes. Upon completion of the ten-day physical preparation of each cycle, the treatment was continued and included in the training process, which was conducted 5 days a week, twice a day as preparation at the beginning (15 minutes) and at the end of training (10 minutes) (McClintock, 2005).

The sample of respondents

The sample of respondents consisted of seven top table tennis players with spinal cord injury who were classified according to the International Sports Table Tennis Categorization (TT- table tennis), which were sorted into sitting class (TT1-TT5) (Kruimer, 2005; The ITTF Classofication Code, 2010). They are all Serbian representatives, 4 male and 3 female athletes, aged between 23 and 52, the World Cup medal holders (gold, silver, bronze), competing in the TT2 class (level of lesion in the cervical segment C_6-C_7), TT3 (level of cervical -

thoracic segment lesion C_8-$Th_{7,8}$), TT4 (level of thoracic - the lumbar segment lesion Th_8-$L_{1,2}$). Male respondents are with a "complete" spinal cord injury of C_6/Th_7 level and female respondents are with the "complete" spinal cord injury of Th_7/L_1 level. The sample is representative. Major age span is typical of athletes with disabilities engaged in individual sports (competition categories exclude age as a parameter)

The measuring instruments sample

The variable sample consists of 10 anthropometric measures: body height (BODHEI), body mass (BODMAS), chest circumference (CHCIRC), abdominal circumference (ABDCIR), circumference of a stretched upper arm (CISUPA), circumference of a bent upper arm (CIBUPA), abdominal skinfold (ABDSKF), back skinfold (BACSKF), upper-arm triceps skinfold (UATSKF), upper-arm biceps skinfold (UABSKF), based on which a morphological status was assessed, while one was derived – body mass index (BMI), which served as the basis for assessing the nourishment level. All anthropometric measures were expressed in centimeters with the 0.1 cm precision, apart from the body mass which was expressed in kilograms with the 0.1 kg precision. Body mass index represents the relationship between body mass in kilograms and square of height in meters (ITM = kg/m^2). A normal level of nourishment ranges between 18.5 and 24.9 kg/m^2, undernutrition is characterized with the values below 18.5 kg/m^2, while the values between 25 and 29.9 kg/m^2 are classified as overnutrition.

Anthropometric measures were taken by means of an anthropometric procedure which included the following measuring instruments: the Martin anthropometer, a decimal scale with sliding weights, John Bull calipers and a plastic measuring tape.

Statistical analysis of data

Basic central and dispersion parameters were calculated for each anthropometric measure: arithmetic mean (AM), standard deviation (SD), standard error (SE), confidence interval (CI), maximum (MAX) and minimum (MIN) values. Student's test at $p < 0.05$ significance level was used to determine the effects of kinesiology treatment on the morphological characteristics of the respondents, while the results were processed using the statistical package SPSS, version 14.0 (Wragg & Williams, 2004).

RESULTS

Table 1 shows values of central and dispersion parameters for male and female respondents, obtained through descriptive analysis of anthropometric variables at the initial measuring.

Table 1 *Descriptive statistics of morphological space for the initial measurments*

Variables	Anthropometric variables of male respondents (n=4)						
	Min	Max	As	Sd	Se	confidence inter.	
						min	max
BODHEI	172.00	184.40	178.28	4.65	2.07	172.53	184.02
BODMAS	68.00	82.00	74.60	6.15	2.75	6.69	8.22
BMI	20.00	25.60	23.22	3.15	1.72	20.40	24.80
CHCIRC	96.00	107.50	100.90	4.72	2.12	95.04	106.76
ABDCIR	89.00	95.00	91.00	2.35	1.05	88.10	93.92
CISUPA	24.50	33.00	30.00	3.52	1.57	25.63	34.38
CIBUPA	25.50	35.00	31.30	3.82	1.71	26.56	36.04
ABDSKF	7.00	29.00	18.44	7.84	3.50	8.71	28.17
BACSKF	7.40	16.00	12.24	3.28	1.47	8.17	16.31
UATSKF	4.80	7.80	6.26	1.20	0.54	4.77	7.75
UABSKF	3.40	7.20	5.44	1.45	0.65	3.64	7.24
Variables	Anthropometric variables of female respondents (n=3)						
	Min	Max	As	Sd	Se	confidence inter.	
						min	max
BODHEI	167.00	172.00	169.00	2.64	1.53	162.42	175.57
BODMAS	56.00	58.00	57.00	1.00	0.06	5.45	5.95
BMI	18.90	20.80	19.96	2.45	1.02	19.20	20.10
CHCIRC	84.50	92.00	88.67	3.82	2.21	79.20	98.15
ABDCIR	73.00	76.00	75.00	1.73	1.00	70.77	79.30
CISUPA	25.00	28.00	26.33	1.53	0.88	22.54	30.13
CIBUPA	27.00	29.50	28.20	1.26	0.73	25.04	31.32
ABDSKF	11.60	13.00	12.27	0.70	0.41	10.52	14.01
BACSKF	8.00	15.40	11.77	3.38	1.95	3.40	20.20
UATSKF	4.00	10.80	6.27	3.93	2.30	-3.48	16.02
UABSKF	4.00	8.80	5.73	2.66	1.54	-0.88	12.35

BODHEI – body height; BODMAS – body mass; BMI – body mass index; CHCIRC – chest circumference; ABDCIR – abdominal circumference; CISUPA – circumference of a stretched upper arm; CIBUPA – circumference of a bent upper arm; ABDSKF – abdominal skinfold; BACSKF – back skinfold; UATSKF – upper-arm triceps skinfold; UABSKF – upper-arm biceps skinfold.

Based on the calculated values of the relationship between body mass and height (BMI = kg/m^2) at the initial measuring, it was established that the nourishment level is within the normal range considering the age and condition of patients. He absence of obesity was observed in most patients, except in the case of patients with the "complete" spinal cord injury at $Th_{6,7}$ level, in which case minimal obesity was recorded (25.6 kg/m^2). The nutritional status of a female respondent with the spinal cord injury at $Th_{7,8}$ level was said to be at the lowest limit of the normal (18.9 kg/m^2).

Table 2 shows values of central and dispersion parameters for male and female respondents, obtained through descriptive analysis of anthropometric variables at the final measuring.

Table 2 *Descriptive statistics of morphological space for the final measurments*

Variables	Anthropometric variables of male respondents (n=4)						
	Min	Max	As	Sd	Se	confidence inter.	
						min	max
BODHEI	172.00	184.40	178.28	4.65	2.07	172.53	184.02
BODMAS	68.00	80.00	73.60	5.40	2.42	6.70	8.05
BMI	20.00	25.00	23.00	3.10	1.55	20.20	24.50
CHCIRC	94.50	106.50	100.70	4.59	2.05	95.00	106.40
ABDCIR	83.00	98.00	91.00	6.77	3.02	82.60	99.40
CISUPA	23.00	35.00	30.30	4.60	2.06	24.58	36.01
CIBUPA	24.00	36.00	31.80	4.72	2.11	25.93	37.66
ABDSKF	5.80	26.20	15.32	7.94	3.55	5.45	25.18
BACSKF	6.40	14.60	11.08	3.17	1.41	7.13	15.02
UATSKF	4.80	6.80	5.68	0.81	0.36	4.68	6.68
UABSKF	2.20	6.60	4.08	1.68	0.75	2.00	6.17
Variables	Anthropometric variables of female respondents (n=3)						
	Min	Max	As	Sd	Se	confidence inter.	
						min	max
BODHEI	167.00	172.00	169.00	2.64	1.53	162.42	175.57
BODMAS	55.00	57.00	55.66	1.15	0.66	5.27	5.85
BMI	18.60	20.20	19.50	1.85	0.94	18.90	19.80
CHCIRC	83.00	90.00	87.50	3.90	2.25	77.79	97.20
ABDCIR	71.50	78.50	74.66	3.54	2.04	65.85	83.47
CISUPA	25.50	28.00	26.66	1.25	0.73	23.54	29.79
CIBUPA	26.50	30.00	28.00	1.80	1.04	23.52	32.47
ABDSKF	10.20	12.00	11.40	1.04	0.60	8.81	13.98
BACSKF	8.20	12.40	10.45	2.11	1.22	5.20	15.73
UATSKF	4.00	9.40	5.80	3.11	1.80	-1.94	13.54
UABSKF	4.00	7.60	5.20	2.08	1.20	-0.37	10.36

BODHEI – body height; BODMAS – body mass; BMI – body mass index; CHCIRC – chest circumference; ABDCIR – abdominal circumference; CISUPA – circumference of a stretched upper arm; CIBUPA – circumference of a bent upper arm; ABDSKF – abdominal skinfold; BACSKF – back skinfold; UATSKF – upper-arm triceps skinfold; UABSKF – upper-arm biceps skinfold.

Based on the result values for assessing body mass and abdominal circumference of both male and female respondents at the final measuring, it was established that the respondents did not belong to the group of overweight people, while among the female respondents a trend towards the decrease in body mass index was observed. The nutritional status of the female respondent with the spinal cord injury at the $Th_{7,8}$ level was observed to be at the lowest limit of the normal (18.6 kg/m^2), while these values among other female respondents remain within the normal range (19.7 kg/m^2 and 20.2 kg/m^2). The identified values of the abdominal circumference variable for male and female respondents are within the normal range.

The results regarding the effect of the applied additional kinesiology treatment on the morphological status of male and female respondents are given in the Table 3. A statistically significant difference was observed only in the case of the upper arm skinfold variable – biceps (UABSKF), among the male respondents ($p = 0.05$). As far as all other variables characterizing the morphological status of male respondents are concerned, the nominal values of the obtained results speak in favor of the final measuring, but are not statistically significant. Among female respondents, no statistically significant difference was observed after the treatment in anthropometric space.

Tabela 3 *The effects of applaying the additional kinesiology treatment on the morphological status of both male and female respondents*

Variables	GENDER									
	Male					Female				
	AS	Sd	t	df	p	AS	Sd	t	df	p
BMI	0.80	0.84	2.14	3	0.099	1.33	1.52	1.51	2	0.270
CHCIRC	2.00	22.00	0.20	3	0.849	11.66	15.27	1.32	2	0.317
ABDCIR	0.00	60.31	0.00	3	1.000	3.33	24.66	0.23	2	0.837
CISUPA	-3.00	12.55	-0.54	3	0.621	-3.33	10.40	-0.55	2	0.635
CIBUPA	-5.00	12.74	-0.88	3	0.430	1.66	11.54	0.25	2	0.826
ABDSKF	31.20	31.3	2.23	3	0.089	8.66	6.11	2.45	2	0.133
BACSKF	11.60	11.10	2.34	3	0.079	13.00	14.73	1.52	2	0.266
UATSKF	5.8	5.02	2.58	3	0.061	4.66	8.08	1.00	2	0.423
UABSKF	13.6	5.55	5.48	3	0.050	5.33	6.11	1.51	2	0.270

$p < 0.05$ statistical significance

DISCUSSION

Due to the lack of literature on the effects of additional kinesiology treatment of the morphological status of table tennis players with disabilities, the authors found it appropriate to compare the results of their study with the results of the studies dealing also with the assessment of the morphological status of the athletes and non-athletes with the spinal cord injury, since all but one respondent in this study were those diagnosed with the spinal cord injuries (paraplegia, quadriplegia). The studies consulted were mostly done on non-athletes and are mostly cross-sectional studies, which is why the discussion is divided into two directions. The results of our research at the initial measuring were compared to the results of the given studies. The other part of the discussion refers to the evaluation of the results at the initial and final measurement with respect to the application of the additional kinesiology treatment.

The average height of male respondents in our research (178.28 ± 4.65 cm) is practically identical to the height of non-athletes with disabilities (173 ± 7.1 cm; 176 ± 0.05 cm, 177 ± 0.06 cm, 175 ± 0.1 cm) (Buuccholz, Mcgillivray & Penchar, 2003; Dionyssiotis, Lyritis, Papaioannou, Papagelopoulos & Thomaides, 2009). However, the body mass results of the top table tennis players (74.6 ± 6.15 kg) and that of the respondents from the mentioned researches (71.2 ± 14.6 kg; 81.36 ± 13.0 kg, 76.67 ± 17.12 kg and 76.67 ± 17.12 kg) differ and are in favor of the athletes. Taking into account the results from the final (73.8 ± 5.4 kg) and initial measuring (74.6 ± 6.15 kg), body masses of the respondents in our study, it may be established that having undergone the additional kinesiology treatment the respondents had better values on average, which were not significantly different. If we compare the results regarding body height (169.0 ± 2.64 cm) and body mass (57.0 ± 1.0 kg) of our female respondents with the results of female non-athletes from other studies (height 154.0 ± 10.6 cm, body mass 57.5 ± 14.2 kg) (Buuccholz et al, 2003), (body height 172.0 ± 5.7 cm, 165.5 ± 10.8 cm and body mass 55.0 ± 7.8 kg, 57.3 ± 9.7 kg) (Schmid, Knöebber, Vogt, König, Deibert, Bültermann, Henrich, Baumstark, Berg & Storch, 2008), different values can be observed indicating the fact that female table tennis players have uniform body mass values, which probably results from being engaged in sport activities.

At the final measurement, female, as well as male respondents had lower body mass values which were not statistically significant, but based on the nominal values there is an evident trend towards the improvement of results for all the variables of anthropometric space in favor of the final measurement. The results of the study which was done on basketball players, athletes and tennis players with disabilities and which deals with the assessment of total and segmental body composition also includes the results of longitudinal skeleton dimensionality, body mass and voluminosity obtained through a standard anthropometric procedure and derived BMI [16]. The results of our research at the initial measurement for male respondents referring to the assessment of the BMI (23.22 ± 3.15 kg/m^2), chest circumference (100.90 ± 4.72 cm), abdominal circumference (91.0 ± 2.35 cm) and an extended upper-arm circumference (30.0 ± 3.52 cm) are consistent with the results of the study mentioned (BMI: basketball players 23.1 ± 3.7 kg/m^2, athletes 23.0 ± 2.8 kg/m^2 and tennis players 23.6 ± 5.3 kg/m^2; chest circumference: basketball

players 100.3 ± 11.8 cm, athletes 100.9 ± 7.4 cm and tennis players 98.9 ± 17.0 cm; abdominal circumference: basketball players 81.4 ± 6.9 cm, athletes 79.4 ± 5.1cm and tennis players 82.3 ± 7.1 cm; a left extended upper-arm circumference: basketball players 32.7 ± 2.7 cm, athletes 32.0 ± 2.1 cm and tennis players 32.8 ±3.8 cm). A difference was observed with respect to the abdominal circumference in favor of our respondents, while the difference in chest circumference and an extended upper-arm circumference was in favor of the respondent of the given study. This can be accounted for by a different structure of sport activities where the work of upper body muscles and those of the upper extremities is consistent with the demands of technique elements in sports activities.

None of the variables for assessing circumference and skinfolds (except for UABSKF among male respondents) of the respondents of both genders showed a statistically significant difference. The difference in the nominal values recorded between the initial and final measurement with respect to the application of the additional kinesiology treatment is in favor of the results obtained at the final measurement.

CONCLUSION

Based on the results of the analysis of the morphological status of the leading table tennis players with spinal cord injury, there is evident improvement of all the nominal values upon completion of the additional kinesiology treatment, with the exception of UABSKF variable, among the male respondents, where a statistically significant difference was observed ($p < 0.05$). The results obtained this way can be affected by a small number of respondents, but also by an insufficiently long application of the kinesiology treatment. In other variables the differences are not statistically significant, but the positive trend of the obtained results between the initial and final measurement implies the need to introduce the additional kinesiology treatment into regular training activities of the top table tennis players with disabilities, which is supposed to become a compulsory segment of the training process of this population of athletes.

The lack of research related to the table tennis players with disabilities triggers the need for researchers to engage more into the problems of the morphological status which can have impact on all the segments of the training process of this population.

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FLAT FEET, PRONE FEET AND POSTURE IN FIRST GRADE CHILDREN

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SUMMARY

Introduction: Posture is the way we hold ourselves, in sitting, standing or even lying down. Correct posture gives not only a smart appearance but also helps to prevent injury and illness of the spine. The presence of abnormalities in ankle-foot complex would be a logical prerequisite for the development of abnormalities in other parts of the children's body.

The aim of our study was to establish frequency of flat feet, prone feet and posture deviation in first grade children. The outcome of this assessment will be used to determine the choice of exercises that may improve the deficits discovered during the assessment.

Methods: 31 girls and 27 boys mean age 7years old were studied. For the purposes of that study we used: posture assessment, ankle-foot complex assessment, pedobarographi to evaluate the transverse and longitudinal arch of the foot. The plantar pressure distribution was recorded using I-Step foot scanner in erect standing position.The result analyzed using the Bravais-Pearson's correlation coefficient (R).

Results: Abnormal posture were observed in 80% of the children, while 12% of assess children have no deviation in ankle-foot complex. There is no significant correlation between sex and pronation (R -0.13), age and posture abnormality (R 0.08), age and pronation (R 0.14), age and flat feet (R 0.24). There is no direct correlation between flat feet and posture abnormality, as in our study there is only one such case. There is a strong correlation between pronation and postural deviations (R 0.86).

Conclusion: The pronation in ankle-foot complex is the leading factor for the variation in the children's posture and it should be monitored and treated during children's development. To determine the proper treatment is important to invent and use the precision assessments that separate the two deformities (pronation and low arch – flat feet).

Keywords: ankle foot complex; foot arch; foot pronation; baropodometric analysis

INTRODUCTION

Posture and spine deviations were always subject of discussion and observation of orthopedists, pediatricians and parents. The problem has existed for many years and experts never ceased to look for updates to the reasons and evolution as well as to their treatments, because early diagnosis and timely treatment is important for the best prognosis (Raikov, 2011).

The postural alignment starts its development from early period of life with development of the spine and its curvature. Children build their posture by development of movements and by muscles growth. When the body is in correct balance, all its parts, including the internal organs, are held in good position and function normally (Markovska, 2013).

Problems with children's posture should be well known by school's and children's doctors, physical education and general education teachers, parents and sociality. Posture deviations can have a progressive evaluation. This can lead to severe deformity of the spine, which impair the function of internal organs, reduces performance and sometimes lead to invalidity (Karaneshev et al., 1982; Langova et al.,1999; Mancheva, 1971).

According to a study of the University of Ruse over 30% percent of the students are overweight as a result of impaired lipid metabolism, 20% of them have spinal deviation with variety of types and degrees (scoliosis, kyphosis, lordosis), 18% have flat feet, 15% have posture deviation, 3% chronic bronchitis and acute viral infections, and 1% others (Sadaq, 2010; Tsankov, 2010)

Posture - It is your power foundation - a stacked framework from your feet through your legs, hips, spine and shoulders to your head. The neutral position from which all movement arises (McGill, 2007). Posture is the position in which you hold your body upright against gravity while standing, sitting or lying down (Hugh, 1935).

Good posture is the attitude which, is assumed by body parts to maintain stability and balance with minimum effort and least strain during supportive and non-supportive positions (Shimaa, 2012). Good posture is much more than merely "standing straight"; it is the use of all parts of the body with proper balance, with ease and grace. This proper use of the body is called good body mechanics. The body is in some ways like a machine; its parts are accurately adjusted to one another, and if any part is out of correct position the machine does not work perfectly (Hugh, 1935). Good posture, on the other hand, means your bones are properly aligned and your muscles, joints and ligaments are working as intended - specifically for you (Gibson, 2013).

For good posture to be maintained the following must be obtained: The ability to maintain the body upright in good and erect position with less energy.; The ability to maintain balance in upright position via keeping the line of gravity near the center of the base of support (Shimaa, 2012). The spinal column is not deviated laterally and its normal lordotic and kyphotic anteroposterior curves are not exaggerated (Osgood, 1932).

