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Faculty of Sport and Physical Education

XXIII Scientific Conference
„FIS COMMUNICATIONS 2021"
in physical education, sport and recreation
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Book of Abstracts

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FOREWORD

Dear Authors, esteemed Scientists, with a great pleasure and honor I am writing this Foreword to the Proceedings of the XXIII International Scientific Conference "FIS COMMUNICATIONS 2021" held in Niš, October 21 - 23, 2021. This year is particularly important because the Faculty of Sport and Physical Education of University of Niš is celebrating 50th anniversary. Organizing the conference in this year brought a big challenges to the organizers, as well to the participants. Global crisis caused by the pandemic COVID-19 brings different measures of protection which changed and burden organization of the big events such as our conference. However, International Scientific Conference "FIS COMMUNICATIONS 2021" continues a tradition of bringing together researchers, academics and professionals from all over the world, experts in sport, physical education and recreation. The Book of Abstracts is consisted of 69 abstracts written by more than 190 authors from 14 countries. Abstracts are divided into four sessions depending on the topics investigated as follows: Individual and Team Sports, Physical Activity and Health, Physical Education and Interdisciplinary. In addition to the contributed abstracts, two invited keynote presentations were given by professor Antonio Tessitore from the Foro Italico University of Rome (Italy), professor Rıdvan Ekmekçi from the Faculty of Sport Sciences, Pamukkale University, Turkey. Distinguished keynote speakers covered very interesting topics from Decision making in team sports to the always needed planning of the training of elite athletes. This Book of Abstracts will furnish the scientists of the world with an excellent reference book. I believe also that this will be an impetus to stimulate further study and research in the field of sports science. We thank all authors and participants for their contributions.

Chair of the Scientific Committee

Nenad Stojiljković, PhD

CONTENTS

Plenary Sesion

WHAT DOES IT TAKE TO BE AN ELITE ATHLETE- HOW THE CHAMPIONS WORK?

Rıdvan Ekmekçi

Pamukkale University, Faculty of Sport Sciences, Department of Sport Management, Denizli, Turkey

UDC 796.01:159.9

Mental Successful athletes are those who can maintain their positive attitudes and behaviors. A high level of personal motivation forms the basis of an athlete's success. When realistic goals, proper concentration, good emotional control, and the ability to cope with stress are added to this, it is certain that you will always be one step ahead of the others.

To realize all these features, it is important for the athletes to discover themselves mentally. Developing skills requires long training and lots of repetition. However, to maintain these skills well and to exhibit the desired high-level performance in every competition, it is essential and necessary that the mental control and mental preparation process need to be a very good or excellent.

How we know and understand what we need to do to become an elite athlete. Well, it all started after your birth. Your genetics and innate talent and abilities are the first initiators in the process of making you an elite athlete. Today, we can tell from gene analysis how talented you are, your injury susceptibility, recovery speed, explosive strength, or stamina. Also, we can learn with DNA test your concentration level or calmness. In addition to these, we can learn whether you have gluten sensitivity, your lactate tolerance, or your metabolic rate. Athletic skill tests, psychometric tests, blood test and performance analyze are other analyzes that must be done on the way to become an elite athlete. In addition to all these, emotional control, stress management, good sleep, quality nutrition, exercises to increase mental endurance, attention and concentration exercises are the things that should be on the way to become an elite athlete. Professional elite athletes today work with their own training programs prepared by experts. These experts are doctors, physiotherapists, mentors, sport psychologists, nutritionists, personal trainers, conditioners, and athletic trainers. They prepare for competitions with their own expert teams. For example, LeBron James spends 1.5 million dollars a year for his expert team. It is possible to add more examples like Cristiano Ronaldo, Novak Djokovic, or Michael Phelps. On the other hand, especially with the growth of the economy in professional sports, not only athletes but also teams have started to include such experts in their staff.

To be a professional elite athlete, you need to know very well what your physical and mental capacity is and how you can improve it. In addition, you must learn what you need to do to maintain the skills you have acquired. Especially positive psychology, meditation and mindfulness exercises are very valuable in developing mental skills. Good

performance at a professional elite level depends on the small details. To reach physical and mental potential, athletes need to work in discipline and detailed.

Talents makes you successful but if you want to be a champion or a legend, you must live professionally and work in discipline.

Living like a champion – to do list

Good sleep: Sleep between 22.00 – 06:00.

Good food: Eat what you need not what you want.

Good physical training: Improve your physical condition in proper way.

Good mental training: Improve your mental abilities and cognitive skills like focusing, mental toughness and problem-solving skills.

Good concentration: Be aware of type of your brain and learn how to concentrate yourself.

Positive psychology: Learn what positive psychology is and apply it in your life.

Positive manner: It is important to have positive manner, keep smile and keep your head up.

Positive energy: Think positive, be positive. Remember, motivation comes from positive energy.

Learn stress management: Stress is a performance creator, just focus on and manage it.

Learn time management: Yesterday is a history, tomorrow is a mystery but today is a gift, don't waste your time.

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Keywords: sport, elite athletes, champion, sport psychology, mental training

DECISION MAKING IN TEAM SPORTS: ANALYSIS OF DETERMINANT FACTORS AND METHODOLOGIES OF TRAINING

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UDC 796.015.5
796.332

In addition to a high level of physical and physiological conditions, to succeed in team sports require players to possess a high level of technical and tactical skills. Decision making is the process through which players choose what they will do in a play, mainly to support the tactical component of the game. It impacts on the performance through two dimensions: individual solutions generated in the moment of the action (*reading the play*) and collective strategy (*pre-determined solutions*). In particular, the variability and unpredictability characteristics of actions, require team sports players to continuously take successful decisions in the play in both ball possession and not possession conditions (Grehaigne, Godbout, & Bouthier, 1997). To have an idea of the flow of decision has been estimated that a normal person makes about 6000 decisions throughout the day while a football player usually makes more than 2500 decisions during a single match (Teoldo, Guilherme, & Garganta, 2017). In some instances, the choice may be simple, based on a yes-o- not context, in others be more complex. The more players are skilled, the more they are able to extrapolate and process information from the competitive environment in order to identify salient, predictive, global cues within the context of the play and their intended goal. In addition to expertise, and other covariables that influence the quality and accuracy of decisions, mental fatigue can play a relevant role (Kunrath, Nakamura, Roca, Tessitore, & Teoldo Da Costa, 2020). It has been reported that mental fatigue compromises the ability to maintain attention on what is important during a task, compromising focus, performance adjustment, rapid and accurate reaction, and interpretation of meaningful cues in the visual field, as well as reducing technical performance (Coutinho, Gonçalves, Wong, Travassos, Coutts, & Sampaio, 2018). Among other well-known factors, a related decision making training might include: a) to play exploring different degrees of freedom, b) to elicit eliciting reinvestment by leaving room for mistakes (Petiot, Bagatin, Aquino, & Raab, 2021).