The effects of the good posture include: Helps the muscles in the body to be unloaded and relaxed.; Improves respiratory and circulatory efficiency.; Prevents unnecessary strain and fatigue.; Decreases the incidence of diseases resulting from bad posture.; Improves the subject's state; mentally or psychologically (Shimaa, 2012).

Factors that influence posture: Aging (your body gradually loses its capacity to absorb and transfer forces, however it's not aging that influences posture as does); Inactivity/sedentary living/reluctance to exercise (leads to loss of natural movement flow); Poor postural habits (eventually becomes your structure); Biomechanical compensation (muscle imbalance, adaptive shortening, muscle weakness & instability within the "core"); Body composition (increases load, stresses on spinal structure, leads to spinal deviation); Workspace (ergonomics); Poor movement technique/execution/training; Injury - leads to reduced loading capacity or elasticity; Others (McGill, 2007). Everything links.

Poor posture is a position resulting from any deviation from ideally aligned erect posture (good posture) Figure 1 (Shimaa, 2012).

Poor posture may cause one or more of the following dysfunctions:

1. Defects in: Joints: such as stiffness or immobilization; Bones: such as shortening or deformity; Muscles: such as weakness, paralysis or contracture; Vision or hearing; Both respiratory and circulatory efficiency

2. Bad habits: either from early childhood or from occupational positions.

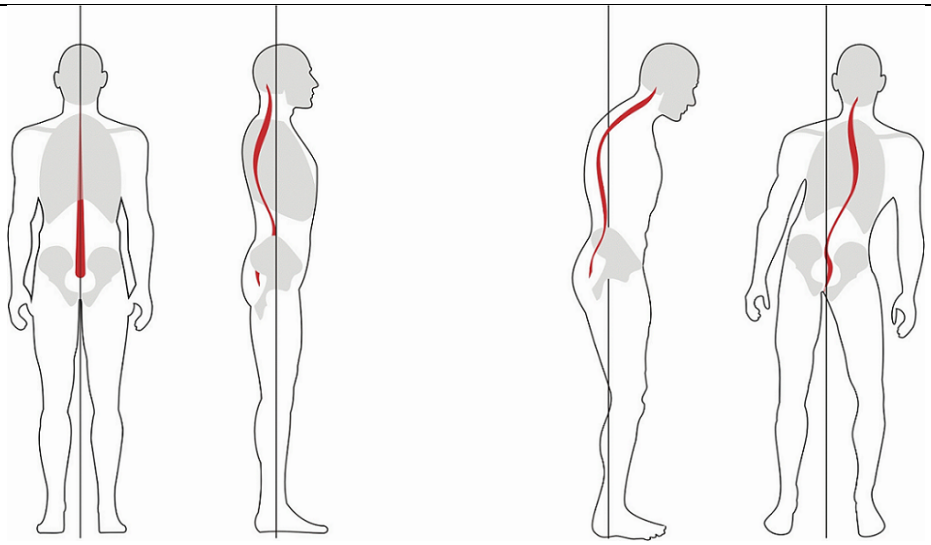
3. Pain, fatigue or bad psychological state.

4. Secondary deformities and compensatory postural defects.

As a result the body functions are altered and this may lead to dysfunction and diseases (Shimaa, 2012). Bad posture puts strain on your body. Bad posture can limit range of movements, cause headaches, muscle aches and joint aches, affect circulation and breathing, and even inhibit your inner organs functioning optimally. You may never have noticed these effects or imagined that you could, or needed to change them (Gibson, 2013).

Types of poor posture - from the lateral view (Kyphotic-lordotic Posture; Flat-back Posture; Sway-back Posture; Lordosis Posture; Kiphosis Posture) and from the back view (Scoliosis) (Shimaa, 2012).

Observation of Bulgarian and international literature shows differences in frequency of postural deviations among children for various authors. A study of the University of Ruse shows that over 30% percent of students are overweight as a result of impaired lipid metabolism, 20% of them have spinal deviation with variety of types and degrees (scoliosis, kyphosis, lordosis), 18% have flat feet, 15% have posture deviation. At EPOS (European Pediatric Orthopedics Society) annual meeting in Basel, Switzerland, experts indicated that the mild deviations are 1% to 3% of all children and severe deviations and later discovered - 0.2%-0.3%. Differences probably due to unequal methods of diagnosis, in unclear pathology and difference in the age range of studied people.



GOOD POSTURE	POOR POSTURE
This child stands at his full height, with his weight on the balls of his feet. He holds his head high, with his chin in. His chest is high, and his shoulder blades do not slick out in the back. His abdomen is drawn in. The curves of his back are slight. His knees are straight.	This child stands in a slumped position, with his weight on his ankles and heels. He holds his head forward, with his chin out. His chest is flattened and sunken and his shoulder blades stick out in the back. His abdomen is relaxed and sags. The curves of his back are too great. His knees are slightly bent.

Figure 1 Differences between good and poor posture

The spine is the axis of our body and its condition affects the human condition. When people sit they tend to slump, especially when their brain is involved in other things. The most affected are the children of primary school age and those in the early stages of puberty.

The main prerequisites are: incorrect posture (seat of learning desks and work at home); wearing school bag in one hand or on the shoulder; habit to sleep on the same side of the soft bed; anatomical prerequisites (such as bones, joints, ligaments and muscles - progressive development of foot arch, the position of the joints of the lower limbs, the position and stability of the pelvis); neuromuscular control of the central nervous system receiving different information through eyes, vestibular system and pyramids and extrapyramidal system and finally psychogenic influences such as mood and mental attitude; poor living conditions in which the child lives, poor nutrition, frequent illness from infectious and others diseases, leading to the general weakening of the body (Mancheva et al., 1964; Hap, 2010)

One of the most common and easily recognizable symptom look at the posture of the child is the different level of the shoulders. Another symptom is called symptom of bad-designed skirt (dress or skirt does not stand a symmetricaly). Little more difficult to identify from parents, but not by specialists symptom of unequal thales triangles which can be seen in the upright child in back view. In severe cases is observed hump or chest deformity front and back (Raikov, 2011).

In bad posture, a particular segment may be out of alignment and this can increase the strain on muscles in the area. The muscles have to work extra hard to keep the body segments in balance.

Posture is like building construction (Figure 2) – like every construction has a base and body also has, namely the ankle-foot complex.

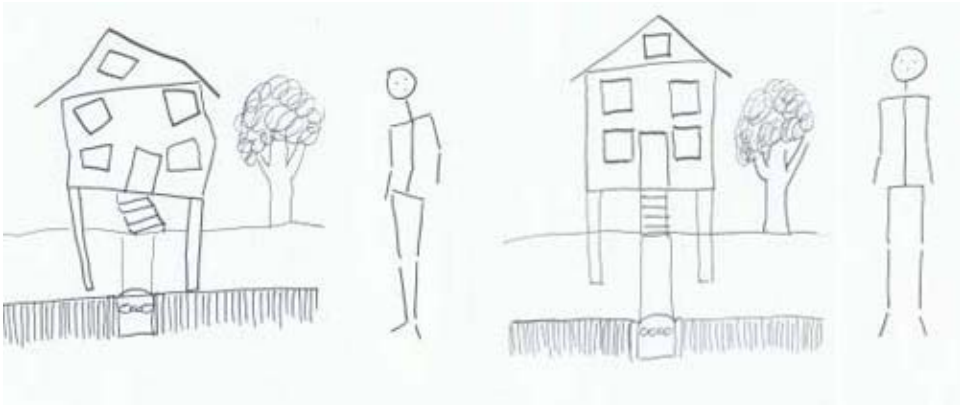


Figure 2 Comparison between posture and building construction

Anatomists, biomechanical engineers, and clinicians have studied the foot and ankle complex for centuries. Each discipline has provided its unique insight into the structure and function of this unit. The diversity of approaches, however, has also led to varying interpretations, resulting in considerable confusion regarding the operation of this complex (Oatis, 1988)

B.Sokolov, G.Markova and Doseva (1956) have shown that a majority of children in middle school age who have a flat feet, have a spinal curvature (46.84%). Yankelevich (1956) has shown that a large percentage (60-70%) of children with spinal deformities, have a flat feet (Sokolov, 1991). According to the report on the health of the Bulgarian nation in 2011 over 60% of pupils in first and second grade have flat feet and fallen arch, which affects gait and lead to spinal deformities – these are the results of a study of National Center for Public Health and analyzes in Sofia (Markovska, 2013). All this shows that the flat foot and spinal deformities affect static body.

Ankle-foot complex consists of a lot of bones and joints, which form ankle joint and the foot, but both work together in a complex. It is a strong and complex mechanical structure containing 26 bones, 33 joints (20 of which are actively articulated), and more than a hundred muscles, tendons, and ligaments.

Ankle joint or true ankle joint is composed of connection of three bones: the lower ends of the two long bones of the lower leg (tibia, which forms the inside, or medial, portion of the ankle; the fibula which forms the lateral or outside portion of the ankle) which are connected with one of the bones of the foot called talus. Ankle has become a "hinge" in which have two movement directions:

- • foot moves down (toward the ground or away from the body, called plantar flexion) and
- • foot moves upward (toward the body in a direction away from the ground) (Hristova et al., 2009).

Beneath the true ankle joint is the second part of the ankle, the subtalar joint, which consists of the talus on top and calcaneus on the bottom. The subtalar joint allows side-to-side motion of the foot – inversion and eversion.

Our feet are very important part of the body. They give us stability; they make walking possible and always are in contact with the place where we are, no matter where we are. According to Chinese medicine on foot is projected whole body in biologically active points, including the spine.

The foot can be subdivided into the hindfoot, the midfoot, and the forefoot:

- The *hindfoot* is composed of the talus (or ankle bone) and the calcaneus (or heel bone).
- The five irregular bones of the *midfoot*, the cuboid, navicular, and three cuneiform bones, form the arches of the foot which serves as a shock absorber. The midfoot is connected to the hind- and fore-foot by muscles and the plantar fascia.
- The *forefoot* is composed of five toes and the corresponding five proximal long bones forming the metatarsus.

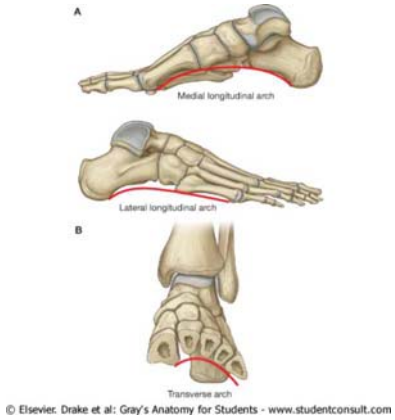


Figura 3 Foot arches

There are two major arches present in the mechanically normal foot (Figure 3), the transverse arch and the longitudinal arch. The longitudinal arch has two components, the medial and lateral arches.

The medial arch, described from posterior to anterior, consists of the calcaneous, talus, navicular, three cuneiforms, and the first three metatarsals, with the head of the talus acting as the keystone because it bears the direct pressure of the body's weight in a closed kinematic chain (Cook, 2012).

The medial longitudinal arch tends to be more important in function because it contributes to the positional mechanics of the mid- and forefoot and helps determine the force transferral between the parts of the foot. This arch provides a "springing" of the foot (Cook, 2012).

Numerous structures are required to maintain the arches of the foot including the plantar fascia (primarily), the central aponeurosis, the plantar ligaments and capsules, the congruency of bony anatomy, and tension within the tendons from their muscular action. Muscle action contributes the least since electromyographic analysis of the muscles of the foot has determined that very little muscle activity occurs until locomotion begins (2). The plantar calcaneonavicular ligament (spring ligament) is the main structure responsible for maintaining the medial longitudinal arch. The long plantar ligament extends the length of the lateral longitudinal arch and is its main structure of support for the lateral arch. (Cook, 2012)

Infant doesn't have longitudinal arch and foot is turned slightly inward. This is completely physiological. Muscles supporting the arch are growing with walking so much that the arch becomes seen. Long time children do not walk as adults, which is the subject of much parental worry and leads to many unnecessary insoles prescriptions. Parents make mistakes when they choose the first shoes and this is one reason why over 60% of adolescents have abnormal foot.

These components of your ankle, along with the muscles and tendons of your lower leg, work together to handle the stress your ankle endures as you walk, run, and jump. One of the functions of ankle-foot complex is to give mobility of the human body. The motions of the ankle-foot complex (Figure 4):

Foot functions are: supporting base providing the necessary stability for standing upright, with minimal muscular effort; • provides rotator movements of the tibia and fibula in the support phase of walking; through its mobility provides adaptation to roughness; through its mobility and shape it acts as a stress absorber stress; act as a lever in thrust (Hristova, 2009).

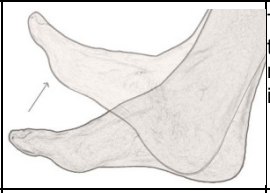
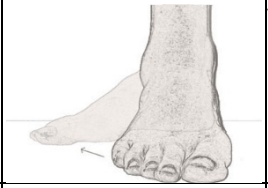
Movement		Primary Joint	Axis of Rotation
Plantarflexion		Talocrural joint, first tarsometatarsal joint, metatarsophalangeal, interphalangeal joint	Medial to lateral
Dorsiflexion		Talocrural joint, first tarsometatarsal joint, metatarsophalangeal, and interphalangeal joint	Medial to lateral
Eversion		Subtalar, talocrural, and transverse tarsal,	Valgus flare
Inversion		Subtalar, talocrural and transverse tarsal,	Varus Flare
Adduction		Transverse tarsal and metatarsophalangeal	Vertical
Abduction		Transverse tarsal and metatarsophalangeal	Vertical
Supination		Subtalar joint and transverse tarsal,	Combined axis of varus, medial to lateral, and vertical
Pronation		Subtalar joint and transverse tarsal,	Combined axis of valgus, medial to lateral, and vertical

Figure 4 Motions of the ankle-foot complex

Deviations in ankle-foot complex can be congenital or acquired. Congenital abnormalities are noticed sooner or later from parents and doctors and accordingly prescribe appropriate treatment. In acquired abnormalities, the problem is that they evolve over time, often asymptomatic and not detected in time by the parents. Much of the variation was determined by social processes - children do not go barefoot, women wear tight shoes with high heels, many people do not know how to choose their shoes properly. This requires regular check-ups at specialists. The most common acquired abnormalities in children are:

- **metatarsus** - low transverse arch

- **flat feet** – low medial longitudinal arch. The most common reason is thinning and rupture of the main supporting arch muscle, but often observed and other causes, such as additional bones in the foot, which modify the strength and vector withdrawal and lead to deformation. Children's flat feet often begin with start walking and with the first shoes which are not correct. Therefore, suspected deformities must make all necessary investigations, including MRI. Accurate diagnosis in early childhood provides great opportunities for successful treatment with appropriate therapy and exercises. Neglecting the problem of "flat feet" in childhood often leads to permanent damage of the musculoskeletal system with growing. During the examination it is seen that the flat foot has modified form. It is prolonged, especially its inner edge, which can be observed when looking back and sides. Around the transverse arch there is skin thickening under second and third heads of the metatarsals. In front of lateral malleolus there is visible folds. Total foot is flattened and enlarged in the middle and at the front. (Sokolov,1991)

- **pronation/overpronation** - In anatomy, pronation is a rotational movement of the foot (at the subtalar and talocalcaneonavicular joints). Pronation of the foot refers to how the body distributes weight as it cycles through the gait. Types of pronation include neutral pronation, underpronation (supination), and overpronation.

Neutral pronation is the most ideal, efficient type of gait when using a heel strike gait; in a forefoot strike, the body absorbs shock instead via flexation of the foot.

Overpronation - As with a neutral pronator, an individual who overpronates initially strikes the ground on the lateral side of the heel. As the individual transfers weight from the heel to the metatarsus, however, the foot will roll too far in a medial direction, such that the weight is distributed unevenly across the metatarsus, with excessive weight borne on the hallux. In this stage of the gait, the knees will generally, but not always, track inwards. An overpronator does not absorb shock efficiently. Overpronator's arches will collapse, or the ankles will roll inwards (or a combination of the two) as they cycle through the gait. An individual whose bone structure involves external rotation at the hip, knee, or ankle will be more likely to overpronate than one whose bone structure has internal rotation or central alignment. An individual who overpronates tends to wear down their running shoes on the medial (inside) side of the shoe towards the toe area.

An individual who underpronates also initially strikes the ground on the lateral side of the heel. As the individual transfers weight from the heel to the metatarsus, the foot will not roll far enough in a medial direction. The weight is distributed unevenly across the metatarsus, with excessive weight borne on the fifth metatarsal, towards the lateral side of the foot. In this stage of the gait, the knee will generally, but not always, track laterally of the hallux.

Like an overpronator, an underpronator does not absorb shock efficiently – but for the opposite reason. An underpronator's arches or ankles don't experience much motion as they cycle through the gait. An individual whose bone structure involves internal rotation at the hip, knee, or ankle will be more likely to underpronate than one whose bone structure has external rotation or central alignment. Usually – but not always – those who are bow-legged tend to underpronate. An individual who underpronates tends to wear down their running shoes on the lateral (outside) side of the shoe towards the rear of the shoe in the heel area.

Pronation and supination are triplanar motions. When these motions occur with the foot fixed, therefore, the resulting motion of the leg must also be triplanar.

Pronation with a fixed foot results in inward rotation, medial deviation, and a slight forward inclination of the leg, whereas supination produces the opposite results. Pronation on the fixed foot, therefore, tends to flex the knee, whereas supination tends to result in knee extension. Often supination and pronation and inversion and evercion used synonymously. /Oatis,1888/

All information above and the fact that the percent of postural deviation in children age is growing explains interest of the specialists in this causes.

The aim of our study was to establish frequency of flat feet, prone feet and posture deviation in first grade children and show whether deformities in ankle-foot complex is related to posture deformities in first grade school children (between 6 - 7 years). The outcome of this assessment will be used to determine the choice of exercises that may improve the deficits discovered during the assessment.

METHODS

Participants

After informed consent of the parents and initial research in school year 2012-2013 was performed an examination of children in first grade from 145 PS in Sofia for spinal deformities. 31 girls and 27 boys mean age 7years old were studied.

Instruments and Assessments

For the purposes of that study we used:

- Static posture assessment - done by physical therapist in Frontal and Sagital Plane and documented with standardized photos. The examination of the posture begins with inspection from front, sides and behind for asymmetry and deformity. To assess posture ideally, the subject stands upright on both feet, and attention should be given to the following: No movement in the atlantoaxial or atlanto-occipital joint which results in protrusion of the jaw.; Stands as straight as possible.; Knees should be straight as much as possible.; Head faces forward and arms beside the body.; Almost all joints of the body must be in the neutral position.

The parts which are important to be observed: Head alignment; Curvature of the spine; cervical, thoracic and lumbar; Shoulders and arms; Pelvic inclination; Hip, knee and ankle joints.

- Posture evaluation - according to Slanchev (1998) there are 4 types of posture, which are marked by the letters A (very good posture), B (good posture), C (middle posture), D (poor or bad posture). Posture C and D are spine deviation in the anterior-posterior or lateral direction.

- Ankle-foot complex assessment - The examination of the ankle and foot begins with inspection from front, sides and behind in nonweightbearing and weightbearing (Weightbearing shows the functional deficits in the longitudinal and transversal arches and ankle joint. Under weightbearing - when all toes have contact with the surface, there occurs a compensatory calcaneal valgus (eversion) and internal rotation of the tibia. As a whole the system shows ankle hyperpronation.). Foot analysis was made - position of the foot in standing position (abduction, adduction or straight forward); abnormalities in foot structure and function (hyperpronation, hypersupination, flat foot, cavus foot bilateral or unilateral). The wear pattern of the shoes may give a good hint of a correct biomechanical diagnosis. General shoe deformation and heel tilting to valgus is frequently found in the hyperpronation syndrome (that is, nonweightbearing forefoot varus with compensatory calcaneal valgus under weightbearing). In hypersupination (that is, non-weightbearing forefoot valgus with compensatory calcaneal varus under weightbearing) the heel tilting of the shoe is to varus. In hyperpronation the shoes have worn out from the medial side and in hypersupination from the lateral side, respectively.

Pedobarographi to evaluate the transverse and longitudinal arch of the foot. The plantar pressure distribution was recorded using I-Step foot scanner. The plantar pressure distribution of populations was recorded using I-Step foot scanner in erect standing position for 10 second on the foot scanning plate. I step F–scanner uses 1024 barometric sensors and measures the force exerted by foot every one cm. The Pressure information (force/ area) collected by the sensor is then analyzed by the high tech-I step software.

Figure 5 I-step

Statistical procedures

The result analyzed using the Bravais-Pearson's correlation coefficient (R). Analysis of data was performed using SPSS software.

RESULTS AND DISCUSSION

Table 1. Posture impairments findings.

Posture impairments	
Normal	12 (20%)
Kyphosis	1 (2%)
Lordosis	9 (16%)
Scoliosis	6 (10%)
Kyphotic-lordotic	4 (7%)
Kyphotic-scoliotic	0 (0%)
Lordotic-scoliotic	17 (29%)
Kyphotic-lordotic-scoliotic	9 (16%)

Table 2. Posture findings (posture standards)

Posture type	
1- Very good	0
2 - Good	12 (20%)
3 - Middle	40 (70%)
4 - Bad	6 (10%)

Table 3 Posture deviation by age

Age	NO	YES	Total
6		2	2
6.5	1	4	5
7	10	25	35
7.5	1	15	16
Total	**12**	**46**	**58**

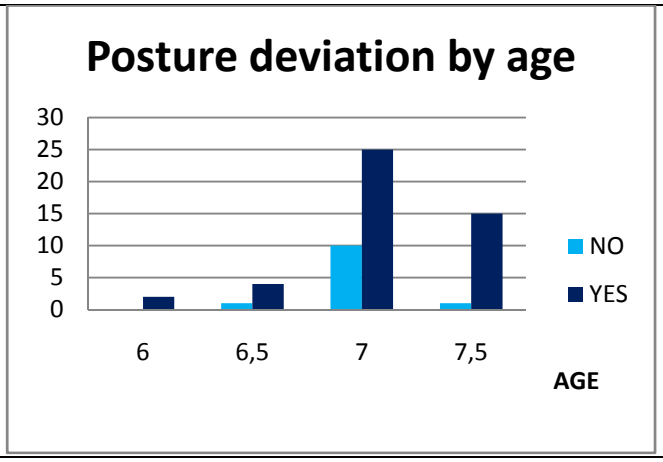


Table 4 Distribution of pronation by age

Age	NO	YES	Total
6	1	1	2
6.5	0	5	5
7	5	30	35
7.5	1	15	16
Total	**7**	**51**	**58**

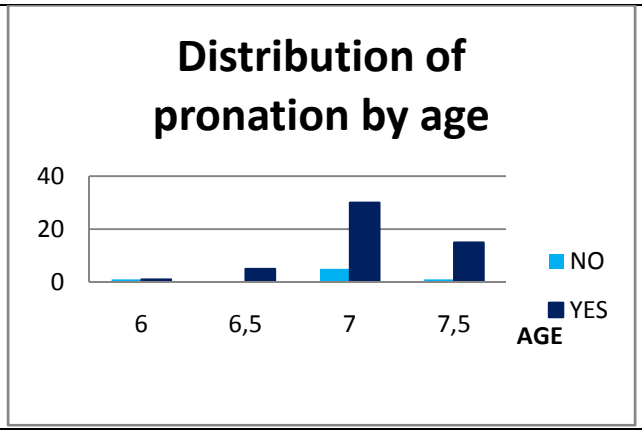
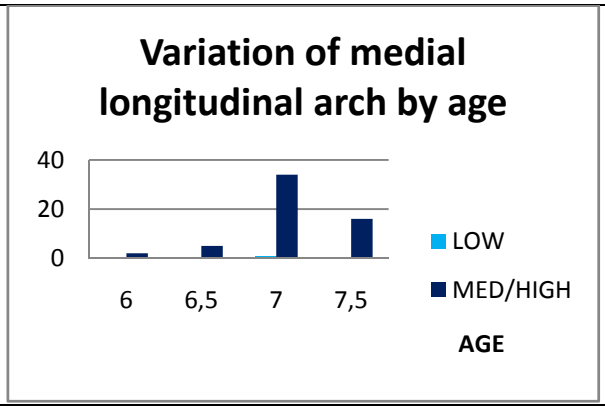


Table 5 Variation of medial longitudinal arch by age

Age	LOW	MED/HIGH	Total
6	0	2	2
6.5	0	5	5
7	1	34	35
7.5	0	16	16
Total	**1**	**57**	**58**



Abnormal posture were observed in 80% of the children, while 12% of assess children have no deviation in ankle-foot complex. There is no significant correlation between sex and pronation (R -0.13), age and posture abnormality (R 0.08), age and pronation (R 0.14), age and flat feet (R 0.24). There is no direct correlation between flat feet and posture abnormality, as in our study there is only one such case. There is a strong correlation between pronation and postural deviations (R 0.86).

CONCLUSION

The main conclusion from this study is that we need to make a detailed assessment of the foot and ankle-foot complex in children, especially in the early years when the development of the lower limbs is not completed. The pronation in ankle-foot complex is the leading factor for the variation in the children's posture and it should be monitored and treated during children's development.

Invent and use of precision equipment that separates the two abnormalities (pronation and low arch – flat feet) because only proper assessment will be used to determine the choice of exercises that may improve the deficits discovered during the assessment, and to identify those exercises which are most suitable for the improvement of the stability of the spine.The high percentage of posture deviation prove its wide prevalence among children in the first grade and the need of correct and timely treatment.

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COMPARISON OF FREE-STYLE WRESTLERS COMPETATIVE ACTIVITIES ON EUROPEAN CHAMPIONSHIP IN 2013. AND 2014.

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SUMMARY

Introduction: Subject of this essay is comparison of top free-style wrestlers` competitive activity and aim of this essay is an image perception of top free-style wrestlers technically-tactical activities based on their competitive activity.

Method: Sample of the research presents fights from six weight categories which took place on European Championship in 2013 in Georgia and in 2014 in Finland. 256 fights were analyzed, 129 fights from 2013 and 217 from 2014. These indicators of competitive activity were observed: the number of technical actions, and the number of certain groups of techniques, the number of implemented points and number of points gained by value of the action, presence of technical action in standing position and the parterre, the number of points per minute of a round, the points per a round, penalties, passivity, challenge, the way of winning.

Results with discussion: In freestyle wrestling continues trend of narrowing the repertoire of techniques that are used, rarely are used attractive techniques and low risk techniques for the attacker prevail. Nevertheless, the last change of the rules benefits the increase number of the points and made wrestling fights more attractive and dynamic.

Conclusion: The last modified rules of the wrestling fight did not impact on application of more attractive wrestling techniques, which present the top of technical perfection of every wrestler, but this change is a significant contribution for more attractive and more dynamic fight, and thus more interesting for the audience.

Keywords: wrestling rules, pointing techniques, duration of the fight.

INTRODUCTION

Results that describe the athletes` competitive activity are indicators that most directly reflect relationship between the training process and competition results in the certain sports branch. Identification and analysis of the most important competitive activity parameters, quantitatively determination of the impact and their mutual correlation, as well as the explanation of their dependence and relation with the certain aspects of the training, represent a very important and delicate research task. Naturally, this kind of research has real meaning only when it is realized in terms of distinct orientation toward the maximum score, or in the most important competitions (Jovanović, Koprivica, Ćirković, & Koropanovski, 2010). Analysis of competitive activity in wrestling shows unequivocally which elements of the technique are used most frequently and which tactics details have special significance, but also indicates the direction in which we should focus on wrestlers` fitness and psychological training. Success in wrestling is a good indicator of compatibility of all these factors, whereby enabling the necessary knowledge and skills to be successfully manifested, and indicators of competitive activity "reveal" the way in which these training factors are manifested in the wrestling fight.

Although the rules of wrestling are changed very often (Kasum, 2008), some general rules have not suffered significant changes. Apart of these general rules, which did not put up too much of a substantial changes, the rules of the fight itself are changed very often, sometimes even several times a year. Thinking about last major rules change in wrestling began on 12/02/2013. when it was proposed wrestling should be off the program of the Olympic Games. As the reason for this decision was given weak popularity

of this sport, a small number of viewers, unclear rules for the general public and insufficient participation of women in management bodies. In this way, the very foundation of Olympics was shaken, therefore intensely thinking due to refresh modern wrestling and keep wrestling sport in the Olympic Games began. The first major step was the replacement of the President of the International Federation of Associated Wrestling Styles (FILA). FILA elected its new President, Serbian Nenad Lalovic who replaced Swiss Raphael Marinetti on 16/02/2013. firstly as a temporary, and from 18/05/2013 officially as the President of the International Wrestling Federation. It all resulted that at the 125th meeting of the Olympic Committee (IOC) , held in Buenos Aires on September 8, 2013, it was decided to keep wrestling as an Olympics discipline, since in the competition of baseball (24 votes) and squash (22 votes) it gained the most votes (49). The most important changes in the rules, which provide wrestling to regain its status in the Olympic Games are:

- The number of rounds is limited on two, and their duration increased from 2 to 3 minutes;
- Getting on the back are now rewarded 2 points instead of 1, and takedowns brought by throw are rewarded 4 instead of 3 points;
- Passivity is immediately penalized;
- There is no more the ball draw in tie 0:0 result;
- Technical superiority in freestyle gains 10 points advantage and win the match (before it gained 6 points advantage and win only in a particular round);
- Rewarding throws for 5 points are offcast;
- Interruption after two throws for 3 and one throw by 5 points is abolished,
- Change in the number of weight categories (six in Olympic Games and in other competitions eight categories).

Competitive activity in wrestling was analyzed by Tuenneman (1997) , who by comparing the results of the senior and junior, noted that there are no significant differences in the structure of implemented points, thus juniors as well as seniors, the most number of points achieved by parterre techniques. Tuenneman (1998) compares indicators of wrestlers competitive activity at the World Championships in Greco -Roman and freestyle in 1998 in Gävle and Tehran and notes that declining trend in the number of gaining points per minute was stopped which had been present since 1994. The increase is minimal in comparison with the previous year, from 0.8 to 0.9 points per 1 minute of the match, but it is very significant that for the first time since 1990, the number of points achieved from a standing position had been increased. At the World Championships in 1990, 58 % of points were gained from a standing position, then there is a steady decline, but by 1998, there was a certain increase of 33% points gained from a standing position, in comparison with 1997. when only 27% of the total score was recorded from a standing position. Regarding performed throwing techniques two techniques are still dominated from parterre position (aufreisser and suplex), while all the other techniques are far behind them by the number of points. Sahmuradov (1997) says that certain techniques which had great importance in the 60s and 70s, are almost entirely vanished from the wrestlers` technical and tactical repertoire. Analyzing the Olympic Games in 1992 and 1996, he finds that the arsenal of used techniques is very narrowed, and it is by far the most common techniques grips for feet and aufreisser. Podlivaev (1999) noted by analyzing wrestlers` competitive activity at the Senior European Championship in 1995 and the Olympics in 1996., that the most common techniques were attacks by gripping legs , then aufreisser and techniques getting on the back. Of all techniques successfully performed at the European Championship, even 36.2 % were leg attacks, 27.7 % were turnover techniques in parterre - aufreisser and techniques getting at the back 13% of all techniques, while at the Olympics leg attacks technique made 26.6 % of all techniques, aufreisser even 34.2% and getting at the back again 13% of all implemented techniques. And in juniors points were gained mostly by grip by the leg 27.7% of all successfully realized points, aufreisser 1606%, while third significant group of techniques was throwing form standing position by grabbing the leg 13.9% of all pointing techniques. The same author made an significance algorithm of realized techniques by minutes of the match, from what it can be learned that turnovers aufreisser and leg attacks are most frequently used techniques in each part of the match. He asserts that foundation of wrestling fight in standing position make relatively easy gained pointing techniques, which do not carry a high risk , taking off to the ground and throws by leg gripping ,

and various types of getting on the back, while from parterre techniques for most common is aufreisser. By the sample of 21 analyzed final matches from European Championship in 2013 (Markovic and Aksum, 2013B) following indicators of competitive activity were acquired: 157 points were gained in 102 actions , of which by the getting on the back were more than 50% of points, i.e. actions with low risk dominated, and by observing realized pointing actions by parts of the rounds, it can be noticed that pronounced effectiveness of performance was in the second part of these periods, suggesting that at the major competitions, physical fitness factor has great significance on the match course. Analysis of World Championship in 2013 (Markovic and Kasum, 2013) confirmed that in freestyle wrestling, and after the rule modification, the trend of narrowing down the techniques repertoire is continued. By comparison with the European Championship in the same year the number of points in the matches for a medal was not significantly changed, but the number of actions declined by 20 percent. With the increase of the action getting on the back value on 2 points significantly increased the number of points in the standing position and the average value of pointing actions increased as well. Rules modification eliminated the possibility of passivity, where worse wrestler waits till the end of the round with tie 0 0 result, and then tries to take advantage by fortune factor during the ball drawing in which chosen wrestler take advantage in grabbing the opponent legs.

The subject of this research is competitive activity of top freestyle wrestlers analyzed at the European Championships in 2013 and 2014. and the aim of this essay is to assess the specificity of the top freestyle wrestlers` competitive activity before and after rules changing, and observing the effects of the rules changing on the freestyle wrestlers` competitive activity.

METHODS

Sample survey

The sample of this study were matches in 6 out of 7 weight categories from European Wrestling Championship in 2013, as well as approximately 6 similar Olympic categories out of 8 in total from European Championship in 2014. The following weight categories were elaborated:

- EC 2013- 55kg, 66kg, 74kg, 84kg, 96kg, 120kg (60kg category was excepted)
- EC 2014 - 57kg, 65kg, 74kg, 86kg, 97kg, 125kg (61kg and 70kg categories were excepted)

Total number of matches on both competitions is 262, 131 matches per each European Championship, still this research analyzed 256 matches. On the competition in 2013 one match ended by withdrawal of the opponent before match started, while the other match was missing in the archive, therefore 129 matches were elaborated. From competition in 2014 four videos were missing, and the sample was made by 127 matches.

Method of data collection

Data collection was accomplished by the documentary method i.e. by data analysis from video recordings of the complete competitions (Dartfish TV, 2013; Dartfish TV, 2014). Some typical parameters of competitive activity were observed: duration of the match, way of winning, kinds and number of point, pointing techniques, action values, number of technical actions, number of particular techniques, number of points in standing position and parterre, number of actions in standing position and parterre, average value of action, number of points per a minute of the match, number of points per a round, average value of round duration, average value of match duration, number of penalties, passivity warning, challenge, technical fall.

Statistical data processing

Wrestler competitive activity is presented through the quantifiable indicators of appearance frequency of particular elements and their submodalities. Modalities frequency of competitive activity is expressed by total value, average value per fight, as well as percentage values of modalities frequency in relation to the total registered prevalence of this indicator.

RESULTS

On EC in 2014 there was decline of number of rounds (Table 1). New rules don't predict third round, still in 2014 the number of second rounds was declined, as after advantage of 10 points not only the round is gained but the match in whole as

well, so there is much more with technical fall and fall. New rules excepted match extensions, where there after tie 0:0 result the ball draw determined which wrestler had grabbing leg advantage. On European Championship in 2013. total duration of all 36 extensions was 262 seconds, and mostly won a wrestler who grabbed the leg. Still, because of extension of a round time from 2 to 3 minutes total duration of all matches increased more than 4000 seconds, while decline of total duration of the match was not noticed in any weight category. On EC in 2013. average duration of the match was 255 seconds, which is 70.88% out of total duration of the match (6 minutes), and on EC in 2014, an average duration of the match is 292.5 seconds or 81.26% out of total match (Table 1). Minimum duration was in the heaviest category only 234.4 seconds (120 kg) and 254.2 seconds (125 kg), while the easiest category often lasted longest.

Table 1. *Number of processed matches, rounds and their duration*

Compet.		European Champtionship 2013						European Championship 2014					
Cat. (kg)		55	66	74	84	96	120	57	65	74	86	97	125
No. of m.		17	24	25	24	21	18	18	22	19	27	22	19
Total		129 matches						127 matches					
Round	I	17	24	25	24	21	18	18	22	19	27	22	19
	II	17	24	24	24	21	17	17	18	14	22	21	14
	III	4	7	7	5	9	3						
Total		291 round						233 rounds					
Extan.		7	7	6	6	9	1						
Round-sec	I	2008	2880	2772	2700	2333	1961	3233	3675	3200	4511	3903	2957
	II	2023	2586	2586	2627	2337	1953	2941	2145	2091	3197	3424	1873
	III	480	840	725	600	913	302						
Extan.		40	31	96	39	83	3						
Matches		4551	6337	6179	5966	5666	4219	6174	5820	5291	7708	7327	4830
To		32918 seconds						37150 seconds					
Round-s		118.7	114.6	108.6	111.8	109.5	110.9	176.4	145.5	160.3	157.3	170.4	146.4
Round–s		112.12 (93.43 %)						159.4421 (88.58 %)					
Match- s		267.7	264.1	247.2	248.6	269.8	234.4	343	264.5	278.5	285.5	333	254.2
Match-s		255.18 (70.88 %)						292.5197 (81.26 %)					

At EC 2013, 129 observed matches implemented 904 points, of which 41 point went on penalties and failed challenges, 598 points were gained in standing position and 265 points in parterre. At EC 2014. there were significantly more gained points. 127 matches implemented 1282 points, of which 80 were as a result of penalties and failed challenges, 871 point was gained in standing position, while 331 point was gained in parterre (Table 2). At EC 2013, challenge failed in 21 cases, and only was excepted three times, while at EC 2014 challenge failed 13 times, and successfully used 6 times.

Table 2. *Number of implemented points through standing position and parterre, challenge, penalities, passivity.*

Comp	European 2013.						Total	European Championship 2014.						Total	
Cat kg	55	66	74	84	96	120		57	65	74	86	97	125		
Stand	72	100	114	87	104	121	**598**	**863** 125	170	131	152	145	148	**871**	**1202**
Parterr	28	46	51	65	44	31	**265**	38	65	74	105	26	23	**331**	
Penalt.	0	0	0	0	1	0	**1**	1	0	0	2	1	0	**4**	
Challenge	5	2	5+ 2U	5	3+ 1U	1	**21+** 3U	2	4	3 + 1U	3 + 2U	0	1 + 3U	**13+** 6U	
Pass.	6	1	6	4	2	0	**19**	12	4	8	14	11	14	**63**	
Total	**904**							**1282**							

Table 3. *Number of realized actions and their values*

Action No. for:		EC 2013		EC 2014	
1 point	Stojka	400	453	83	131
	Parter	53		48	
2 points	Stojka	12	117	301	444
	Parter	105		143	
3 (2013) or 4 (2014)		52 points		46 points	
5 points		4		0	
Total actions:		**626**		**621**	

At EC 2013 there were successfully realized 626 actions, and in EC 2014 621 actions (Table 3), still in 2013. dominate actions were those for 1 point, while in 2014. for most common were two points actions.

At EC 2014 the number of actions in parterre increased from 122 to 146, and the most common techniques were: aufreisser and crossed legs. Slight decline in realized actions of getting on the back from 287 to 274 (Table 4).