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Keywords: Decision Making, Mental Fatigue, Team Sports Training

Individual and Team Sports

INITIAL DESCRIPTIVE MODEL INDICATORS OF FOOT MOVEMENT FREQUENCY IN HIGHLY TRAINED DANCERS MEASURED BY THE FITLIGHT METHOD: A PILOT STUDY

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UDC 796.012.2.226:793.3

The main goal of the experiment is to describe the initial model indicators for estimating the frequency of foot movement in dancers of national and international level, in dance disciplines Latin and Standard, Latin formation and Contemporary dance, using four taping tests, which are designed for this study. The sample was comprised of 12 experienced dancers, of which 10 were youth, aged 16-19 and two were adult dancers, aged 19+. Participants were introduced to the method of performing the tests immediately before the measurement, after which the dancers were warmed up for 10 minutes. The tests were randomly assigned to the participants through two attempts with the right and left foot. The study used FitLight Trainer, a wireless system of interconnected sensors that registered runtime. The results of descriptive statistics showed great homogeneity of raw results from two attempts, within 26% coefficient of variation, and could be considered for the target group-population of dancers as generally reliable. The results of differences in relation to gender, expressed as a percentage, between the average values of the examined time variables are in favor of men, except in Test 3, performed with the left foot, where women have an advantage of 10.9% over total time and 19.11% over average time. In order to define the final model indicators and furthermore, metric characteristics of the applied tests for estimating the frequency of leg movements in dancers, it is necessary to repeat the measurement on a representative sample, which would include athletes from other sports and non-athletes.

Keywords: sports testing, coordination, precision, balance, FitLight

CHANGES IN SPEED AND AGILITY OF YOUNG FOOTBALL PLAYERS UNDER THE EXPERIMENTAL TRAINING PROGRAMME

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UDC 796.012.13.332
796.015.2.332

The aim of the research was to determine to what extent motor abilities, speed and agility, in young football players (aged 7 to 10) would change after a six-week long programmed training process. 30 football players aged 7 to 10 from football club 'Vucje' in Vucje participated in the research. They had been training football for at least one year. The following measuring instruments were applied for estimating speed and acceleration: 5m Sprint, 10m Sprint and 40m Sprint. A different set of measuring instruments was applied for estimating agility: 505 agility test, Balsom run and Arrowhead agility drill. The subjects were tested before and after the training programme which took place during the preparation period in 45-minute sessions in the first part of the training, two times a week. The results show that there is a statistically significant difference between the first two speed tests (5m - .000; 10m - .001), whereas the third test shows no such statistically significant difference (40m - .118). There is no statistically significant difference in the first agility test between two testing situations (505 agility test - .116) but there is a significant difference in the remaining two agility tests (Arrowhead agility drill - .000; Balsom agility test - .001). Student's t-test results show that the applied 6-week long training process had a positive effect on the changes in the starting speed (5m Sprint) and acceleration (10m Sprint) results. However, there was no improvement in the maximum speed results (40m Sprint). The applied training programme positively affected agility in two out of three applied measuring instruments (Arrowhead agility drill and Balsom agility test).

Keywords: young football players, speed, agility, changes

RESEARCH OF THE RESULTS FROM ONLINE STUDIES IN TACTICS AMONG 10-13-YEAR-OLD CHESS PLAYERS

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UDC 794.1-053.5

The aim of the research was to establish the actual possibilities of 10-13-year-old chess players studying online in order to learn certain topics in the field of chess tactics. Our major question was whether there is a significant correlation between teaching chess tactics in person and online. The research was done among 37 competitors with Elo rating 1050-1400 points from four chess clubs in Bulgaria. They were divided into two groups. In one of the groups the sessions were conducted only online, and in the other group – only in a training hall. As an organizing framework of our research we used a unified lecture course on chess tactics which included 10 basic topics. For each topic we created a test battery consisting of six tasks graded according to their difficulty level. At the end of the two-month lecture course, we checked the degree to which the pupils from the two groups had learnt the educational material. The applied Student's t-test for two independent samples showed that the difference in the results from the two forms of testing was insignificant, i.e., it was not a consequence from the form of testing but from fortuitous factors. The result from this research can help chess coaches working with this age group to take a much more professionally conscious choice regarding the ways of teaching chess tactics during their training sessions.

Keywords: chess education, chess tactics, face-to-face and online training

THE EFFECTS OF FOUR-WEEK SAQ TRAINING ON SPEED, AGILITY AND EXPLOSIVENESS IN SOCCER PLAYERS AGED 11-12

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UDC 796.332-053.5
796.015.53

It is very important to influence the development of motor skills in soccer players at the right time, because they are the key to success in soccer. The aim of the study was to determine the effects of SAQ training in young soccer players (aged 11-12 years) on speed, agility and explosive power over a period of four weeks. The sample consisted of 40 soccer players of the youth soccer club "Mladost Apa" from Apatin, who were divided into two equal groups (experimental and control). The experimental group implemented a training program that included three trainings per week according to the SAQ method, for the development of speed, agility and explosiveness, while the control group of soccer players conducted regular soccer training. The results of a total of 9 variables obtained in groups of tests consisting of anthropometric measures (three tests) and motor tests (six tests) were obtained by testing. The value of the T-test suggests that the subjects of the experimental group had statistically significantly better results in the final measurement in all variables except the 20m slalom with the ball. The results of the control group showed that there are statistically significant differences between the initial and final measurements in the 20m ball Slalom tests and on the T-test. These results show that speed, agility and explosiveness training, as part of the overall training process, can be considered a useful tool to improve these skills among young soccer players. In this regard, they confirm that SAQ training is one of the most important methods to improve these abilities.