Table 4. *Review of realized actions presence*

Actions		In standing position					*In parterre*			Fall post.	In Cat.
Categ.:		Throws	Takedowns	Push.	Counter	DNL	DNL	P.Clutch	Counter		
EC2013	55	7	4	15	1	28	5	13	0	1	74
	66	6	6	16	0	57	5	23	1	0	114
	74	6	11	20	0	49	2	21	2	4	115
	84	5	6	13	0	52	1	31	2	3	113
	96	10	5	13	1	53	2	23	0	1	108
	120	8	9	15	2	48	3	11	1	5	102
Total:		42	41	92	4	287	18	122	6	14	626
EC2014	57	8	3	16	1	38	3	18	2	4	93
	65	7	2	8	2	62	1	31	3	2	118
	74	4	5	11	1	44	5	32	2	1	105
	86	11	8	10	3	41	1	41	8	7	130
	97	1	5	22	0	52	0	12	1	2	95
	125	2	18	9	1	37	1	12	0	0	80
Total:		33	41	76	8	274	11	146	16	16	621

Table 5. *Aritmetic mean of actions and intensity of their realization.*

Compt.	European Championship 2013						European Championship 2014					
Catg.	55	66	74	84	96	120	57	65	74	86	97	125
Actions	1.35	1.28	1.43	1.35	1.37	1.49	1.75	1.99	1.95	1.98	1.8	2.14
Total	**1.38 points per a second**						**1.94 points per a second**					
Intens.	41	42.5	35	37	36.8	27.6	34.7	23.95	24.5	27.93	40.04	25.97
Intens.	**1 point in 36.4 seconds**						**1 point in 28.98 seconds**					

At Championship 2013 it needed, approximately 36.4 seconds for each gained point, while in 2014 it was approximately 28.98 seconds for each gained point (Table 5).

An interesting change was noticed in the dynamics of achieving points. At the European Championship in 2013 in the first round 38.38 % of the total number of points was made, while in 2014 in the first round 54.06 % of the total score was made (Table 6).

AT EC 2013 technical fall win was achieved within 4 matches while the classic fall achieved 5 times, and after introduction of the new rules fall was achieved 12 times, and technical fall even 45 times. Only 70 of 127 elaborated fights was over by a point advantage at the end of match time. The Realization of technical fall as a way to win increased by more than one hundred percent, and technical superiority over the opponent was implemented in 45 fights (Table 7). This achieved less "empty" time for a break between rounds, which by itself makes the competition more interesting for viewers.

Table 6. *Achieved points per minutes in a round*

Rounds:		I			II			III			Extension	Total per cat.
Categories		1'	2'	3'	1'	2'	3'	1'	2'	3'		
E	55	5	31		20	33		2	8		12	111
C	66	20	39		52	16		6	8		8	149
2	74	23	39		45	39		16	5		9	176
0	84	26	40		41	34		6	7		7	161
1	96	26	29		38	26		15	9		11	154
3	120	29	40		39	32		9	3		1	153
Total:		129	218		235	180		54	40		48	904
		347 (38.38%)			415 (45.91%)			94 (10.4%			48 (5.31%)	
E	57	21	22	35	35	38	27					178
C	65	56	53	33	43	26	32					243
2	74	33	47	38	26	47	25					216
0	86	46	59	47	69	28	27					276
1	97	25	36	28	28	30	36					183
4	125	37	52	25	17	35	20					186
Total:		218	269	206	218	204	167					1282
		693 (54.06%)			589 (43.94%)							

Table 7. *Way of attaining win at cometitions*

Winning type:/Competition:	EC 2013	EC 2014
On points	120	70
Fall	5	12
Technical superiority	4 matches(2 individual rounds)	45 matches

DISCUSSION

One of the main reasons for introduction of the new rules was wish that match become more attractive and dynamic, and make more points. This goal was achieved, and the total number of points earned increased from 904 to ca 1282 points (Table 2). Duration of the rounds is increased from 2 to 3 minutes, the total duration of the fight is increased as well, also the number of executed rounds decreased from 291 to 233 (Table 1). In addition, the number of fights that end by interruption because of superiority significantly increased (Table 7), and this is what the public wants to see, and therefore comes to the competition. Referees now constantly put pressure on competitors to take an active fight, and due to the passivity, the referees adjudge 30 seconds in which the competitor is obliged to make a point, that is, to actively attack his/her opponent and try to implement some action. Realization of the given task annuls the second warning, while by unfulfilling the given obligations automatically causes awards point to the opponent. A remarkable difference is noticed in declared passivity in elaborated competitons, which reflects the seriousness of referees work in order to improve wrestling. At EC 2013 19 points for passivity is declared in the processed sample of six weight categories fight, while at EC in 2014 that number is more than tripled with 63 points (Table 2). Although the total duration of the fights increased to 4000 second in 2014, at EC 2013 passivity is declared after every 1732.5 seconds, while the EC in 2014 after only 589.7 seconds (Table 2). It is also important that the rule changes eliminated the possibility that with passive wrestling worse wrestler waits ending of the round with a score of 0:0, due to the ball draw, which provides him to gain a huge advantage to establish a grip for the feet and that way wins that round. As we mentioned at the European Championships in 2014, after changing the rules technical effects worth 2 points prevail, unlike the previous European Championship. EC 2013 by getting on the back gained 287 points , while the same technique in 2014 achieved even 548 points , an increase of 261 points. By applying the new scoring, by which 3 points actions now are valued 4 points , despite the small number of action realization, in 2014, there is increase of the number of points , as well as increase in the arithmetic mean of performed action in the competition at 1.94 in the prior-year points in 1.38 per action . By individual observation of categories in competitions it can be

noticed that the highest value of implemented actions is in the heaviest weight categories. Notwithstanding the increase in the number of points achieved after the introduction of the new rules remain the conclusions of previous studies (Sahmuradov, 1997; Podlivajev, 1999) that in freestyle wrestling narrow repertoire of techniques that apply to use less and less attractive techniques, and more prevalent techniques that do not carry a significant risk for the attacker. Regardless of the increase in the number of achieved points after the introduction of the new rules, still the conclusions of previous studies remain (Sahmuradov, 1997; Podlivaev, 1999), that in freestyle wrestling repertoire of techniques is narrowed, that wrestlers less and less use attractive techniques , and techniques that do not carry a significant risk for the attacker is more prevalent. If the difference in points obtained by increasing the value of actions and increasing penalties for passivity was subtracted from the present value of total implemented points in processed matches at EC 2014, we would get very similar data on actual points in the competitions, as number of implemented actions approves. That was in 2013 achieved a total of 626 stocks that were scored, and the 2014 scored a total of 621 shares (Table 4). In this way in 2013, 626 point actions were implemented in total, while in 2014, there was 621 actions (Table 4).

By researching the competition activity in final matches at EC 2013 (Markovic and Kasum, 2013B) it was noticed that a larger number of points were made in the second round of the match. 347 points were gained in the first round, which is significantly less than number of implemented points in the second round, which is 415 points (Table 6), and total duration of the second round in all matches is slightly lesser than total duration of the first round (Table 1). However, results of this research tell that now more points are achieved in the first round, even 693 of total 1282, which is 54% of total points, while 589 points are gained in the second round, or 46% of total points (Table 6). That way the match became very dynamic from the start, and wrestlers intensively trying to achieve an advantage from the very beginning of the match. By the previous rules wrestlers did not bother to make a significant advantage in the first round, because these points were not passed on to another round, and by the new rules points are transferred to the second round, and wrestlers are far more motivated to make a significant advantage. By that a factor of physical fitness further gains in importance, because these rules of engagement imposed the need to create advantage in the first round and increase or retain the advantage until the end of the match.

These results indicate that the new rules benefit the visually interesting match, in the sense of greater number of gained points and made it more active, for a wider audience, but the most attractive and scoring most valuable wrestling throws and remained poorly applied in the biggest competitions. Of course, if the application of these rules wrestling back to its former glory and halls of prestigious international competitions start to be filled, it can be said that a task completed. Of course, if the application of these rules brings wrestling back to its former glory and halls of prestigious international competitions start to be full again, it can be said that a task completed. In this regard, one must consider the current prevalence and popularity of this sport in different countries and regions of the world, and compared to the results that we will get in a few years time to create the right image.

CONCLUSION

In freestyle wrestling, and after modified rules, continued the trend of narrowing use of technique repertoire, which is consistent with previous studies conclusions (Sahmuradov, 1997; Podlivaev, 1999; Markovic and Kasum 2013 B). Attractive throws with big scoring values are rarely used and low risk techniques for the attacker prevail. Total number of points significantly increased, and at EC 2014, even 1282 points were gained, while at EC 2013, only 904 points were gained. Whereat, total number of successfully implemented techniques remain the same. Change in value of some point techniques, as well as larger number of declared passivity, significantly effect on lager number of achieved points. However, number of implemented actions remained unchanged, which supports the hypothesis that the competitors` result is not significantly changed, but the fight, because of valuation of achievement , has become more uncertain and more interesting for the viewer. Though the number of attractive throws declined, there was increase in the average value of implemented actions in the fight, as at EC in 2014 , in standing position and in parterre action for two points prevailed, while in 2013 were far most numerous actions for 1 point. After applying new rules the number of implemented actions is significantly increased in standing position

and in parterre, which is, i.a., result of point value increasing of low risk techniques, getting on back, to 2 points. So techniques for 2 points prevailed at this competition, which is very different from the European Championship in 2013, where one point actions prevailed (Markovic and Kasum, 2013B).

At European Championship 2014, there was significant grow of declared public warnings due to passivity, so the opponent competitor was awarded a point 63 times, while at the same competition previous year only 19 times. Rules modification eliminated possibility for the worse wrestler to stay till the end of the round in tie 0 0 result, and by fortune factor (the ball draw) gains advantage by setting leg grab.

Challenge, introduced in wrestling a few years ago, apart of its general function, to correct certain referee mistake, is sometimes used for technical sake, so the wrestler could rest or take advice from his coach. Because of the rule of points transferring in the next round, and the opponent is awarded a point if referee decision was correct, this tactic way is decreased. At EC in 2014. challenge was requested for the strong reason and often it was effective, while in 2013. it was mostly used only for tactical reason (wrestler can take a rest), and that is way it was ineffective.

Rules change had a great impact on tactically conducting the fight, and physical fitness has even more important role. Top wrestlers continuously attack from the very beginning, why larger number of points is made in the first half of the round, which is new regarding to previous European Championship. Rules impose requests with high rate of fight, meaning that wrestlers must be more effective from the very beginning of the match. Viewed individually by a round there also has been changes compared to EC in 2013, and now a larger number of points are made in the first round of the fight, as a result of the transferring and collecting points in both rounds, which was not the case by the old rules.

Research results indicate that there is no big difference among competitive activity in different weight categories, and the main role in all weight categories have high risk technical actions.

We can conclude that last rules modification of wrestling fight does not impact on larger application of wrestling techniques, which are cream de la cream of every wrestler technical perfection, still this change significantly benefits more interesting fights for the viewers. Wrestling fight became more attractive, passivity is more often penalized, there are more gained points, and more wins with Fall and Technical Superiority. All these implies that the rules change improved the wrestling fight, but one of the main problem is not solved – wrestlers continued to skip the most attractive throws and gain a good result with less attractive and far safer actions.

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Interdisciplinary

MOBBING MANAGEMENT IN SPORTS ORGANIZATIONS

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INTRODUCTION

Mobbing is pathological deviant behavior, most often of one person to another, inappropriate to human kind. It is common in some animal kinds, aiming to exclude one being from the crowd, when all are joined against one, which can even result in physical extermination. Unfortunately, this phenomenon is present in modern society as well, which is the most often result of social processes of globalisation, transition and inadequate privatization.. It is more frequent in transitional societies, post-socialistic countries where mobbing activities, abuses, humiliation, underestimation and other kinds of psychological terror of one person to another are carried out, planned, systematically in longer period of time. Most often, aiming to keep job, or to remain in the team, mobbing victims keep quiet, suffer and are ”always in stress condition”.

For the same phenomenon of mistreatment there are numerous terms:mobbing, if maltreatment is present at work; bullying, if maltreatment is present in school, psychological terror at work, unfriendly behavior at work, business trauma, psychological aggression, emotional violence. Mobbing is physical process that is very difficult to be recognized, usually is happened behind closed doors, jobbers incline to manipulation, they are shrewd, everything is carried out under the mask of worry and well intention. Here are some characteristics for mobbing, when it is hardly recognized:

- Giving “the slave tasks”, which overcomes psycho-physical abilities of the person
- Depriving information/giving false information
- Overstated supervision
- Overloading with work tasks and insisting for results in unreal periods of time
- Obstruction of requirements for holiday, professional improvement and promotion

More easily recognized mobbing:

- Fury directed to victim, often due to trivial matters
- Personal abuse and giving pejorative names
- Persecution with threats
- Permanent overestimation of work and efforts
- Physical attack
- Social isolation
- Spreading false information aiming to form pressure at person

Only small number of European countries (Sweden, France, Belgium, Holland, Serbia) have established particular Law on maltreatment prevention at work place. In the most of other countries mobbing is regulated through existing articles of the Work law or Criminal law (Germany, Great Britain, Ireland ...). Four years ago in Serbia has been established the Law on maltreatment prevention at work (Official Bulletin of RS, No 36, 2010). Concerning this law, maltreat is every active or passive behavior towards employee of the group of employees that is repeated, taken over, having the aim or violates dignity, respect, personal and professional integrity, health, status of employee that causes fear, creates unfriendly, degraded or abusive surroundings, aggravates work conditions, results in isolation of employee or provoke the personal initiative at employee to break a work contract or some other contract. In the transition process and privatization moral maltreatments are obvious in psychological torture aiming to get off surplus of

employees in privatized firms, get off professional and skilled persons and to employ obedient persons without work experience and politically suitable persons. Articles of this law are related to: employers, employees, persons engaged out of work relation, every other person who participates in work at employer, cases of sexual abuse. Concerning this law maltreatment is provocation or aggravation of others to some behavior. Executor of maltreatment is employer as physical person, or responsible person engaged at employer as legal person, employee or group of employees at employer who perform maltreatment. Protection from maltreatment at employer can be carried out through bringing charges: a) if employer is not accused, the requirement is presented to him. The requirement can be made by employee who considers that is exposed to maltreatment, trade union representative, person in charge for safety and health at work, employees representative or the Board for safety and health at work. Employee can bring charges against employer at the responsible court. Before employing the person, employer informs the employee on prohibition of maltreatment in written form, in order to protect the employee from maltreatment.

Employer and the whole management is obliged to adequately perform mobbing administration, i.e. undertake certain preventive and corrective activities with the goal to prevent expression, but also its disabling or elimination in cases when this behavior is manifested, which means good knowledge of nature, causes of mobbing, activities of creating mobbing, consequences of mobbing for an individual, victim of mobbing and also for the whole organization. Mobbing is mainly performed behind the closed doors, without witnesses and without real proofs. In order to prove mobbing it is necessary to identify activities for creation of mobbing behavior within organization. Thanks to numerous performed investigations, Heinz Leymann has succeeded to identify even 45 different activities closely related to mobbing. Starting from consequences for victim, he has classified them in five categories:

- Activities that endanger the way of expression and the way of communication of victim;
- Activities that endanger social relations of victim;
- Activities that endanger reputation of victim;
- Activities that endanger the quality of personal and professional life of victim;
- Activities that endanger health and life of victim.

Employer, i.e. manager should have to register such activity and to follow the position of potential victim in the organization, as well as possible attacks to it. If the mobber is present in the organization it is expected that after the first attach at the victim his attacks are going to become continual and intensified. The task of employer and the whole management is to prevent mobbing by active measures, such as: fast solving of conflicts in the organization, establishing clear rules of behavior of members in organization, adequate selection of candidates when employing new members of organization, creating the models of communication, organizing educations and training courses within organization dedicated to mobbing, creating culture which doesn't support mobbing behavior but care for cooperation, mutual respect and dignity, establishing the ambient where clearly and free can be indicated to possible presence of mobbing, strengthening civil behavior among members of organization, creating good interpersonal relations in organization. If mobbing activities have already started the task of manager is: to intervene in overcoming situation that have initiated mobbing behavior; to prevent and adequately punish mobbers; to protect victim in proper way and give her all necessary help and support; to rehabilitate victim in adequate way. The problem arises when the mobber is employer or general manager who is most often surrounded by poltroons supporting him; in this situation is necessary "to survive mobbing" by mobilization of all emotional resources of victim.

HOW TO SURVIVE MOBBING?

Control your emotions, but how? There are four reasons why it is necessary to do this. Firstly, emotional flood can be fatal. Every time when we are emotionally overloaded we are more inclined to acquire disease related to stress. Second, emotional flood confuses us and therefore it is very hard to concentrate and work qualitatively; the mobber seeks for the reason to make victim unproductive. Therefore the victim has to make additional effort in order to avoid any perceptions concerning its qualitatively performed work. Third, it is impossible to answer to aggressive attack and for example, to

run away for another job. Fourth, you cannot be angry and depressive talking around how you are in serious position because you are going to disperse potential helpers. Relating to control of emotional flood, there are three main emotions that are provoked by mobbing: anger, fear and sorrow. Every of these emotions are considered as range of emotions. - Uncontrolled anger can be transformed in fury, irritation; - Uncontrolled fear is transformed in paranoia; - Uncontrolled sorrow is transformed in depression. All these emotions are normal and natural reaction to threat concerning survival but they become inappropriate when we do not control them. Control of emotions is very important. Here are some steps that victim can undertake in order to gain greater control of its emotions.

Control your reflection, but how? Nobody never says "as much as I was thinking about something it became less important". First we have to control our thoughts than we can control our emotions. Every time when we think about emotionally-provocative event we can live it because our brain doesn't make the difference between real event and memory of it or even fantasies of event. When imposed thoughts come in our minds it is the imperative to create verbal commands, such as: "No", "Stop", "Go" or any other short but powerful command, which, followed by visual image of maltreatment, if it is repeated during the time, is going to be experienced, lived as attack.

Decrease the power of thoughts, but how? In the way that power of nice, smiling thoughts overcome thoughts on anger, fury against mobber. It is going to require continual repetition until it becomes powerful. But if you think every time how much you hate your mobbers, hate will become weaker, as well as the power of your attackers. This doesn't mean that attacks are funny - they are surely not, but this means that you have opportunity to control your answers to attacks and so you will have greater chances to survive them.

Focus your attention on your body, but how? Mobbing takes great physical tribute, body and mind become weak. Besides, emotions are followed by powerful physiological response, and by control of these responses we can control our emotions. Get training, run, just move. If you become to feel depressive, stand up, straighten up your body, walk, or just walk in your room. (Avoid walking at cold weather, do not eat too much!). Just move your body, and your mind will follow it.

Focus your attention on your physiological reactions, but how? When we are excited our body answers by physiological reactions: our face and ears get red, hands are shaking, fists are clenched, mouths are loosen, body is stiffed and is sweating. Calling the attention to physiological responses we can learn to control them. Train techniques to slow down hearth activity and breath by meditation techniques, training, humor, etc.

Get laugh, watch films, enjoy in paintings, stories, nice persons.

Change your emotions, but how? When you acquire emotion of anger, fury, sorrow, confusion, just think whether do you want to be merry, calm, happy. Key matter is to make small step - small matter can be watching three minutes funny video, working something at home, walking with your pet. It is small step, but when you do it again and again ..., it can be the beginning of your changed emotions.

Check your medicines, if you take some of psychotropic medicines it may increase your suffer. Do not take any medicines that have side effects - anxiousness, depression or suicidal thoughts.

Avoid writing about this matter - Writing, sending E-mails at forums and blogs that provoke anger usually are not of any help. Every time when you write what happened and how do you feel about this, it will give more power and emotionally you will live the attack again. Prepare all what is necessary for your legal strategy in struggle, but at the other way, while you are at emotional and physical distance from mobber. If you are inclined to writing, write with all means about it but only if you are at emotional and professional safety place for writing.