Keywords: young soccer players, motor skills

MINI HANDBALL- A TOURISM PRODUCT FOR INCITEMENT AND IMPROVEMENT OF SPORTS TOURISM OFFER

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UDC 796.322.4:338.48

Sports tourism is one of the fastest growing types of tourism to which many researchers have devoted their attention over the past three decades. Therefore, there has been constant need to expand and improve the offer due to the increasingly demanding shareholders both on domestic and international markets. This paper aims to point to attractiveness of a new type of handball (mini handball) that could incite and improve sports tourism offer of a destination. Mini handball concept and resources are some of the crucial factors that can qualify this sports game to be included in sports tourism offer. In addition to the concept and resources, this paper considers benefits of expanding sports tourism offer by including mini handball.

Keywords: mini handball, sports tourism, destination development, offer development

ANALYSIS OF SHOT SUCCESS INDICATORS AMONG FEMALE BASKETBALL PLAYERS

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UDC 796.323-055.2

The analysis of data related to the basketball game is becoming more popular with the appearance of sites that offer this data. More complex methods in the indicators of success analysis in the game bring a larger number of data whose systematization and analysis is a necessary prerequisite for a successful team scouting. Thus, conditions are created for gaining an advantage in terms of adequate technical and tactical preparation of opposing teams. The aim of the research is to analyze the indicators of shot success in the most efficient basketball players and determine the difference between them. A total of 2838 shot indicators were analyzed with the use of non-parametric and parametric statistics. The type of movement before the shot, the type of shot, the period of the game when shooting, the distance from which the shot is performed and the outcome of the shot were analyzed. Chi-square test and ANOVA method was used for determining the differences in shot success indicators between top ten female basketball players. Also, the post hoc and z-test analysis for comparing the differences among specific pairs of players were conducted. With the use of Chi-square test and ANOVA method, the results showed statistically significant differences among the players with the p-level of ($p \leq 0.05$). The players differentiated in the type of movement before the shot ($p=0.00$), the type of shot ($p=0.00$), the period of the game when shooting ($p=0.01$), the distance from which the shot is performed ($p=0.00$), except in the outcome of the shot ($p=0.29$). It was found that the players statistically differed in all shot variables except in the shot outcome variable. In variables where statistical difference was found, post hoc and z-tests showed that players who played on center and power forward positions mainly differed from players on guard positions in most of the indicators.

Keywords: scouting, shot variables, position, team sport

STUDY REGARDING THE IMPACT OF THE COVID-19 PANDEMIC ON THE CHILDREN'S TRACK AND FIELD TRAINING

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UDC 796.015.26:614.4-053.5

The COVID-19 pandemic has led to a world halt of sports. From the highest level of performance to the lowest, all athletes have been affected to various degrees. This study aims to analyze the impact of the Covid-19 pandemic on the children's track and field training. It is important to identify some of the biggest challenges confronted by children during this time and understand their physical and mental state. In order to identify some of these challenges, a questionnaire was created. The questionnaire data were gathered from the coaches, children, and parents of the children involved in track and field. The answers have shown similarities between the means used by coaches to train children during this period, when training sessions have been conducted also online due to pandemic restrictions. The conclusions show the importance of the coaches' ability to remain constantly connected to children during the pandemic, in order to maintain their motivation to keep practicing track and field. The most important abilities of the coaches include an improved communication (because it was easier to connect with children), and an effective way of transmitting the information.

Keywords: track and field training, children, Covid-19 pandemic

INJURY PREVENTION AND PREDICITION IN TEAM SPORTS: IS THE MACHINE LEARNING A PROMISING TOOL?

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Sport industry rapidly growth in the last few decades but injuries of athletes have a great impact on both mental state of the individuals and the performance of a team. Additionally to the impact on an athlete's health, injuries can also limit athletes' ability to train and perform which affect their preparations for and availability to take part in competitions. Therefore, ability to achieve lifetime dreams and aspirations of sporting success could be limited due to injuries. Sports injuries are not only associated with results of athletes and their teams, but also their long-term health, quality of life, socio-economic status, and consequently, the general financial burden on the society. It is well known that cost of injuries, due to treatment and rehabilitation, rapidly increase because the incidence of sport injuries is increasing. Recent research shows that injuries in Spain cause about 16% of season absence by football players which corresponds to a cost of 188 million euros per season. Additionally, Premier Football League clubs paid a total of 255 million euros to injured players during last season which is similar amount reported for NBA basketball players. The economic consequences are more serious for college and high school contact sports such as football, soccer, basketball, handball, etc. According to recent estimation, cost per year ranges from 400 million to 1.3 billion euros and from 4.8 to 17.2 billion euros in college and high school athletes, respectively. Consequently, many different prevention programmes and strategies were developed and implemented in practice to decrease overall injury rates in the last few decades. However, their outcomes and success rate were limited due to problem complexity. Existing literature is focused on mono-dimensional approach (i.e., use just one variable at a time to estimate injury risk) without fully exploiting the complex patterns underlying the available data. However, one of the key issues related to every injury is large number of fitness and performance input variables which can lead to athlete's injury. The major problems with such number of variables are: 1) how to combine all of them in one complex system to get certain answer, 2) how to value each variable in complex system, and 3) how to filter the most important variables for athletes' injury prevention. Therefore, key issue in the sports industry nowadays is the possibility to predict injury risk and performance due to economic and sport reasons. Mono-dimensional approaches are not effective in practice due to low precision (<5%). Therefore, multi-dimensional, easy-to-interpret and fully data-driven approach which predict injuries with a precision higher than 50% is urgently needed in sport industry. Moreover, there is a need to develop and evaluate the potential of statistical models suitable for injury prediction in athletes at all level to: 1) decrease injury incidence; 2) decrease cost of injuries in sports industry; 3) increase athlete's long term health status.

Keywords: artificial intelligence, athletes, incidence, injury rate

DIFFERENCES IN COORDINATION AND BALANCE BETWEEN MALE AND FEMALE ELITE SPORT CLIMBERS

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796.52-055.1

A very small number of authors studied coordination and balance as important motor skills responsible for success in sport climbing. Also, a small number of studies have been conducted on the differences between male and female sport climbers. The aim of this study was to determine the differences in coordination and balance between mele and female elite sport climbers. The research was conducted on 21 elite sport climbers (10 males aged 17.3±1.57 years and 11 females aged 16.0±1.55 years), Youth World Cup participants held in Arco, Italy. Study was carried out using six variables (three for the evaluation of the coordination and three for balance). The results indicate that globally there are no significant differences in coordination between male and female elite sport climbers, except in the coordination with a baton test in which men were statistically significantly more successful. However, there are statistically significant differences in balance at the multivariate level in favor of men, as well as in the Flamingo test, while the crosswise standing test on a balance bench was at the very limit of significance. These results probably point out at two more possible components in the specification equation that make male elite sport climbers still climb harder routes than female elite sport climbers.

Keywords: balance, coordination, differences, elite sport climbers

SEASONAL CHANGES IN OVERALL PERFORMANCE OF BASKETBALL PLAYERS

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796.015.52

Basketball players have been affected by very high internal and external loads during a competitive season. Complex, aerobic and anaerobic nature of basketball with performing variety of repeated high-intensity activities, high demands of the game and chaotic schedule lead to the appearance of great pressure to the Central Nervous System (CNS) and neuromuscular fatigue. Taken altogether it may negatively affect overall basketball performance during the season. The purpose of this systematic review was to summarize evidences for the changes on variables related to the basketball performance during the competitive season. Five electronic data bases (Google Scholar, PubMed, MEDLINE, ERIC, and Research Gate) were searched until the 5th of October, 2021. A search was conducted and search terms included 'intra-seasonal variations', 'basketball players', 'explosive power', 'strength, 'endurance, 'COD', 'specific basketball performance' and 'sprinting speed'. Inclusion criteria were controlled trials, basketball players, physical and basketball performance assessed pre- and post-season, with or without transition assessment. A systematic review of the available literature was undertaken in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. To determine the quality of each study, the Physiotherapy Evidence Database Scale (PEDro) scale was used. A total of 14 studies met the inclusion criteria. The total sample consisted of 461 basketball players from five different leagues. Twelve studies examined variability in the composition and physical abilities of basketball players. One study examined the variability of neuromuscular fatigue during the season and one study aimed to investigate the variability of game-related statistics. The analysis of previous research has shown conflicting and incomplete results. Basketball players increased the height of vertical jump, aerobic and anaerobic capacity during the season. Sprinting speed decreases as well as level of cognitive abilities and focus which may negatively affect the performance of technical and tactical elements. Also, reduced values of maximal strength, which is a consequence of the differentiation of those abilities that are more important for basketball success. Basketball players improved body composition, reduced the fat percentage and increased the percentage of lean muscle mass, while body mass remained unchanged at the final assessing. However, these changes depend on the rank of the competition, gender, age and whether the basketball players are starters or non-starters. Considering the fact that basketball is developing progressively, future studies are needed in order to implement an adequate training process.

Keywords: team sport, variations, explosive power, speed, agility

TEAM ASSOCIATION AND EFFECTIVE COMMUNICATION IN KORFBALL

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While there were a certain number of sports branches in the world in previous years and the number of people playing was limited, today there are various sports branches in the world. As the number of sports branches increases, the statistics of being played and watched for each also increase. Thus, every new sport branch finds itself in competition with others and tries to increases its visibility in order to be one of those sports. In this study, korfball, which is one of the developing sports branches, is evaluated in terms of sports management elements. The definition of the branch, its history, the way korfball is played, the field and material knowledge, its social impact, the economy of korfball in the Netherlands, which is the homeland of korfball, were examined. It is seen that korfball is a very popular branch in the Netherlands, where it emerged. In Turkey, korfball is a sport branch in the Emerging Sports Federation and its activities are being carried out. The main purpose of this study is to examine whether there is a gender difference in terms of "effective communication in team sports" and "team unity" in korfball, which is the only sport in which male and female athletes play together. In addition, descriptive analyses were made in terms of age groups, education levels and duration of involvement in korfball. Finally, the effect of "acceptance and positive conflict in effective communication" on team unity was examined with regression analysis. All 250 athletes from 12 korfball clubs in Turkey were reached. Statistical analyses were made with the data set of 133 athletes who responded. As a result, a significant difference was found in terms of gender and duration of interest in korfball sport. In addition, a weak relationship was found in the cause-effect relationship of the association and communication of the korfball players within the team. In this study, which was applied for the first time to korfball players in Turkey, high average values were obtained in terms of team unity and effective communication. In korfball, which is a versatile sport, the gains of the athletes are quite high. According to the results of this study, considering that women's effective communication skills are high, it can be recommended to increase the number of women in sports organizations and teams.

Keywords: korfball, effective communication, team unity, team sports

EFFECTS OF SHORT-TERM CIRCUIT TRAINING ON PHYSICAL PERFORMANCE IN YOUNG VOLLEYBALL PLAYERS

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The competitive advantage among the volleyball teams, regardless of the level of play, is largely dependent on the physical preparation of the team and single players. High-intensity interval training can improve performance in different sports. The purpose of this study was to determine the effects of 4-week circuit high-intensity interval training on physical performance in young volleyball players. Thirty-five male adolescents from two different clubs were included in the study, of whom 16 (Age: 14.7±0.6 years) went to a circuit training group and 19 (Age: 14.8±0.5 years) to a control group that maintained their usual volleyball training. The test battery consisted of anthropometric measurements (height, mass, BMI), and a number of physical fitness tests. The tests were completed over two consecutive days with a requirement that no physical activity be performed on the day before test day 1. First day assessment included body mass and height, sit ups, standing long jump, and medicine ball throw and the test day 2 was for Yo-Yo intermittent recovery level 1 test (YYIR1). A circuit training program was applied three times a week under the supervision of a researcher. One circuit of eight stations using body weight as resistance was developed, and then repeated twice in each session. Each station consisted of an exercise lasting from 15 to 25 seconds, and the rest time between them was 25 to 35 seconds. No significant changes were observed in both groups for body mass and BMI after the training intervention. However, after the training intervention, circuit training group showed significant ($p<0.05$) improvements in all the parameters analysed, medicine ball throw ($p=0.02$), standing long jump ($p=0.04$), YYIR1 ($p=0.02$) and sit-ups ($p=0.01$) compared with pre-test values. No significant changes ($p>0.05$) were observed in control group after the four weeks of regular volleyball training. The present study mainly aimed to evaluate the fitness effects of circuit training program compared with a volleyball programme in volleyball players. The results indicate that, in comparison to the control group, circuit training resulted in an improvement in physical performance in young players. There were no changes in body mass status, which could be due to a very short program the players were involved in. The results of this study showed that the implementation of circuit training into regular volleyball sessions seems to provide an appropriate stimulus for improving physical performance in young volleyball players compared with control group that was engaged only in volleyball training.