Somebody will probably ask the question in what context appears phenomenon of mobbing and how it is solved in sports organizations. The answer is very simple because mobbing is happening everywhere and at every place and particularly in sport. In every sportsman “smoulders” competitive spirit, competition is great and therefore is necessary psycho-physical stability in sportsmen, coaches and professional staff. It is not enough to train, it is necessary to develop characteristics of personality which predetermine sportsmen for success and which differ them later significantly from the others. These characteristics are persistence, responsibility, self control, emotional stability, self confidence, resolution etc. Developing of motivation is significant for success in sport , like motive for attainment, level of ambition and generally, all those motives that are key stimulations for him personally to train and to

develop in his field. (Popov M, 2014). Synchronized activity of the team, structure of coach's personality is very important for harmony because identification of the members of the team with him is very intensive. Due to his personality mainly depends in what proportion sportsman is going to identify himself with the coach, his behavior, attitudes, requirements, values he seeks for, etc. Intelligence is one of characteristics related to success in performance of any business, any role - even the role of the coach as professional and pedagogical manager of the team. Emotional intelligence is that "something" intangible in every person. It defines how do we manage with our behavior, social turbulences and how do we make personal decisions that give positive results. For sportsmen it can be very important to learn how to recognize their emotions and how to express them adequately, i.e. how to manage with them efficiently. Management of emotions is ability to use conscience about our own emotions and actively choose, select what do we talk and work, i. e. stay adaptable and behave in positive way. Emotions can get us in trouble if we allow them to lead us without even a little bit of conscience; but our rational thoughts can be equally problematic if we try to behave as robots, without any feelings. The best results are achieved by those who apply unique mixture of common sense and feelings. (Skoric,M. 2013).

Complex and very responsible role of the coach is in contrast with passive, indifferent, non-initiative, unambitious person. Passive and unambitious coach usually considers the team as "the lazy crowd" and that it is impossible to achieve some significant results. If this is followed by feeling of omniscience - all knowing, infallibility, irreplaceability like savior, than it can have negative effect in work process, achievements and also it can have negative impact to personalities of sportsmen the coach is working with. Emotional stability is quality necessary to every person, especially coach. Satisfying emotional stability also includes adequate level of frustrated tolerance and resistance to failure and frustrations. Quality of justice and equity is particularly desired characteristics which sportsmen look for in their coaches. It is very complex to coach to treat completely equally every member in the team and to do nothing that will enable some thinkings that they are not equal and that there exist privileged persons in the team. Coach who connive at some individuals while the others are punished strictly and severely is not the authority and he is less convincing in his requirements and in matter he is insisting for. He should respect and appreciate personality of every sportsmen, to measure success and failure of all in the same way, to express consistence in evaluation and estimation of work results.

WHAT IS TO BE UNDERTAKEN IF MOBBING HAS ALREADY STARTED?

Measures of protection that employees can apply if mobbing has already started...

1. In front of witnesses, resolutely but calm say to person who is mobbing you that his behavior is not acceptable to you and that it should be stopped immediately;
2. Write your diary: write down date, time and event with as much details as possible and with names of witnesses;
3. Keep your proves: copies of letters, E-mails, faxes, messages, decisions, demands that you have sent or received from mobber;
4. Do not behave in the same way as mobber because you will then very hardly prove that you are the victim, not mobber;
5. Ask from authorized physician to determine that aggravation of your health status is the result of mobbing at work;
6. Refer to your lawyer. He will advice you what legal possibilities are at your disposal.

INSTEAD OF CONCLUSION

Aristotelian challenge

Everybody can get angry - it is easy. But to get angry at right person, by the right degree in the right moment, due to right reason and in correct way - it is not easy. (Nikomah's ethics)

MOBBING AS THE RESULT OF UNETHICAL COMMUNICATION IN A SPORTS ORGANIZATION

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INTRODUCTION

COMMUNICATION

The paper is the form of review where the topic is violent behavior at work as the generally existing phenomenon in all spheres of life and work of human beings, as the result of bad communication and conflicts, also present in the field of sports organizations.

Communication is information transmission from sender to recipient meaning that recipient understands information. Function of communication is integration of organizational activity. It is the mean to modify behavior, carry out changes, transfer information and realize goals. Transfer of information from one person to another is necessary process wherever – in family, organization, team, group. We can consider communication as the mean of people integration in organization in order to realize mutual goal. Activity within the group is not possible without communication because coordination and change cannot be carried out. The purpose of communication in an organization is to realize change – i.e. to direct actions towards wellbeing of organization. Information in modern organization have to be very fast. The problem is quantity of information and therefore it is not necessary to have great quantity of information but relevant ones. In successful organization can be classified few ways of communication:

1. **communication towards down** – coming from people at higher organizational levels towards those at lower levels within organizational hierarchy.

2. **communication towards upper levels** – from inferiors to superiors continuing to cross organizational hierarchy.

3. **side (lateral) communication** – horizontal stream of information among people of equal or similar organizational levels and diagonal stream of information among different organizational levels who are not in direct relation of hierarchic dependence.

Communication can be: **written, verbal, nonverbal** (face expression, body gesticulations).

Obstructions and delays in communication can be:

1. Lack of planning
2. Undefined assumptions
3. Semantic distortion
4. Inadequately expressed massages
5. Communicational obstructions in international surroundings
6. Loss of information during transmission and inadequate memorizing
7. Careless listening and pre-early conclusion
8. Undistinguished communication
9. Distrust, threat and fear
10. Insufficient period for adaptation to changes
11. Information overload
12. Other communicational obstructions

Methods to improve communication

Listening is the key of understanding. Methods in improving listening are as follows:

To stop talking

To facilitate, help partner in talking

To demonstrate speaker you want to listen
To remove causes of disturb
To feel compassion for speaker
To be patient
To control your nature
To be careful with arguments and critics
To ask questions

INTERPERSONAL COMMUNICATION

Organization is significant field in analysis of interpersonal communication. At present organization is mainly defined as composition. Every organization has its culture, information networks and organizational relations. Organizational culture includes habits, ways of organization and communicational group in an organization. Here are also classified mutual norms, memories, stories, ceremonies and rituals. It is very important to understand culture of the organization where we work.

Mutual relations among people are sources of various resistances, conflicts, misunderstandings, impose of personal interests and interests of formal and informal groups. In order to prevent conflict to become greater one it is necessary to find solution on time, i.e. it is necessary to manage the conflict. If there is no knowledge of causes and forms of conflict, knowledge on their possible constructive/destructive influence is going to be missed as well.

Three types of situations when conflict arises can be differed:

1. When one side notice that the other side doesn't follow the rules
2. When one side resists the other
3. When resistance of one side causes reaction of the other.

Conflict can be defined as process that arises, develops and prevails in mutual relation of misunderstanding of at least two subjects that demonstrate interest for the same values. This means that different business aims, differences in interpretation of facts and disagreements concerning practical expectations and manners can result in conflict.

This definition includes all types of conflicts – from obvious conflict, characterized by great antagonism that is evident in every moment, to hidden (secret) disagreement where persons hide their antagonism toward others, i.e. confirm everything you say and completely agree with you until you turn out your shoulders, and then…

In professional surroundings conflict includes every dispute or resistance that appears as the lack of power, resources or social position, different values, i.e. resistance of different needs, wishes and interests. Conflict cannot be necessary negative, it can also have positive results. The group can come to better solution by direct presentation of opposite opinions which is more effective than group opinion and thinking – agreement at any price. Investigations demonstrate that managers spend the great part of working time (around 20%) in solving conflicts, which indicates to importance of understanding the causes, mechanism and the way of solving conflicts in one organization.

Common causes of conflicts in an organization are as follows:

1. Personal intolerance
2. Disagreement on values and norms
3. Unclear work distribution
4. Limited resources
5. Inadequate communication
6. Mutually dependant work activities
7. Unreal/unclear rules and norms
8. Unsolved/pushed out earlier conflicts

There are three possible results of conflict situations: "one wins the other loses" (victory – defeat solution); "one and the other loses" (defeat – defeat solution); "one and the other wins" (victory – victory solution). The conclusion derives that conflict resulting in the third outcome i.e. victory – victory solution is the only good and qualitative procedure with conflict (Macvanin N. et all, 2010, 2011, 2012).

STYLES IN SOLVING CONFLICTS

Depending on intensity of personal interest of an individual, that is, their care for welfare of others, there are five dominant styles of solving non-functional conflict:

1. **Integration**

Two sides confront their attitudes, together identify problem, recommend and suggest possible solutions.

2. **Helpfulness** (attentiveness)

This style comes from reduction of differences and emphasizing of mutual interests.

3. **Domination**

Domination is applied by individuals that pay much more attention to their own than mutual interests.

4. **Avoidance** (escape)

This style is passive one, disassociation from the problem, even active hiding.

5. **Compromise**

Compromise is the process of establishing the balance between realization of personal and mutual interests. Each member has to withdraw something.

Compromise is key word that should result in communication, not in verbal or even physical conflicts. Every of us can give up the part of our interests if it is the aim of general interest. All of us have to ask ourselves what is our communicational level and what we have to do to improve our communication. We have to try to be better through learning from the best ones, in order to become qualitative source of knowledge, able to transmit it to others. During the conflict two hidden processes can be found:

- One relates to loss of confidence in another side, it is increasingly considered as unfriendly. This tendency very often enables the end of conflict even if the other side is ready to show some kind of good willingness;
- The other process is transformation of the starting position for conflict. Conflict has its natural end which sooner or later comes in phase where both sides suffer more than what is potential benefit from victory.

Outcomes of conflicts are victory or defeat, compromise or defeat at both sides. However, further analysis includes not only final outcome but also spent time, energy and resources as well as prediction of further relations among two sides.

CAUSES OF CONFLICT

Causes of conflict in the organization are different and can be classified in three main group of factors: first are considered as of communicational nature, the second are of structural matters and the third are reflexion of behavior of organizational members, their roles and interpersonal relations. These are considered as communicational factors, structural and factors of personal behavior that should be decreased at acceptable measure or solved in the interest of successful business.(Nikezic S. Kijevcanin V, 2010). This particularly take place in organizations where power was not related to the importance of roles i.e. work tasks or organizational positions. In organizations that have the practice of authoritarian power and neglect the role of cooperation, helping or participation based on self-initiative and awareness on mutual goals and needs that are always useful.

It is well-known that in every organization exists optimal level of conflicts that is acceptable and functionally integrated, which "generates positive organizational characteristics". At the other side if the conflict has too low level then organizational characteristics are threatened and organization is not able to adapt efficiently to certain changes in surroundings. Certainly, if such situation concerning conflicts is prolonged, existence of organization can be endangered. If, however the level of conflicts is too high, there is potential danger of some chaos which can threaten not only organizational characteristics but also survival of the organization, their existence. (Gibson J, et all).

In the next part are going to be presented types of organizations depending on organizational circumstances which has the main role in appearance of conflicts and mobbing.

ORGANISATIONAL CIRCUMSTANCES

Authoritarian circumstances without repression

Authoritarian group circumstances are characterized by autocratic management primarily with centralized decision-making and control of behavior of group members by managers or powerful group. To preserve authoritarian surroundings it is necessary that great part of the members accept autocratic management whether for personal predispositions or because there is no choice or because it is powerfully directed towards preserving of group status and avoidance of troubles that can be the result of disagreement with autocratic manager. In such circumstances in the organization mobbing is more frequently present because the person who disagrees to authoritarian leader has to be exposed to various pressure and disabilities. Behavior control of group members and blocking of their freedom concerning decision-making endanger their needs for self-expression, social improvement, equal treatment with other group members.

Authoritarian circumstances with repression

This form of circumstances is characterized not only by autocratic management but also by organized support to manager and systematic application of repressive measures to those who do not accept attitudes of the manager and his team (criticism, threat, punishment, systematic

underestimation of opposite minded person, endangering its position in the group, endanger its professional increase and finally, provoke elimination from the group). Repressive authoritarian circumstances is preserved not only because of compulsion but also due to personal predispositions of member groups and particularly relating to their values. Tolerance of repressive authoritarian circumstances is contributed and supported by system of values oriented to satisfy existential needs, survival and safety. Higher needs doesn't have significant value in this system just like higher values such as self initiative, freedom, humanism. They have never been developed or are even suppressed. An individual who doesn't posses predispositions to accept autocratic decision-making is faced to destroyable conflict if admits politics and opinions of the autocratic nucleus endangering its own safety. Persons who are characterized by extremely expressed personality and individualism are the most endangered by this conflict as well as those persons in whose value system equality and democracy have particular position.

Circumstances characterized by protective relation

Protective circumstances can appear in different ways. The most frequent is situation is one where the leader of the group completely controls behavior of the other members but at the same time takes care of them during all the time they follow his ideas. Surely, for preservation of such circumstances is necessary that the greater part of group members accept protective relation of the leader, whether due to personal predispositions (acceptance of authorities) or because success in the group is their most important value. Protective form of relation is very frequently present in sport associations, where the coach has nearly absolute control of behavior of young sportsmen but they are at the same time awarded for loyalty and he also takes responsibility to solve their problems out of sport. One of types of protective relation is frequent in our work organizations. In conditions of reduced financials and insufficient participation in decision-making and great number of work groups, the most of the members reduce their involvement at the less acceptable level. In such circumstances mobbing is very frequent. While the leader controls his members and makes decisions in their name mobbing is absent but as soon as somebody of group members decides to think on his own and to have individual attitude and activity, preconditions appear at the surface where leaders apply different kinds of pressure and terror against some members of the group.

Circumstances of disintegrated work group

Decision-making in such group is not jointly because it predicts existence of crucial mutual values and certain level of emotional relation or even tolerance among members of the group. Disintegrated work groups have the following characteristics:

- Autocratic management. Applying repressive measures it causes displeasure and aggression that acquires all group members resulting in their mutual dismission.
- Conflicts arise, which can be caused by various problems, for example problems concerning distribution of financials, struggle for professional promotion etc.
- Long-term disagreement of group members concerning basic values, confidents and attitudes.

In disintegrated group most often appears mobbing and repressive measures from some powerfully subgroup because there is the lack of sympathy and solidarity among group members. Disintegrated group is characterized by: as the unit it influences unfavorable to an individual; it cannot be social unit that stimulates satisfying of any significant social needs because efforts of an individual to achieve social status or adequate position in the group does not influence the other members. In disintegrated group the most frequent is horizontal mobbing (among group members at the equal hierarchical level) although cases of vertical mobbing are not rare phenomenon (among group members at different hierarchical level). Indifference, lack of sympathy and conflicts that are always present in such groups are causes of permanent dissatisfaction and aspiration to withdrawal and very often to leave the group. Conclusion can be derived that disintegrated groups offer much more possibilities concerning mobbing phenomenon, i.e. psychotic terror in the group.

Quasi democratic circumstances

When some group members try to change fundamentally the process of decision-making then powerful group includes mobbing and repression and indicates in this way that democratic decision-making is only the form. Ritual of democracy is maintained because it is the interest of the group having power. Such circumstances are characterized by decision-making that is only formally democratic. This means that group members participate in

discussion on problems of the group and they vote but decision is made by absolute majority of votes. This is only quasi democratic ritual because decisions are not essentially made in democratic manner. The most of group members votes in advantage of powerful group (most often managers). Quasi democratic circumstances are most often characterized by groups in those societies that proclaim democratic decision-making in order to motivate workers for greater efforts but which have not created conditions for proper democracy as well as in societies where democratization process has just started.

Democratic circumstances

Democratic circumstances is the most favorable form that can appear in organizations. In this organizational circumstances is very low possibility for appearing of mobbing phenomenon. Decision-making in democratic circumstances is joint, in the group which means that significant part of group members participate in discussion on essential matters and decision is made by majority of votes. Democratic circumstances in its developing stadium also include making of such decisions that are not an expression of will of majority but represent compromise of opinion of different subgroups within the group. In the process of decision-making in democratic circumstances the most important is discussion, investigation how to solve problem and also plenty of ideas, attitudes and alternative solutions which represent different ways of approaches of group members. System of values includes: acceptance of others, cooperation with others, skill of investigation and asking questions and tolerance. Participation in decision-making in democratic circumstances motivates group members to realize decisions. In order to develop system of values and habits necessary for productive democratic atmosphere in organization, change of social circumstances and social values is needed as well as real estimation of work - to prevent and enable situation that worker makes great efforts but gains a little. Relating to managers, they can make a lot in work organizations towards developing of habits and values that are necessary for more efficiency business activities of groups and organizations. The only condition is that they should be energetic, creative persons, ready to take risk.

CONCLUSION

In sport organizations the most acceptable form of organizational atmosphere is protective relation. Sportsmen are young people and they accept very much this relation of coach and management. However, concerning interpersonal relations and communication, very often occurs that there are significant obstacles and misunderstandings. Conflicts in sport are frequent due to pressure of competition. It can happen in any time - before, during and after competition when sportsmen are the most stressed and excited. Such conflicts are increased or emotions are more expressed because sportsmen have extraordinary need and desire to win. At the first sight, some trivial conflicts and incidents can become very important. Conflicts among sportsmen or among sportsmen and coach can destroy very hard work and career that was built and developed many years before, during long period of time. Such conflict can cause and provoke sportsman to withdraw and to leave competition. Identification of the nature of the conflict and finding solution is only possible through mutual understanding of both sides in conflict. Conflicts in relation sportsman-coach are very often because these sides do not understand each other. For example, coach and sportsman with low level of tolerance - at the beginning of conflict each side stays at its starting position that is negative, unacceptable and completely opposite to the other side. It is not because of the lack of respect of each other but because of the lack of understanding the way of communication and how the conflict should be managed. Conflict in relation sportsman-sportsman can result in more dramatic outcome. There are cases where sportsmen are at the same level of performances when one of them tries to sabotage and underestimate success of the other sportsman. In such cases it is necessary to develop healthy, competing and positive communicational relation.

MEDIA INFLUENCE ON THE DEVELOPMENT OF THE OLYMPIC MOVEMENT

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SUMMARY

Modern Olympic Games are a global sporting, media and commercial event that brings together top athletes and attracts millions of viewers. It can be said that their planetary dimension was obtained thanks to high-quality communication devices. Rapid social change and increasingly complex social life in the last hundred years, thanks to scientific and technological revolutions, have brought to light Communication in a multitude of new scientific disciplines. Consequently, the need for research that links the communication and the Olympic Movement arose. The subject of this paper refers to the impact of the media on the development of the Olympic Movement. The aim of this study is to determine the importance of applying new communication technologies in the development of the Olympic Movement. The historical method was applied in the paper. Study results indicate a causal relationship between the media and the Olympic Movement.

Keywords: communication tools, Olympic Movement, relation

INTRODUCTION

Thanks to the means of mass communication, people are able to participate in the most diverse and the most spectacular sporting events, track results, and read or listen to the comments and reports from the game.

Communication in sports was created by the development of a mutually beneficial relationship between sports and the media in the early twentieth century in the United States, along with cultural changes and technological development of the industry, urbanization and modernization. Sports have become the means of achieving incredible success, while communication and journalism were the allies who supported their validity. But in the 1930s, or the period known as the "Great Depression", there was a sharp reduction in salaries for the journalists, and thus the owners of sports organizations began to cover the expenses of journalists to follow them on their journeys for the positive reputation from the public. During this period, a special relationship was created between the owners of sports organizations, promoters and journalists.

Radio entered the media scene in the 1920s, while television appeared in the 1950s. It is important to emphasize that the radio and television fostered the development of sports by bringing sporting events to the real time and adding an image and sound to the sports story. According to Koković (2007), television developed rapidly, intrusively and with a lot of noise. It became a competitor to the other media.

In addition to the printing press, radio, television, and cable television movies have also taken their special place in the history of communication of sports. Films at that time reflected the emotions that arise in sports.

Today, viewers have the ability to follow reports from sporting events on the radio, television or the Internet, without being in the sports arena. By perfecting the technology of mobile telephony, the opportunity for monitoring sporting events on a personal phone camera became possible. The mobile phone screen enables broadcasting of advertising videos from the sponsors and other advertising banners.