Keywords: strength training, adolescents, fitness, effects

BODY COMPOSITION AND STRENGTH OF BASKETBALL PLAYERS

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Basketball, as a team sport, requires a developed physical readiness in order to play a game successfully. In addition, motor abilities, changes in body composition and the growth of the body with maturation greatly affect the basketball game. The aim of the study was to determine how body composition affects the strength of basketball players. Nineteen basketball players, aged 14.10±0.55 years, with a sports experience of 6.77±1.25 years, participated in the research. All subjects were clinically healthy and had no serious injury in the last six months until the day of testing. Body composition (body height, body mass, body fat percentage, muscle mass percentage and body mass index) was determined using Omron BF511 bioimpedance device *(Omron Healthcare Co., Kyoto, Japan)* and Martin's anthropometer GPM 101 *(GPM GmbH Switzerland).* Explosive, repetitive and static strength were tested, with the help of specific tests. The relationship between body composition and strength was assessed using Pearson's coefficient of correlation and the statistical significance was set at $p<0.05$. Statistical procedures and analyses were performed using the statistical program IBM SPSS Statistics 20.0. The results of this study show a high correlation of body composition with strength variables. The greatest responsibility for the relationship among the variables had the results of body mass index ($p<0.01$, $p<0.02$, $p<0.05$), body fat percentage ($p<0.02$, $p<0.05$), then, body weight ($p<0.02$, $p<0.03$) and the variable that has the lowest correlation with strength variables is the percentage of muscle mass ($p<0.05$). The results of this study show a negative correlation between body mass index, body mass and body fat percentage with all strength variables, which proves that higher parameters of the previously mentioned variables, have decrease the effect on strength performance. One static strength variable was positively correlated with the percentage of muscle mass and this proved that a higher percentage of muscle can improve a certain part of static strength.

Keywords: body fat, body muscles, explosive strength, repetitive strength, static strength

EFFECTS OF EXERCISE PROGRAM ON DEVELOPMENT OF LOWER LIMBS' EXPLOSIVE STRENGTH IN TENNIS PLAYERS: A SYSTEMATIC REVIEW

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796.015.52

The aim of the research was to determine the effects of exercise programs on lower limbs' explosive strength in junior tennis players. For collecting of appropriate scientific researches from 2010 till 2021 the following keywords were used: tennis, eplosive strength, training and exercise program, motor ability- in three electronic databases (Google Scholar, KobSon, SCI index). Based on the keywords, the existing scientific researches have gone through three levels of selection in order to enter the final analysis. These analyzed researches are presented through five groups of parameters: authors of the research, sample description (sex, age and number), experimental treatment (description, frequency), measuring instruments and results. Only 10 researches have met the criteria, and the analysis shown that the exercise programs lasted from 6 to 8 weeks, with weekly training frequency between two and three times of 30 minutes, that is, as an addition to the training. Exercise programs that have been used for the development of lower limbs' explosive strength in tennis players were of plyometric type, with and without equipment. The tests, by which the assessment of the lower limb' explosive strength was determined, were: CMJ, CMJ (bilateral/unilateral), SJ, DJ and OLH. The results of the applied exercise programs have shown, in all of the analyzed researches, statistically significant progress ($p<0.05$). A lower-limb explosive strength represents a very significant segment within the basic motor skills of tennis players in the junior category due to the latent period of development period, but also to the pretensions of the increasing dynamism of the tennis game. In accordance with this, the research can help trainers to use the information for planning the development of the explosive strength of their tennis players, and for athletes to advance and manifest the maximum potential of this part of this basic motor space.

Keywords: plyometric training, training, basic motor skills of tennis players, jumps

DIFFERENCES BETWEEN PACING PARAMETERS OF ELITE MALE SPRINT SWIMMERS

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UDC 797.21

The main objective in competitive swimming is to complete the race in the fastest possible time. Pacing parameters are considered a key element in performance. Aim of this research was to determine the differences in drop off parameters between butterfly (Fly), breaststroke (Breast), backstroke (Back) and freestyle (Free) of elite male swimmers in 100 m events. The total sample of study subjects consisted of 64 male swimmers (top 16 finishers from all four stroke), participants of the 2019 World Swimming Championships. The variables analyzed in this study were: Lap_1 - first 50 m of the 100 m, Lap_2 - second 50 m of the 100 m, T100 - total time of the 100 m event and Drop_off - differential between first and second lap time (official results). All data were processed by one-way ANOVA. The results of the research showed that there is a statistically significant difference between the Fly and Back ($p<0.01$), Fly and Free ($p<0.01$), Brest and Back ($p<0.01$) and Brest and Free ($p<0.01$) in Drop off parameters. Based on the results it can be concluded that there is no statistically significant difference in pacing parameters between stroke where movements are performed together (Fly and Brest), also there is no statistically significant difference between stroke where movements are performed separately (Free and Back).

Keywords: world championships, swimming, drop off

MANIFESTATION OF LATERALITY ON LOWER EXTREMITIES IN ATHLETES

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In humans, laterality is manifested by the dominance of one hand, foot, eye, ear. Presence of laterality, caused by the specificity of one sport, can contribute to the development of asymmetry in muscular strength within the muscular system. The aim of this systematic review is to collect and analyse recent studies of the manifestation of laterality on lower extremities in athletes. The final analysis included 22 studies, published between 2017 and 2021. Most of the included studies followed differences between lower extremities in athletes by determining kinetics and kinematics parameters, and one part by determining strength. In almost each group of sports asymmetries between extremities are found. Recommendations for future research are to focus on finding causes of the prevalence of one side of the body and possibilities of neutralizing it.

Keywords: bilateral difference, leg dominance, preferred leg, unilateral and bilateral sports, asymmetry

INFLUENCE OF UPPER EXTREMITIES STRENGTH OF YOUNG GYMNASTS ON SUCCESS IN PERFORMING EXERCISES ON RINGS

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UDC 796.416.2

Artistic gymnastics is the most famous and widespread gymnastics sport discipline, and rings are one of the six apparatus of men's gymnastics all-around. The aim of the study was to determine the influence of the upper extremities' strength on success in performing exercises on rings of young gymnasts. The sample consisted of 13 male gymnasts, aged 14 to 16, who practice gymnastics from 8 to 13 years. The Japanese digital dynamometer IMADAZ2H-1100 with WinWedge 3.4 software was used to estimate the absolute strength of the upper extremities muscles. The values displayed on the digital meter represent the absolute value of the maximum strength. When the absolute value of the strength was divided by the body mass of the participant, relative values were obtained. Based on the obtained results, it can be concluded that absolute and relative strength of the upper extremities do not have a decisive statistically significant influence on success in performing exercises on rings of young gymnasts. The obtained results represents a good starting point for further research in which the influence of other muscle regions that are responsible for the successful performing of exercises on other gymnastic apparatus in all-around, on a larger sample and different ages, could be examined.

Keywords: artistic gymnastics, rings, strength

WHAT PHYSICAL CHARACTERISTICS DISTINGUISH GOOD AND POOR PERFORMERS OF SOCCER-SPECIFIC CHANGE-OF-DIRECTION TASK AMONG ELITE FEMALE SOCCER PLAYERS

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Soccer is an intense, multidirectional, and intermittent field sport. The distance covered in high-intensity and sprinting activities, as well as various explosive actions such as sprinting, jumping, tackling, and changing of direction (COD), appear to influence the outcome of games. Although COD could be related to other physical attributes, it was shown to be gender- and sports-specific. Given the great importance of COD ability in soccer performance, we aimed to investigate whether different functional tests may have an influence on COD in elite female soccer players. Thirty-six female soccer players of the Slovenian national team were recruited and divided into good (GP, N=18) and poor (PP, N=17) performance groups based on their scores at the recently developed soccer-specific COD task test. The linear sprinting speed (5m, 20m, 30m), COD, the countermovement jump (CMJ), the squat jump (SJ), the maximal isokinetic strength of the knee flexors and extensors, as well as the muscle contractile properties of the vastus lateralis (VL), rectus femoris (RF) and biceps femoris (BF) of both lower limbs were evaluated by using tensiomiography. Compared to PP, GP group showed better performance in 5m sprint [mean difference (MD) = 0.16m/s, p=0.019), 20m sprint (MD=0.35m/s, p=0.003) and 30m sprint (MD=0.37m/s, p=0.004), while knee flexion strength at 180°/s of non-dominant (Ndom) leg showed a tendency to significance (MD=0.11 Nm/kg, p=0.056). Of all parameters derived from tensiomyography, only the BF contraction time of the Ndom leg was shorter (MD=-3.88 m/s, p=0.026) in the GP compared to the PP group. The results of the present study indicate that the specific COD task is influenced by linear sprint ability as well as BF contraction time. This could be important information for coaches when planning a structured and progressive strength and conditioning training aimed at developing the physical qualities needed for successful soccer-specific COD task performance.

Keywords: soccer-specific COD, women's football, skeletal muscle contractile properties, neuromuscular assessment, TMG

SPECIFIC MOTOR SKILLS OF WHEELCHAIR TENNIS PLAYERS: A PILOT STUDY

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The aim of this research is to determine the difference in the specific motor skills of tennis players with disabilities with and without rackets in hand. The sample consisted of 10 respondents, tennis players with disabilities aged 19 to 44, with a training experience of one year in wheelchair tennis, Open category (according to the IPC and ITF classification). As a description of the sample of respondents, the parameters for the assessment of anthropometric characteristics of wheelchair tennis players- sitting height and body mass, as well as age are presented. To assess the specific motor skills of the respondents, the following parameters were measured with and without racket in hand: 5m wheelchair riding, 20m wheelchair riding, Slalom and T-test. The difference in the manifestation of specific motor skills of wheelchair tennis players with and without rackets was tested by the Student's t-test for small samples. The results of the t-test of dependent samples samples (results of specific motor skills tests of wheelchair tennis players with racket in hand vs. results of specific motor skills tests of wheelchair tennis players without racket in hand) showed that there is a statistically significant difference in all four applied tests of specific motor skills of wheelchair tennis players - dominated by better results in tests of specific mobility without rackets. The huge difference in values between the tests with and without the racket in hand speaks in favor of the fact that the sample of respondents is without much experience, because the racket in the hand is a "disturbing factor" and slows down the player's movements. Due to this huge difference it is necessary to pay special attention to racket movement training, which is a characteristic of a wheelchair tennis match, which is also the recommendation of modern research. The observed differences do not deviate from previous research.