SUBJECT, PURPOSE AND METHOD OD RESEARCH

The subject of this research relates to the impact of the media on the development of the Olympic

Movement. The aim of this study is to determine the importance of applying new communication technologies in the development of the Olympic Movement. The historical method was applied in the research.

THE IMPORTANCE OF THE MEDIA IN THE DEVELOPMENT OF SPORTS

Sport as a specific form of human activity are of great importance in the life of every individual. Sports and sporting life can be viewed from various perspectives. It is primarily a human activity that encourages, directs and accelerates the normal physical and mental development of man. The significance of sports is much broader compared to the above individual benefits because it has its social dimensions. Sports are a public activity and they are talked about everywhere and by their nature, structure, and the idea that they entail, do not leave a man and his environment indifferent. As such, theyare in a constant interaction with the environment and other sectors of society. Sports bring together people of different race, ethnicity, social status, and age to the extent that it is now almost impossible to find any other human activity that could in this sense be compared with sports. In addition, the importance of sports can be found in the provision of international prestige and recognition of the country, the promotion of national pride and moral values through achieving top results in international competitions. Sports are a picture of the socio-economic system of a country and reflect the level of its overall development. All this can be clearly achieved by providing excellent conditions for training and implementation of sports activities in general, and the role of the state is in this sense irreplaceable.

The interpretation of cultural and civilization values of sports in modern society would be impossible without considering the enormous influence that the media have on sports. It is an indisputable fact that sports are increasingly occupying the space in our society and culture, while communication in sports is becoming equally involved in the daily activities of people from interpersonal relations, public relations and advertising, to the theory, research, new technologies, and of course, printed and electronic media.

By competently using the technological tools (camera, voice memo, mobile phone, etc.), the media can turn a sporting event into the kind of information that corresponds to different social groups. In fact, a sporting event would not be an important event if it were not broadcasted by the media (directly or indirectly), thus creating a "virtual image of the world", and those who achieve above average results in sports acquire special importance (Milosević, 2009).

Sports are a social and cultural phenomenon, and researchers who are interested in contemporary culture, especially mass culture, observe the explosion of various forms of sports. Thus, they come to the conclusion that sports are a phenomenon of the masses whose causality, substance and function should be explained within the broader socio-cultural change. Sports and sporting events are suitable socio-cultural activities in which the mass media operate in order to create and shape the sporting public. The media are the strongest and most prominent mediators between sports and the modern human society. The mass media, especially television, today play an important role in forming the public. The influence of the media presentation of reality is very strong in creating a link between sports and fans.

Modern humanity is largely intertwined with many mass communication media networks. These networks consist of an increasingly diverse range of different means of mass communication. They connect people to the unlimited space and constitute a significant factor in meeting local, national, regional, and global processes in the contemporary world.

Synergy between media and sports, which provided a rapid and massive influx of financial resources in the field of sports, has led to the sports becoming one of the most profitable branches of economy in the world. Sports have become a commercial item and the best product for export to the international market, while television has become a form of commercialism in its purest market form, according to most analyses of its performance in the area of sports. Clubs and professional sports organizations around the world have long been gaining revenue on their own, not only from their core activities, such as taking part in competitions or from their fans, but also from advertising, selling TV rights, transfers of elite athletes, and sponsorships. Huge amounts of money are placed on the market. Huge amounts of world money are in this business, which is in turn focused on sports. Large multinational companies have

realized the importance of sports and for them it is almost an obligation to be involved as sponsors in international sporting events (Žarković, 2013).

MEDIA AND THE OLIMPIC MOVMENT

Development and influence of the media, written - papers and electronic - radio, television and the Internet, have since their occurrence been a significant factor in the spread of sports and sports culture on a global scale. The appearance of sports in the press in some countries of Europe and the parallel development of sports journalism, then the first radio report followed by a television report and live broadcasts of sporting events, have caused sports to be further promoted and to gain more popularity across the globe. Major competitions, such as the Olympic Games and various world championships are followed by millions todayvia television on all continents.

The prestige of certain TV companies and their popularity depend in part on the role they play in the coverage of major sporting events. The fight, which includes acquiring the rights to broadcast the Olympics, is a good example of the synergy that exists in this domain. Sports have a large number of additional values for the advertisers as well as for the television companies.

Given that the mass media, especially television, have a large audience, they have become interesting partners to sports in achieving economic and political goals. This mainly concerns professional sports such as soccer, basketball, football, baseball, hockey or tennis, but also the biggest world sporting events such as the Olympics. Olympics can help promote the sports that attract attention of the media and the fans to a much lesser extent as opposed to the above mentioned sports. Thus, the history of the modern Olympic Games has become the history of the "Olympic commercialization."Because of the possibility of following the Olympic Games as the biggest planetary sporting event via these new communication technologies, and in terms of international competition for titles, medals and big cash prizes, the athletes are ready to be exposed to great risks in order to win, no matter what the consequences. In these circumstances, the fundamental Olympic principles and ideals are forgotten because there is only one goal: to "win at all costs."

In the paper *The Olympic Setting on an Olympic, Media and Personal Level*, presented at the 12th International graduate seminar in Olympia, Dyhr (2005) analyzed the connection of the Olympics and the media, and stated that the Olympic Movement has departed from the Olympic values due to both its own interests and those of the media. He proposes to write a new Charter that would go back to the basic values of Olympism and thus, instead of entertainment for the masses, the Olympic Games would become a role model forpresenting virtues such as fair play, tolerance, harmony and friendship. Bjoerner (2007) in the paper *The Olympic Games Broadcast as Interactive Television - New Media New Games*, published in the Proceedings of the 14th International Seminar on Olympic Studies for graduate students in Olympia, indicates that the Olympics are the world's biggest media event, and thinks that their broadcasting contributes to the global development of the Olympic Movement. He also points out that the new age of digital media for the Olympic Games has begun, and in addition to television, the Games can be broadcasted over the Internet and mobile phones.

Pena (2011) in his final report, *Social Networking and the Olympic Movement*, for the Olympic Studies Centre, which is under the authority of the IOC, together with his associates dealt with this problem very thoroughly in eight chapters and on 345 pages. After the introductory chapter, the second chapter analyzes the socio-demographic data and social network sites. In addition to the global internet search, he discusses Facebook and Twitter through the need for them according to age, gender, and language of the user. He provides an overview of the use of social networks by countries and regions. The third chapter presents a statistical analysis of the representation of the Winter Olympic Games in Vancouver on Facebook, Twitter and Orkut. In the fourth chapter the data for the Youth Olympic Games in Singapore are analyzed in the same way. The fifth chapter presents the results of the social network's most popular sports organizations like the NBA, FIFA, and so on. The sixth chapter is devoted to the top selected athletes, such as Michael Phelps and Usain Bolt, and their statuses on social networking sites Facebook and Twitter, which were monitored in the period during the Olympic Games. In the seventh chapter he presents information about the Olympic Movement, the NBA and FC Barcelona as followed on their status pages based on the representation of their fans. The last chapter gives

an overview of the new communications and social media trends with examples of their use.

Cooperation between the IOC and the media can and should be expressed in a number of very important aspects of modern Olympism, such as requiring the media to verbally and visually respect the contents of the Olympic ceremonies, ensuring that the organizers respect the uniqueness and priority of athletes in the organization of the Olympic Games. It is essential that the media respect the schedule of the competition in accordance with the requirements of the federations, to follow the principle of equality of women in the Olympic Movement in their programming, as well as to clearly and effectively ensure broadcasting of every competition.

In order to achieve these objectives, it is necessary to establish the independence of the Olympic Movement in relation to the possible financial impact from sponsoring institutions and the media, as well as to keep room for negotiations about the promotion of sports and broadcasting conditions with the above mentioned media and sponsors.

The Olympic Movement and sports institutions generally cannot achieve these goals without the knowledge and understanding of the internal logic of the media that is difficult to change. According to experts, the approach to this issue is as follows:

- The spectacle and the seriousness and severity of the Olympic rituals during the ceremonies must be retained.
- Facilitating TV coverage (personalized) for television companies of the participating countries and with no exclusivity for the most developed ones. This means examining new forms of "Olympic Solidarity" as much as technical support for television production and reception of the Olympic Games in less developed countries would allow.
- Mitigation requires the most popular sports (those followed by most viewers) to give some time and percentage to the less popular sports, especially those that are most important for the promotion of the stance “sports for all”. (Miquel de Moragas, 1996, http://ddd.uab.cat/pub/worpap/1996/hdl_2072_10058/WP051_eng.pdf).

CONCLUSION

Thanks to globalization and new communication technologies, Olympic Movement is now available in all its forms (Olympics, Olympic education, etc.) across the globe. There is a causal relationship between the media and sports as a social phenomenon. The media will pay more attention to the sports or sporting events which enjoy an increasing popularity with the viewers, but also, if a sport is increasingly promoted in same media outlets, it will be far more popular, such as the Olympic Games.

The results of the paper suggest a causal relationship between the media and the Olympic Movement. The current reality of the world of sports with an increased number of international championships and competitions is very different from what Pierre de Coubertin experienced in his era. His ideas about the universality were reinforced by communication technology and the communication of the 21st century, but at the same time the unique character of the Olympic Movement is threatened, which primarily emphasized the importance of physical education and participation rather than winning as an absolute imperative. The Olympic Movement must resist these pressures and continue to promote educational and cultural responsibilities of Olympism in the context of the new social phenomenon of “sports and the media." Negotiations between sports institutions (with the Olympic Movement to lead the process) and the media may also include an agreement on the idea of loyalty to promote the core values of sports as described in several of the most important documents about sports of the United Nations, the Council of Europe and the Olympic Movement, namely peace, brotherhood, cooperation, and tolerance.

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ANALYSIS OF REPORTING FROM OLYMPICS IN LONDON 2012 IN THE DAILY BLIC

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SUMMARY

Introduction: A large number of newspapers and magazines include sports sections reporting on sporting events and contents of these sections have a significant share of their total volume. These columns are especially important and their volume is constantly being increased at the time of significant global and regional sporting events such as the continental championships, world championships, Olympics. The Olympic Games are a particularly important international sporting event because there is a large variety of sports and athletic activities represented, and it is especially interesting how and in what manner any given sport is represented (in what proportion, scale, according to which criteria, if any, etc.).

Methods: The subject of this research were articles published in the daily newspaper Blic representing events during the Olympic Games in London in 2012.

The main objective of the study was to collect material for the determination of the structure and relationships of articles published, covering certain sports, during particular days, as well as the ratio of articles dedicated to our team and those which covered other teams.

This study was conducted by means of the quantitative analysis of the collected articles in electronic form in a separate section of the daily newspaper that was dedicated solely to the OG.

Results: On the basis of the conducted analysis it can be concluded that most of the articles were devoted to sports in which our team had their own representatives, but not a small number of articles were also devoted to those sports in which we did not have representatives. Also, there was a significant number of articles that were not dedicated to our team. Another important feature is that a significant number of those articles were not dedicated to specific sports, but to the sports of a general character.

Conclusion: This research has contributed to creating a certain image about how to present sporting events in the daily press, but more complete information and an insight on this topic will be possible to gather when similar studies for other dailies are made, especially if a comparison between the individual dailies is made, which will be the subject of a some other future research.

Keywords: Olympic Games, sport, media, the daily Blic

INTRODUCTION

It is difficult to perceive the enormous contribution that sport makes to the media. In terms of content, there are hundreds of television and radio programs, newspapers, magazines, video games, and hundreds of thousands of internet sites dealing with the topic of sports. It has long been observed what enormous potential sports contents have, as well as the insatiable appetite of the sports information users (readers, listeners, viewers).

Sports reporting has been increasingly represented in all media, both in those engaged only in sports, but also in those where sports reports have become an integral part of the daily program. The media devote increasingly more space to sports and entertainment information, which in turn have been recognized as a key to attract the audience. Sports media are simply competing to include a number of sporting events and provide more sports information in order to attract the attention of as many users as possible.

The idea of monitoring the media (media monitoring) is an extension of the methodological approach in the study of Communications also known as content analysis. Classical theorists of content analysis, especially Bernard Berelson (Berelson, 1959) introduced it as a tool that may

help determine how media function on the basis of which editorial policy on various aspects of social life, including the media, can be defined.

Monitoring is focusing on media activities with the aim of their description and critical evaluation. Although the media contents (messages) can be analyzed quantitatively and qualitatively, monitoring involves content analysis. This means that one classifies and measures what is present, that is, the presence and the absence of certain elements and the determination of the frequency of their appearance.

Based on quantitative content analysis it is possible to find different elements and patterns and social actors in particular time and to point out the interesting moments or themes for further analysis. Longitudinal study of media content can provide interesting information in relation to the cultural transformation: the emergence of certain topics, receding in front of other topics and discussions, the emergence of new actors in the definition and discussion on various social issues and problems. Monitoring of media content in different contexts can be an important model to understand certain problems.

Given that the results of such research are very general, specific questions and criteria will show more specificity so that this kind of monitoring will result in obtaining quality data. Even if one never knows the extent to which external conditions influence the media one can still learn something about the image that is displayed to the public. When one monitors 'forms' of writing on a subject it is possible to compare the space that is assigned to reporters, comments and voices of readers so that they do not only indicate the amount of 'cases', or perception, but the volume of these three different groups of voices.

Mass media are important tools to inform the general public and they also represent the framework for public and private opinion expression, thus scientific description and evaluation of the media activities searching for trends of the ideological narrative discourse in the media is very much needed. Reviewing the contents, particularly the structure of the chosen topic or time period is needed because media contents are a strategic part of a broader conclusion about the media and society. However, just a follow-up (no matter how historical or comparative it may be) is rarely enough to create general or theoretical explanations of the social phenomena. You need to think carefully about what, how and when to follow, because the data themselves do not contain the answers. But, as noted, they can be a good foundation and support for the construction of important theoretical and empirical questions. (Elezović, 2012).

Analysing media contents we have much to learn about the social issues and stereotypes which are reflected in the language and communication.

Sports contents, especially information, have also in our social conditions assumed globalization features. Information on worldwide sports events gradually take precedence over the "local" sports news. To illustrate, the information about a European Champions League match has priority over the information about the national championship match. Although the body of information on sporting events is only one aspect of the overall sports content in them, their marketing presentation in the mass media greatly affects the understanding of sport and its significance for man in modern societies. Hence, the question is posed about the quality of the sports contents and how they can be evaluated (Milosevic, 2012).

A large number of newspapers and magazines includes sports section for reporting on sporting events and contents of these sections have a significant share in their total volume. These columns are especially important and their volume increases at the time of more significant global and regional sporting events such as the continental championships, world championships, Olympics.

The Olympic Games are an event that has great social significance, and they should be observed as a reflection of social conditions. They influence contemporary life, the behavior of people who go in for sport but also those who are engaged in observing the Olympics as a spectacle. The Olympic Games have to a large extent contributed to the popularization of sport and competition on the one hand, and on the other hand, have introduced sport into the mass media, especially on TV.

No other event in the sport does arouse such strong sentiments of the viewers (Savic 2008). The Olympic Games are especially significant international sporting event because there is a large number of different sports and disciplines, so it is particularly interesting how and in what manner individual sports are represented (in proportion, scale, according to which criteria, if any, and the like).

MATERIAL AND METHODOLOGY

The subject of this research were articles published in the daily newspaper Blic representing the events during the Olympic Games in London in 2012, and their contents.

From subject determination of the research follows its main goal.

The main objective of this research was to collect empirical data on the basis of which there would be evaluated and determined the structure and relations of articles published according to sports and days covered, and the ratio of articles devoted to our national team and those who were not.

Corpus of material for analysis is made of the texts of the daily Blic (electronic edition), ie. its contents within the SPORT column monitored at intervals from 27.6.2012. to 16.8.2012.

The realization of the set goal required a pre-familiarization with the relevant theoretical literature, which had to undergo appropriate evaluation, selection and operationalization of the content to fit the idea of this research.

The research applied quantitative and qualitative method of content analysis in electronic media enabling exactness, verifiability and data reliability. This is the method most often used in media data analysis. It is a method of studying media materials, various documents, characters, sound or visual representations and other forms of verbal or written communication between people. Its goal is to 1) describe the contents of individual forms of communication, 2) to classify it, 3) when it is being associated with socio-demographic, biographical, cultural and other characteristics of the authors of the document, as well as those they are intended for, to explain or understand it, in the context of time and space in which it occurred and was in use, as well as to comprehend its meaning and significance for those who produce it and those to whom it is intended to. (Brankovic, 2007).

Quantitative-qualitative content analysis is a research method that seeks to produce objective, quantifiable and reasonable description of the contents. In other words, by monitoring the content one conceives adequate connections and relations between the phenomena in the data. Objectivity of these relations is yet another story: codes and classification methods in media research are not sufficiently unambiguous that it is possible to talk about objectivity. Media monitoring goes beyond just 'recording' the content - it characterizes 'something' to the given criteria. Therefore, monitoring is subjective by its own nature and therefore can be considered as a form of media criticism. Despite these shortcomings, when we take into account the amount of data, the choice of content analysis method seems justified. In addition, content analysis provides creation of a "big picture" or a general description of the research.

Unit of analysis in this study is a newspaper article that contains information concerning individual sports represented in the 2012 Olympics.

Collected (recorded and archived material) was processed - encoded according to a unique code system established for this research. Categories in the system corresponded to the aim and object of this research and facilitated the in-depth analysis, based on categories. (Baćanović). Each category had formulated elements on which the units were classified.

RESULTS AND INTERPRETATION OF RESULTS

As a source of information and basic materials for the analysis there were used sports articles archived in the online edition of the daily newspaper "Blic" in the period from 27.6.2012 to 16.8.2012. The reason why this particular newspaper was taken was that according to the system for sites traffic monitoring portal Blic.rs is by far top ranked as the most visited Serbian website. Website Blic.rs ranks first in the number of visitors and number of page views.

2014 Olympics in London were officially opened 07/27/2014 and were closed 13.08.2014, however thematic coverage of the Games began in Blic a month earlier, and ended somewhat after the official close of the Olympics, hence its reporting period was longer than the duration of the Games.

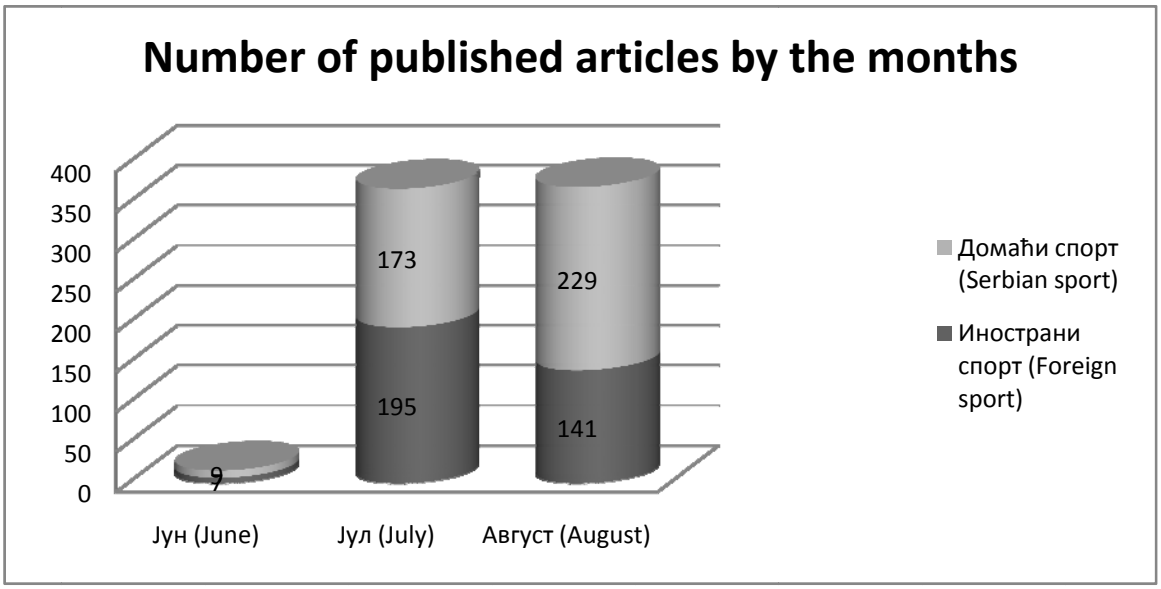
30th Summer Olympic Games were held on the sports courts at the Olympic Village in London, and in some places outside the city, with the participation of 10,500 athletes from 204 countries and territories. Programme of the Olympics events planned competition in 26 Olympic sports,i.e. 39 disciplines: archery, athletics, basketball, beach volleyball, boxing, canoeing, cycling, diving, equestrian sports, fencing, football, gymnastics, handball, field hockey, judo, modern pentathlon, rowing, sailing, swimming, synchronized swimming, table tennis, taekwondo, tennis, triathlon, volleyball, water polo, weightlifting and wrestling. Colors of Serbia at the Olympics in London in 2012 defended

116 athletes in 15 sports (water polo, handball, volleyball, tennis, shooting, athletics, table tennis, swimming, boating, kayaking and canoeing, wrestling, judo, taekwondo, cycling and boxing) , 12 individual and three team sports and the Olympic team comprised 80 male and 36 female athletes. During 51 days of reporting on the events that are directly related to the preparation and participation in the Olympic Games in 2014 a total of 754 articles were published including following sports - athletics, badminton, cycling, boxing, water polo, rowing, gymnastics, weightlifting, canoeing and kayaking, basketball, fencing, football, swimming, wrestling, volleyball, diving, table tennis, archery, shooting, taekwondo, tennis, football, judo, general. The structure of these sports is presented in the following table.