Keywords: motor skills, tennis, people with disability

THE EFFECT OF SPORTSMEN'S EMOTIONAL INTELLIGENCE LEVEL ON THEIR COMMUNICATION SKILLS LEVEL

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The aim of the study is to evaluate and examine emotional intelligence and the level of communication skills of the athletes in team and individual sports such as track and field, wrestling, badminton, table tennis, soccer, basketball, volleyball and handball. Sample of the participants were 204 athletes who play team or individual sports in the amateur and professional leagues in various regions of Turkey. Research data were obtained by using Communication Skills Assessment (CSA) and Emotional Intelligence Inventory in Sports. Moreover, a Personal Information Form has been applied to obtain data about the participants' age, gender, sports category and education level status. SPSS 22.0 software package program has been used to analyse obtained data (descriptive statistics, t-test for independent samples, one-way ANOVA). The significance level has been determined as $p<.05$. The findings of the study indicated that communication skills level of the athletes has differentiated at a statistically significant level. In detailed of analysis the sub-dimensions of emotional intelligence in the communication principles and fundamental skills, and also in the assessment of their own feelings and the willingness to communicate, a significant difference has been observed (in favour to female athletes). Otherwise, related with the affective listening (non-verbal communication) sub-dimension, a significant difference has not been found. When speaking about Emotional intelligence levels of the athletes participating in the study in terms of gender variable, evaluation of the others' emotions, self-evaluation and emotion regulation sub-dimensions, significant difference was found (in favour to female athletes). Otherwise, within social skills and emotion use sub-dimensions, there was no statistically significant difference. Another variable, education level and communication skills comparison showed us significant differences, too. More educated athletes got more scores than less educated athletes. Education levels and emotional intelligence results indicated that there were statistically significant differences between education levels and emotional intelligence sub-dimensions. Last variable was sport category and there was not a single significant difference related to communication skills and emotional intelligence. As a result of this research, gender and education levels in terms of communication level and emotional intelligence have a statistically significant differences, while sports category variable did not cause a statistically significant difference.

Keywords: communication skills, emotional intelligence, team sports, individual sports

DIFFERENCE IN EXPLOSIVE POWER AND AGILITY BETWEEN FASTER AND SLOWER FOOTBALL PLAYERS AGED 15-18

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UDC 796.322-053.6

During the football match high-intensity activities occur approximately every 90 seconds, and the distance covered during the sprint (1.5 m up to 105 m) indicates that player is required both to accelerate and to develop a maximum speed. To the best of authors' knowledge, no study aimed to examine the explosive power (EP) and agility of football players when divided into groups of faster and slower players. In this regard the aim of this study was to determine the differences in explosive power and agility in faster and slower football players aged 15-18. The study involved 50 youth football players (16.4±0.9 yrs, 177.8±5.1 cm, 72.4±4.7 kg) competing in a top youth league. At the time of testing all respondents had training experience of 9±1.3 years and they were divided into two groups: faster players (n=25) and slower players (n=25). EP was determined by CMJ, CMJmax and SJ tests using Opto-jump (Microgate, Italy). Agility was assessed by T-test, Slalom, 4x5 m and 9-3-6-3-9, as well as running speed at 10 and 30 m using Witty photocell gates (Microgate, Italy). Significant difference on 10 m acceleration test have been observed in CMJ, SJ and T-test (p=.043, p=.041 and p=.022, respectively) and on a 30 m run test in CMJ, SJ, T-test, 4x5 m and 9-3-6-3-9 tests (p=.000, p=.002, p=.022, p=.000, p=.019, respectively). Also percentage difference is biggest in EP tests (SJ=11.18%; CMJ=11.96%; CMJmax=8.86%). Statistically, the difference is much more visible when the classification of players is done on the basis of 30 m running than when it is done based on 10 m acceleration. It can be concluded that there is a difference between faster and slower players in all of the tested parameters when the maximum speed is taken as a criterion. When it comes to acceleration of 10 m there is a statistical difference between faster and slower players in certain segments of EP, while the difference in agility parameters is questionable because only T-test showed a statistically significant difference. The main limitations of this study are sub-elite subjects and big difference between youngest and oldest player. Therefore, future studies should consider these limitations and divide players by playing positions.

Keywords: adolescents, speed, power performance, vertical jump, sub-elite players

EVALUATION OF MENTAL SKILLS AND COMPETITIVE ANXIETY IN AMATEUR SOCCER PLAYERS

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In every sport branch a psychological preparation has become as important as physiological preparation. In this context, the psychological skills used by the athletes directly affect their performance. In the light of this information the purpose of the study is to evaluate the mental skills and competitive anxiety level as well as their relationship in amateur soccer players. Sample of respondents constitutes 82 amateur soccer players, aged 18 to 39, of average body height 161.54 cm and average body mass 56.79 kg, who played in regional amateur league in 2020-2021 season. Research data were obtained by using Bull's Mental Skills Questionnaire and Sports Competition Anxiety Test (SCAT). Social science statistical package (SPSS) program has been used to analyse obtained data (descriptive statistics, Pearson's coefficient, t-test for independent samples, one-way ANOVA). The significance level has been determined as $p < .05$. Results showed that there was a significant relationship between mental skills and competitive anxiety in amateur soccer players in Turkey regional league. There were significant relationship between competitive anxiety and subscales concentration ability, anxiety and worry management, self-confidence, motivation and mental preparation ($p < .05$). There was no significant relationship between competitive anxiety and subscales imagery ability and relaxation ability ($p > .05$). It is confirmed that there is a correlation between mental skills and competitive anxiety in Turkish amateur soccer players. The major outcome of this research is a fact that there are relationships between mental skills and competitive anxiety in soccer players.

Keywords: mental skills, competitive anxiety, soccer

THE EFFECT OF MENTAL TRAINING ON MENTAL TOUGHNESS AND PROBLEM-SOLVING SKILLS

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Mental toughness and problem-solving skills are important features of elite athletes. Some studies are showed that mental training techniques are important to improve athletes' success in sport like meditation, imagery, focusing and breathing exercises. Athletes are hard workers and for reaching the higher level they need to train well physically and mentally. Physical preparation is necessary to perform in optimal level. But for elite performance athletes need to be ready mentally too. The purpose of this study was improvement of mental toughness and problem-solving skills in 82 athletes (age: 18.7 years) by mental training. Pre- and post-testing was applied before and after 12-week mental training program which comprised of breathing techniques, meditation, positive thinking, and heart rate variability (HRV) exercises. For this purpose, we used wearable devices to teach mental training skills and to see the results of physiological and mental abilities. Pre-test mental toughness score was 3.35 (total 37.12), and post-test score was 4.1 (total 46.25). Also, confidence, consistency and control score of the athletes were improved. Problem solving score was 88.75 (higher score is weak problem-solving ability) in pre-test, and 73.35 in post-test. There were significant differences between pre- and post-test score of problem-solving skill and mental toughness inventory. Confidence, control, and constancy level of players are improved after 12-week period of breathing, concentration, imagery, and mindfulness meditation training session. As previously confirmed mental training is very important for improvement of focusing, confidence, problem solving abilities, maintain concentration and stay calm, and our study shown that mental toughness and problem solving can be improved by meditation and mental training. These two features are important for the sport performance. Also, it is well known that meditation is important to cope with stress and anxiety, and athletes' concentration level has an effect on their performance, and it all can be improved by mental training.