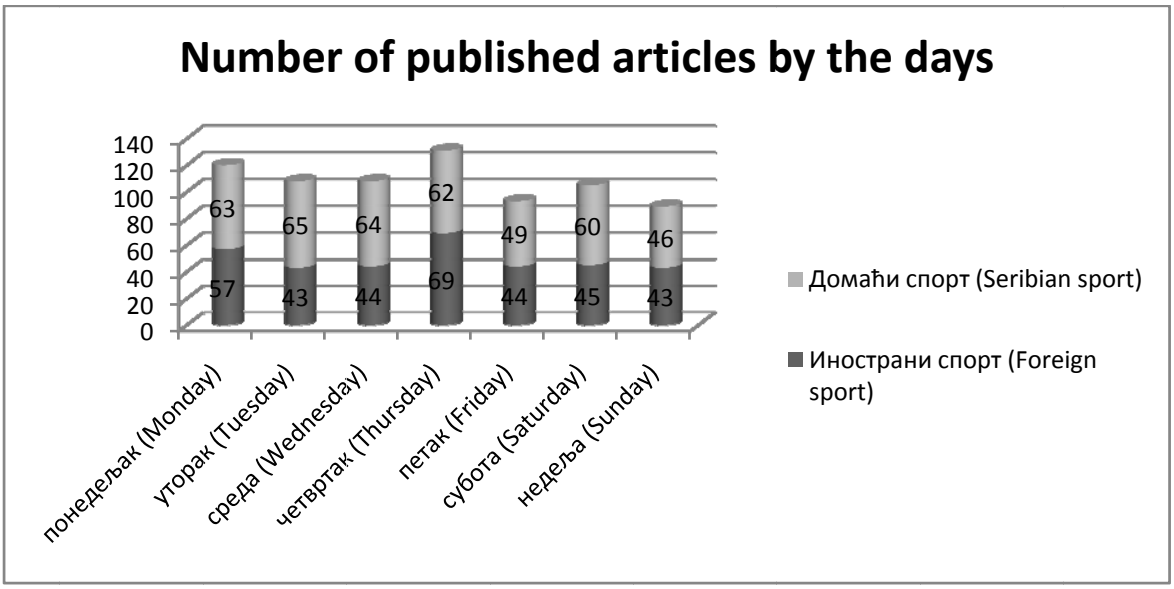
Number	Sports at the Olympics	Serbian national team	Articles in the Blic
1.	Athletics	Athletics	Athletics
2.	Badminton		Badminton
3.	Cycling (bmx, mountain bike, road, cycling path)	Cycling	Cycling
4.	Boxing	Boxing	Boxing
5.	Water sports (Water polo, Swimming, Diving, Synchronized swimming)	Water polo, Swimming	Water polo, Swimming, Diving
6.	Rowing	Rowing	Rowing
7.	Gymnastics (sports, rhythmic, trampoline)		Gymnastics
8.	Weightlifting		Weightlifting
9.	Sailing		
10.	Canoeing (slalom, sprint)	Canoeing	Canoeing
11.	Equestrian sports (dressage, cross country, jumps)		
12.	Basketball		Basketball
13.	Fencing		Fencing
14.	Modern pentathlon		
15.	Volleyball (volleyball, beach volleyball)	Volleyball	Volleyball
16.	Wrestling (free style, Greco-Roman style)	Wrestling	Wrestling
17.	Handball	Handball	Handball
18.	Table tennis	Table tennis	Table tennis
19.	Archery		Archery
20.	Shooting	Shooting	Shooting
21.	Taekwondo	Taekwondo	Taekwondo
22.	Tennis	Tennis	Tennis
23.	Triathlon		
24.	Football		Football
25.	Hockey on grass		
26.	Judo	Judo	Judo
27.			General

The table shows that not all sports were represented in newspaper reporting (sailing, equestrian sport, the modern pentathlon, triathlon, hockey). One can see that there are a number of sports in which the national team of Serbia was not represented, but they were still represented by certain articles in the Blic. Sports that were not presented by the newspaper articles are generally poorly represented in this region, so that, among other things, one can probably explain absolute lack of attention.

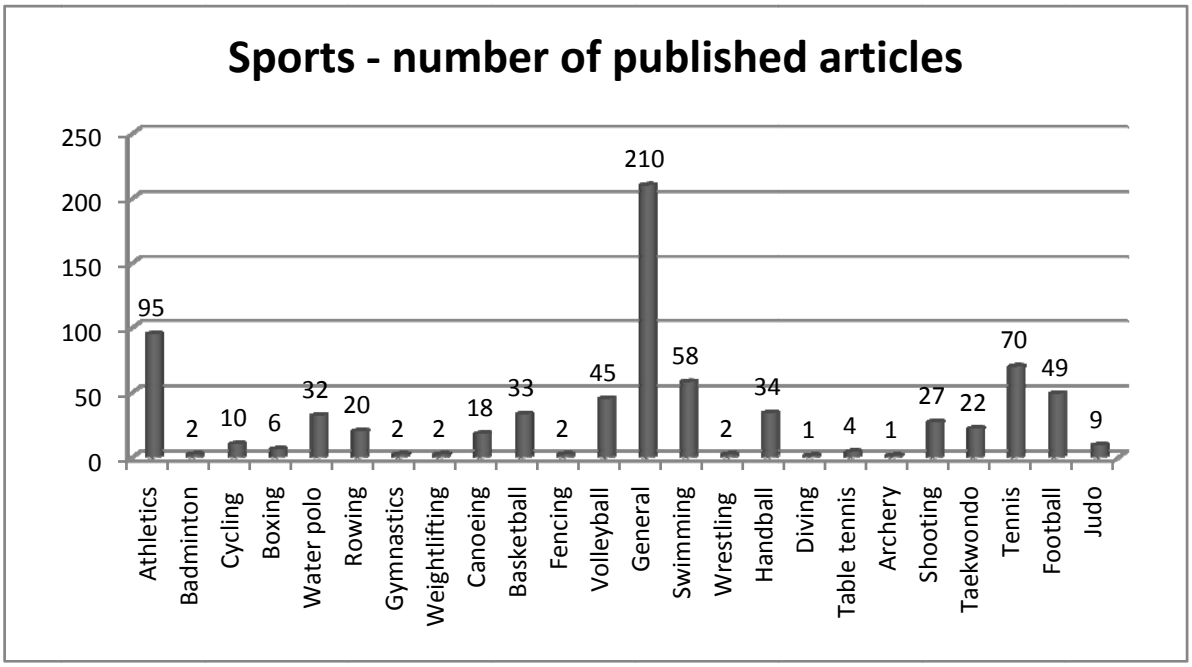
The total number of articles published during this period was 754. The following graphs more closely represent the structure and number of articles published.



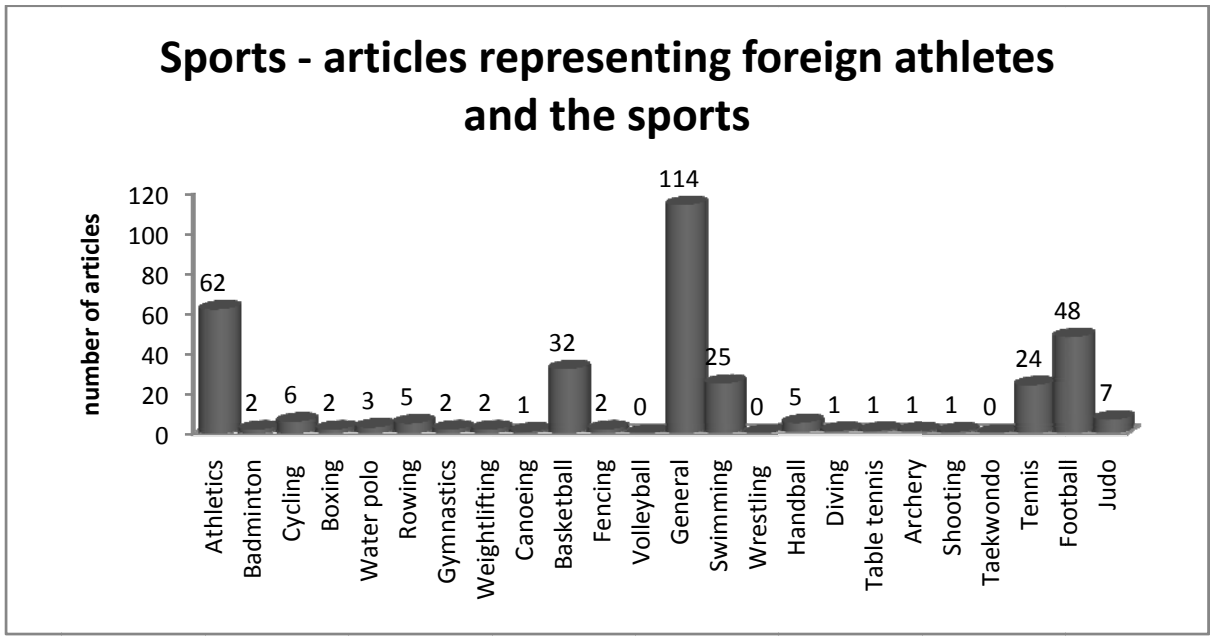
The minimum number of articles was published in June (16), but this is understandable considering the fact that in June, just four days were devoted to OG (from 27.6.-30.6.2012). In July (368) and August (370) almost identical number of articles were published, but in August 13 days were dedicated to the Olympics, while the whole of July covered articles with OG. During the official duration of the Games since 27/07/2014 to 08.13.2014 more than half (from 476 to 63.1%) published articles were dedicated to the Olympic Games. Considering the number of articles published during these three months in June equal number of articles were devoted to local and national teams and sports, in July there was slightly higher number of articles with international issues, while in August a significantly higher number of articles were dedicated to the Serbian team.



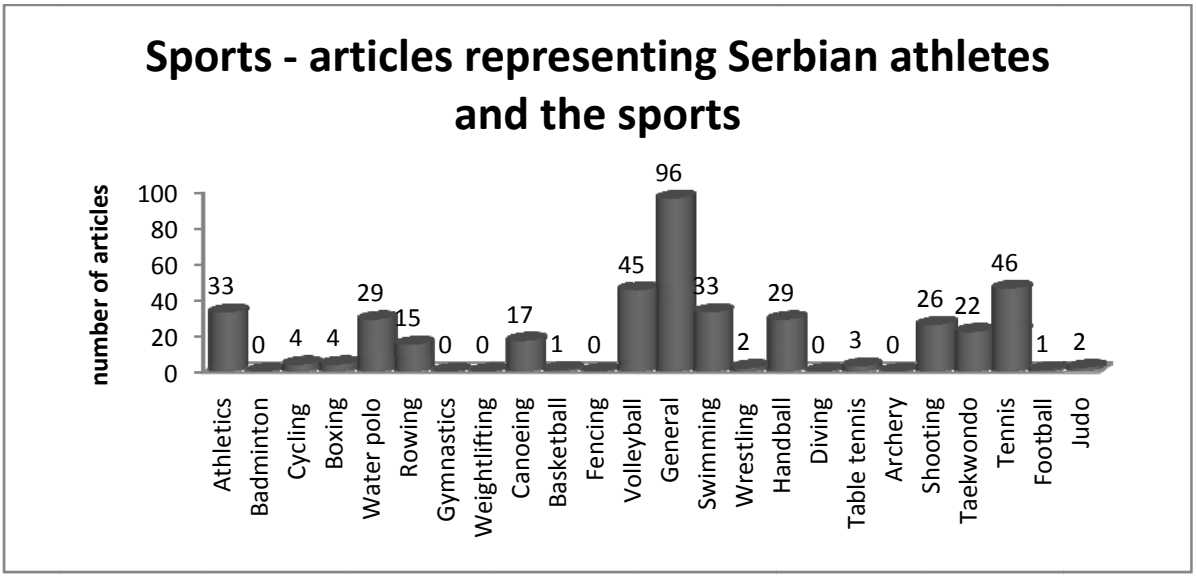
If we examine the publication by the days of the week it can be seen that, on average, every day of the week within a period devoted to OG had over a hundred articles published and that on average domestic sport was more covered than foreign ones.



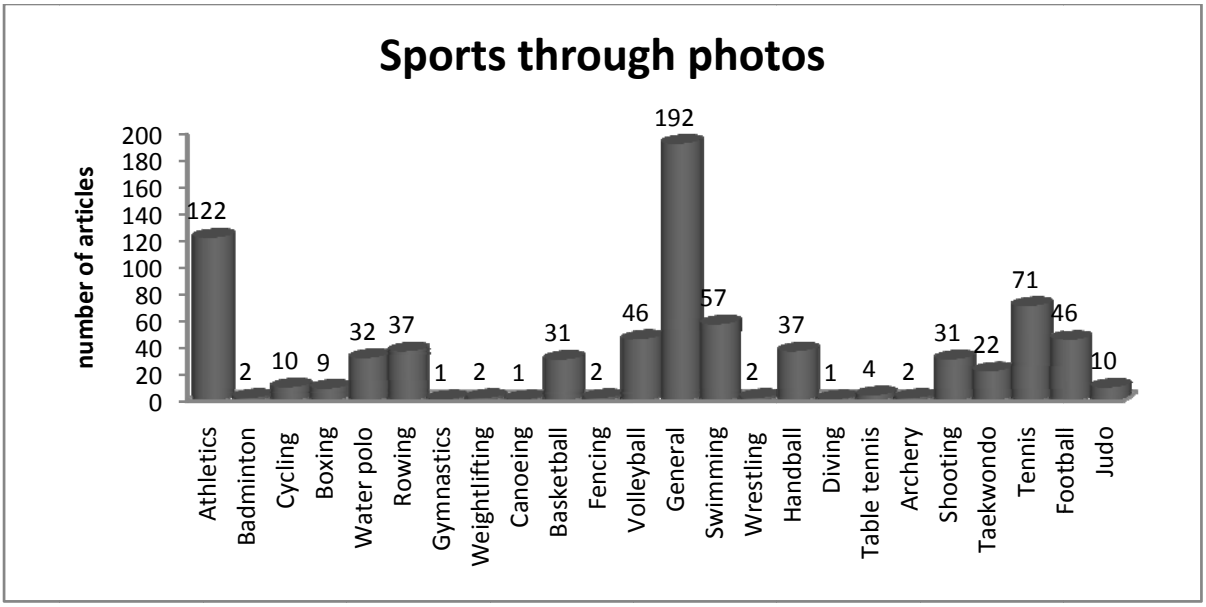
In terms of the representation of sports in texts during the Olympics it can be seen that most articles were not dedicated specifically to any sport - general articles (27.8%), most followed sport was athletics (12.6%), and tennis (9.3%), swimming (7.7%), basketball (6.5%), volleyball (6%), handball (4.5%), basketball (4.4%), water polo (4.2%), shooting (3.6%). Football and basketball are sports that our team had no participants but they were still more media covered than water polo, archery and taekwondo where our athletes won medals. Least were the articles on sports where Serbian team was not represented.



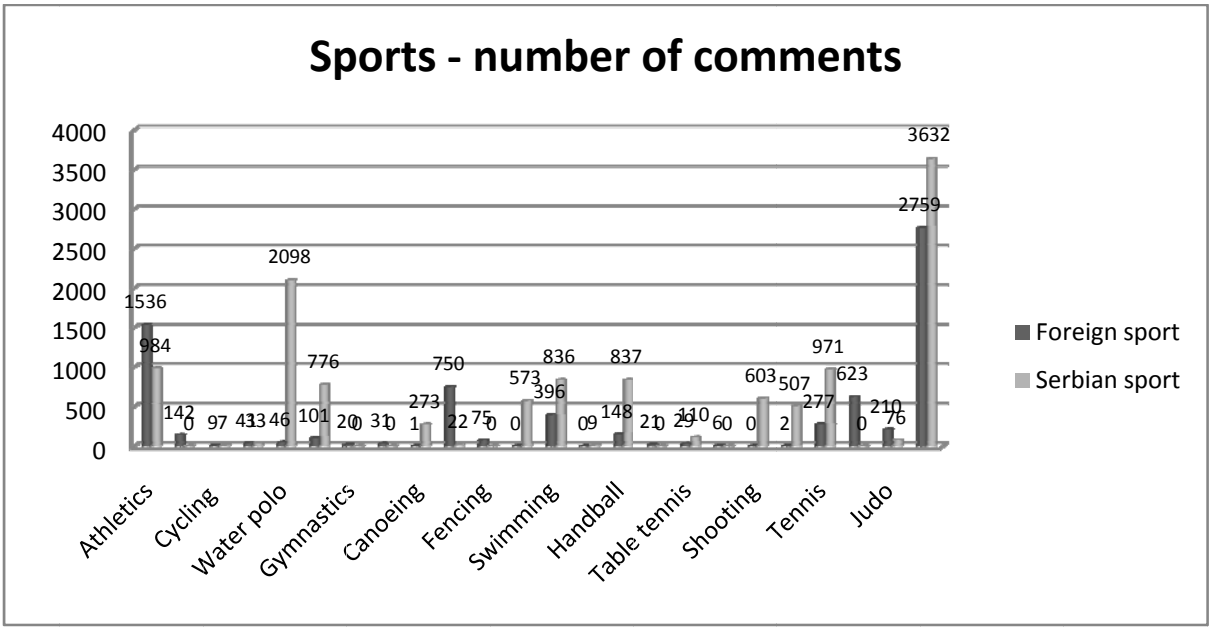
Within the category of articles representing foreign athletes and the sports they participated in most articles were of a general nature (15.1%) of all sports most represented was athletics (8.2%), followed by football (6.4%) , basketball (4.2%), swimming (3.3%), tennis (3.2%). Other sports were significantly less represented in relation to the aaforementioned.



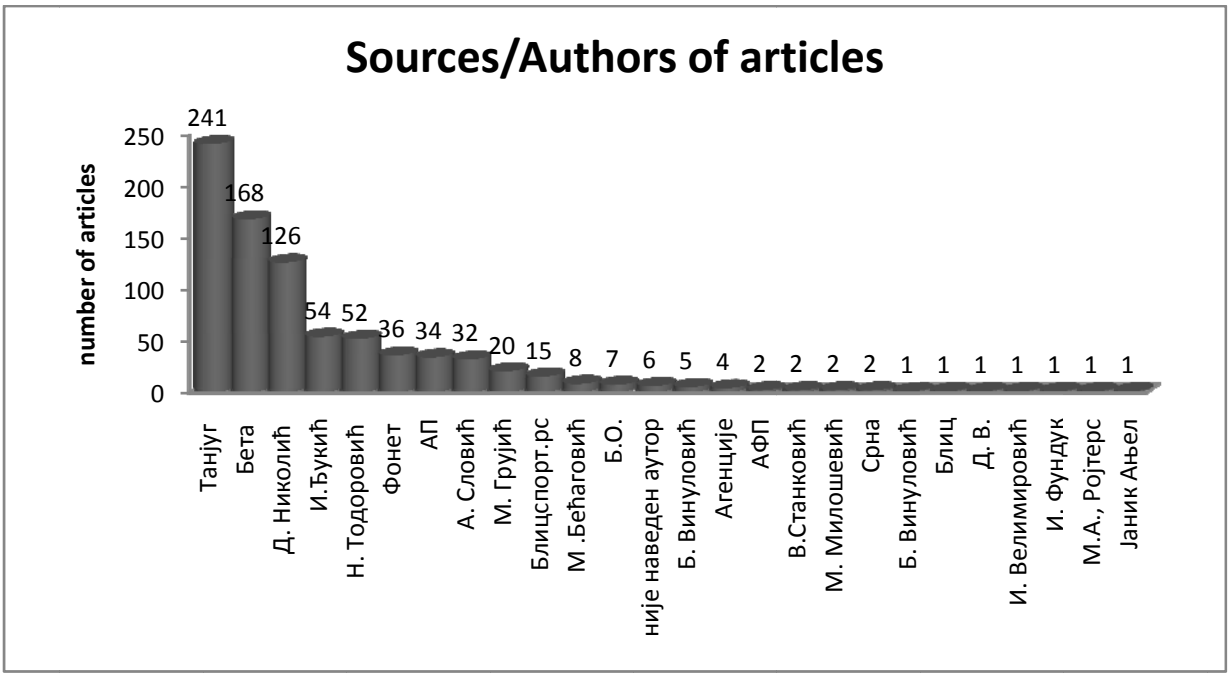
In presenting the Serbian national team again there were most articles of a general nature (12.7%), tennis and volleyball had the highest coverage and almost equal to the number of articles (6.1% and 6% respectively), followed by athletics and swimming (4.4%) , water polo and handball (3.8%), shooting (3.4%), taekwondo (2.9%), kayaking and canoeing (2.2%), rowing (2%). Other sports in which our team had representatives were minimally represented.



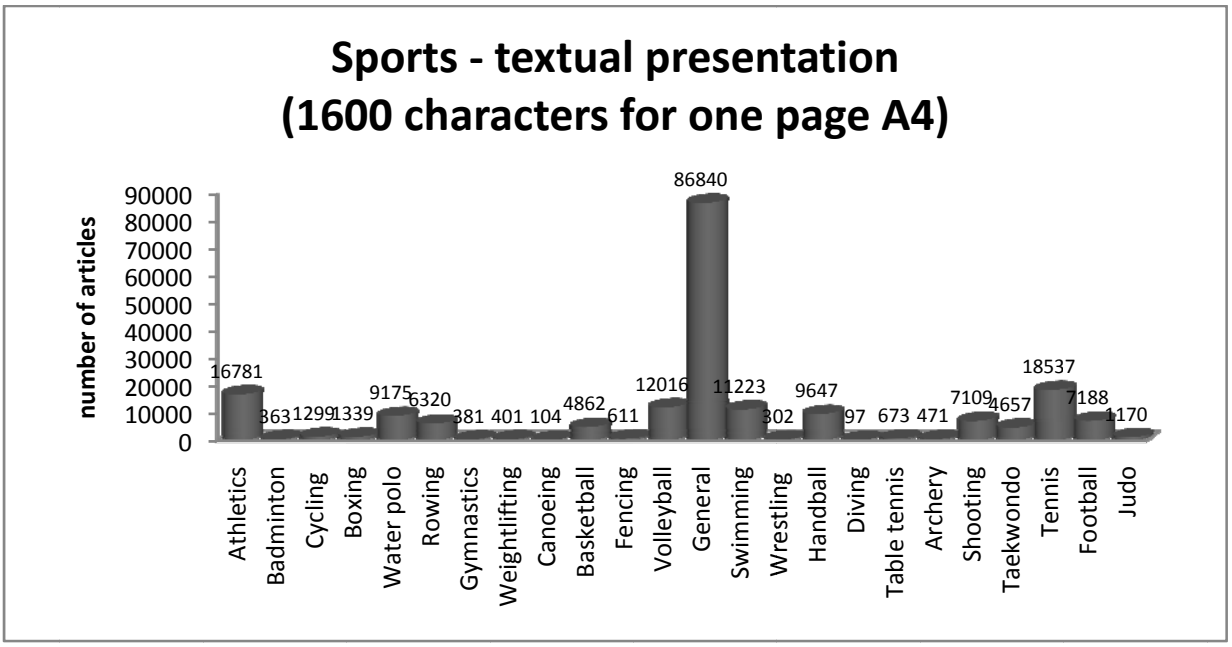
When representing sports through photos, most of articles did not cover just one sport or they were of a general nature. Ordering of thus represented sports is nearly identical to the one where they are textually presented, i.e. most photos were in the articles of a general nature (192) or those who were not represented by just one sport. The difference is that volleyball and football were represented by the same number of photos (46), followed by rowing (37) which was better represented in this way, as well as water polo (32).



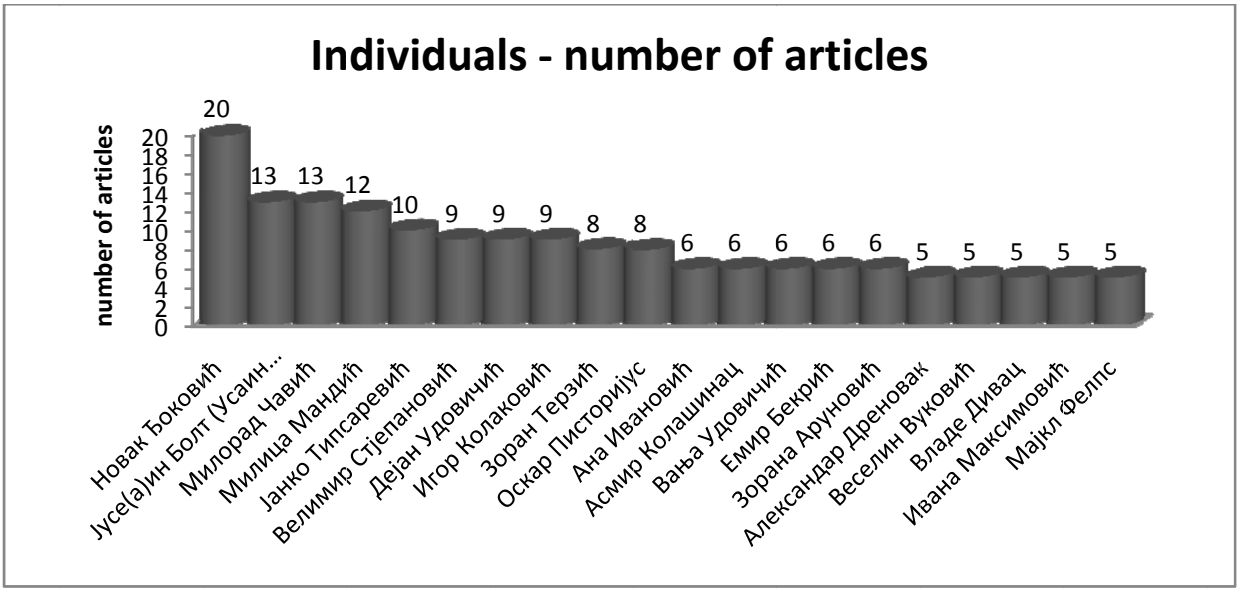
The total number of comments on all articles within the coverage of the Olympic Games in London was 19570. Most reactions were caused by the articles of general themes or topics that were not specifically related to any sport, whereby there were more comments focused on sports related to the Serbian national team (3632). Most favorite sport was athletics and number of comments related to foreign participants in athletics (1536). In addition to athletics attention of readers when the participation of foreign athletes and teams is in question, was directed more to basketball (750) and football (623). On the issue of Serbian athletes and the sports in which they participated, by far the most attention sparked articles dedicated to water polo (2098). In addition to water polo, comments were devoted still largely to athletics (984), tennis (971), handball (837), swimming (836), rowing (776), shooting (603), volleyball (573) and taekwondo (507).



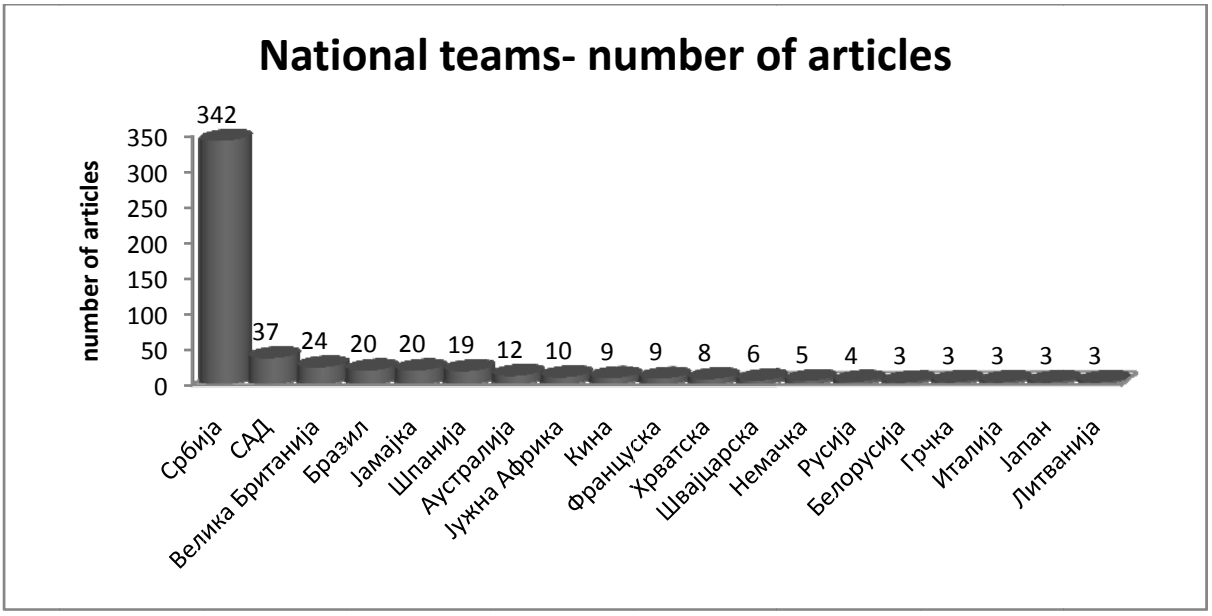
The largest number of articles was taken from various news agencies: Reuters (31.9%), Beta (22.3%), Beta (4,8%), AP (4.5%). Among individual authors most prolific were D. Nikolić (16.7%) and significantly less I. Djukic (7.2%), N. Todorovic (6, 9%) as well as many other authors.



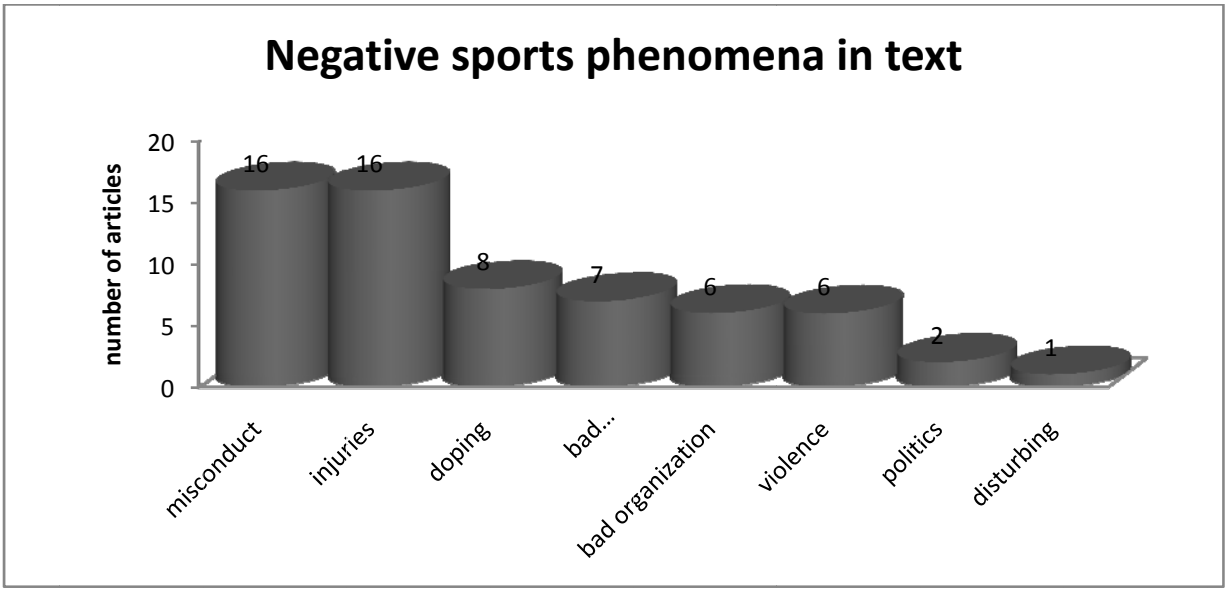
Textually, by far most covered were the articles of a general nature, then tennis, athletics, volleyball, swimming, handball, basketball, archery, rowing, basketball and taekwondo. Other sports were scantly covered by the textual presentation.



The media representation of OG individuals who were mainly or exclusively covered by the articles, totaled 192. First twenty covered were primarily athletes and a number of Serbian coaches and members of the sports delegation at the Olympic Games (Dejan Udovičić, Igor Kolaković, Zoran Terzic, Veselin Vukovic and Vlade Divac). Most of the space was given to Novak Djokovic (20). Also adequately represented were members of the Serbian team and among foreign individuals the top twenty covered were three athletes (Usain Bolt, Oscar Pistorius and Michael Phelps).



When it comes to the national teams, almost half of the articles were devoted to Serbian team (45.4%), followed by the USA (5%), the UK (3.2%), Brazil and Jamaica (by 2.7%), Spain (2.5%). It can be noticed that the representations represented with less than 10 articles and a number of teams who were among the first ten were (China (1.2%), Russia (0.5%), Germany (0.6%), France (1.2%), Italy and Japan (by 0.4%)) by the number of medals won, but they have, however, received much less attention.



Given that the negative phenomena in sports have become its indispensable part, even at the Olympic Games in London there were texts that in some way represented these negative phenomena and generally had a negative connotation. In total, 62 articles were in some way negatively stained. The majority was related to the misconduct and violations of athletes (by 25.8%). It is evident that a small number of cases was extremely negative and covered undesirable effects such as doping (12.9%) and violence (9.7%).

CONCLUSION

Bearing in mind the fact that people follow the media coverage for their own information about current events, primarily in the areas of their own interest, it is possible to assume that specific effects of exposure to the news media content may appear, consciously or unconsciously, in the framework of beliefs, perceptions, knowledge, attitudes, behavior, emotions or evaluations. (Jeffres, 2008).

This means that media by focusing on certain themes or certain elements of particular events that they highlight, can in some way influence the increase of orientation of attention and can attribute greater importance to certain aspects in their audience (readers, listeners, viewers). The thematic orientation of the media for individual elements is a structured selection of content that have particular relevance in view of which they receive media space or time and a specific position. The thematic orientation of the media for individual elements is a structured selection of content that has particular relevance in view of which they receive media space or time and a specific position.

The conducted research to some extent illustrates the above facts and opinions, given that it is expected that any media reporting on such a significant event such as the Olympics devote adequate attention to every sport that represents the Olympics, if not to the same extent, maybe to a lesser extent. In this study it can be seen that this is not the case. The number of followed sports in the studied newspaper is not fully consistent with any sport that represents the summer Olympics, or with the sports in which the representatives of the Serbian national team participated. It is obvious that the editorial board has its own criteria when selecting events that will be presented within the monitored events, and not those that are logical and expected.

As for the number of articles in three months that covered the events related to the summer Olympics, there is a logic and expectancy in the sense that most of the articles were published in August, because the biggest part of the Games was unfolding in that month. It was then that most sporting events took place, which is why in thirteen days there were more published articles than in July, which had ongoing coverage of all the contents dedicated to the Olympics. However, at that time the articles were devoted to preparing and qualifying for the Olympics, and there were considerably fewer events than during the Olympics. In June, there were only four days that covered the Olympic events, so June is not relevant for the conclusion. Also, it was expected for each day of the week to be approximately equal in the number of articles covered on average, during the OG.

It would be natural, when it comes to the objective and realistic coverage of sporting events, for all sports to be treated equally and at least approximately presented in the media reports, especially when it comes to sports in which the Serbian national team participated. However, the analysis shows that it was not so. Most articles were covering the topics of a general nature, or no sport was dominant. Among sports athletics has attracted most attention, although it is not entirely clear why. One reason may be a large number of disciplines that it contains and that each discipline in its own right is a special field of interest. This would further have to be checked by determining the structure of the disciplines that have been presented in the articles, which in this study was not a primary goal. This disparity of sports coverage is also present in the category considering the sports in which Serbian and foreign athletes participated. Structure of sports representation is approximately equal to that in general coverage, whereby in the monitoring of foreign athletes athletics dominated, and in the monitoring of the Serbian athletes tennis and volleyball were dominant sports.

Media coverage of photos from sporting events is also not equal in sports, but it is approximately equal to the distribution that exists in the number of articles devoted to the individual sports. Olympic Games attract the attention of a large number of people which is confirmed by the number of comments individual texts were followed by (in total there were 19 570 comments).

As expected significantly higher number of comments was related to the articles that covered the Serbian national team (12347) in relation to the coverage of foreign athletes (7223). There were most comments on the articles of a general nature which were represented in the highest number. Among sports devoted to the foreign athletes the most commented was athletics and among the sports devoted to the Serbian athletes by far the most commented were the results of the water polo players.

In covering the sports events the daily Blic mostly used agencies news which they took over. Much less articles were compiled by individual permanently engaged authors.

Most of its printed and electronic space Blic has devoted to the topics of a general nature or those where there was a dominant sport (these are usually daily events reviews). Although tennis is not in the first place according to the number of published articles about it, on the basis of this analysis, tennis was most written about. After it, quite expectedly comes athletics.

Most exposed individuals in the articles were expectedly athletes, as well as some selectors. Most covered were Serbian team athletes, less represented were foreign athletes.

During monitoring of sport events at the Olympics, as expected, the Serbian national team was most covered. What was not expected, and is also not clear enough, is the fact that some great national teams which were at the top by the number of medals won (which was expected before the start of the Olympics) were not particularly represented by the media coverage.

Negative connotations in the manner of reporting stemming from the article authors, were not observed, but there were events which had a negative connotation, and they were presented in an appropriate manner. Most of them were those reporting about the inappropriate behavior of the participants in the Olympics, but there were also those which are otherwise mostly regular in sporting events, but much less so here (injuries, doping, violence, and politics).

Presented study can serve as a standard with which the data of other similar studies can be compared and analyzed from different aspects in order to obtain a more complete picture of the media's editorial policy, but also to get other relevant information related to sport.

This research has contributed to creating a certain image about how to present sporting events in the daily press, but more complete information and insights on this topic will be possible when similar studies on other daily newspapers are conducted, especially if one makes a comparison between the individual papers, which will be the subject of some subsequent research.

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