Keywords: sport, sport psychology, mental toughness, problem solving, mental training

BODY COMPOSITION AND MOTOR SKILLS OF BASKETBALL PLAYERS

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Basketball is a popular sport, and the fundament of that popularity is based on pronounced attractiveness, game dynamics, and unpredictability. Often the game itself requires a lot of short sprints and a lot of changes in the movement direction in a small space. In addition to good motor skills, for players to satisfy all the requirements of a modern game, it is necessary to have a particular body composition that can contribute to the game one-on-one. This study aimed to determine the influence of body composition on the motor abilities of basketball players. A total of 25 basketball players participated in the research. Agility assessment was carried out by the following tests: T-test, Zig-zag test, and Slalom test. For speed assessment, running speed was measured at 5, 10, and 20 meters. Body height, body mass, Body Mass Index, percentage of muscle tissue, and percentage of adipose tissue were measured (calculated) for the body composition assessment. The Kolmogorov-Smirnov test was conducted to confirm the data's distribution normality. The relationship between body composition and motor abilities was assessed using Pearson's coefficient of correlation. We can conclude from the results obtained, that there is a statistically significant correlation between body composition and motor abilities. Statistically significant negative correlation was achieved between percentage of muscle tissue and following tests: Zig-zag ($p=0.008$), Slalom test ($p=0.000$) and running speed tests at 5m ($p=0.000$) and 10m ($p=0.000$). The percentage of adipose tissue was positively related to T-test ($p=0.007$) and Slalom test ($p=0.018$). A positive correlation was also found between the percentage of adipose tissue and the running speed tests at 5m ($p=0.003$) and 20m ($p=0.005$). BMI achieved a statistically significant positive correlation only with the T-test ($p=0.006$). The percentage of body fat and body mass index adversely affects the results of agility. Consequently, we can improve the player's skills by improving body composition. The results emphasize the importance of muscle development because the percentage of muscle mass improves agility and speed results in basketball players.

Keywords: muscles, association, strength, speed, agility

DIFFERENCES IN EXPLOSIVE STRENGTH IN ATHLETICS AND VARIOUS SPORTS: A SYSTEMATIC REVIEW

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Explosive power is defined as an ability of short-term maximum muscular force to accelerate the movement of a body or it's parts. In most disciplines of Athletics, the basic criterion of success is the development of the greatest possible reactive force in the shortest possible time of contact with the ground. The aim of this review is to determine the differences in the explosive strength of the lower extremities of athletes who train Athletics and athletes from other sports. For analyzing the adequate literature the following electronic databases were searched for papers published between 2002 and 2020: PubMed, MEDLINE, Google Scholar, ScienceDirect, and Embase. The following terms were combined to design the search strategy: explosive strength of lower extremities, athletics, countermovement jump, tensiometer platform and vertical jump. Included studies were uncontrolled randomized and non-randomized transversal and longitudinal studies that examined the explosive power of the lower extremities in athletes (Athletics) and other athletes using a variety of tests. The included respondents are top athletes of both gender, aged 15 to 35. Of the 578 studies, through elimination and selection based on inclusion and exclusion criteria, 20 studies were selected. Athletes generate greater strength and power than all other subjects of other analyzed sports, for the values of drop jump from the height (60 cm, p=.01). Athletes need less time at the moment of impulse than other groups of athletes, as well as less time for amortisation. Drop jump (60 cm) parameters show that there is a negative correlation for force, reaction time, strength and jump height (-0.4 up to -0.81, p=.001). In sports that are explosively demanding, with the help of various tests, it has been established that athletes have the best values of contact parameters in relation to other sports.

Keywords: explosive strength, athletics, countermovement jump, tensiometer platform, vertical jump

ANXIETY AND COPING IN WATER POLO REFEREES

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Referees in sports have a significant role and, therefore, a huge responsibility. Responsibility is a permanent source of stress. As a result, it is important to understand psychological factors related to coping with stress. The main objectives of this study are to determine which stress coping tactics are most pronounced in more and less experienced water polo referees, and to determine the relationships between anxiety as a trait with specific coping styles. The research was conducted on a sample of 30 water polo referees, of which 16 do this job for more than 5 years, and 14 for less than 5 years. Verified questionnaires were used – COPE and AT29, and Pearson's correlation coefficient and t-test were used as statistical procedures. The results show that there is no difference in anxiety between more experienced and less experienced referees, and that anxiety is associated with different coping strategies- with some the correlation is positive (Focus on and Venting of Emotions Mental and Behavioral Disengagement и Alcohol/Drug Use) and with others negative (Active Coping, Planning, Seeking Instrumental Social Support and Positive Reinterpretation and Growth). Inexperienced referees will more accept the stressful situation as it is, more experienced will seek help from other people. Differences between more and less experienced referees indicate that beginners should improve the use of social support in stressful situations.

Keywords: water polo referees, anxiety, stress

STRUCTURE OF ACHIEVEMENT FACTORS IN RHYTHMIC GYMNASTICS: RULES OF ASSESSMENT AND CURENT PERCEPTIONS

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UDC 796.412

There are different classifications of sports and disciplines. The division into individual and team sports is considered basic. From the aspect of all divisions, they are mainly bipolar as opposed to the psychological typology of sports activities, where certain individual sports belong to the group of aesthetic-coordination ones. Rhythmic gymnastics (RG) is also included in this group of sports, as the most typical representative, where polystructural movements, mostly of the acyclic type, predominate. Activities in RG take place in several disciplines with different apparatus (rope, hoop, ball, clubs and ribbon) or without apparatus in younger age categories. In each discipline, a multitude of elements are performed, which differ from each other according to their structural groups, although exercises of dynamic character prevail over static ones. Previously, the structure of sports achievement was determined on the basis of the so-called "Equation of specification" which was based on determining the contribution of certain segments of the anthropological status of athletes in the projection of sports results. In sports where the achievement is determined according to the subjective assessment of the assessor, its structure is mostly seen through the Rules of assessment. The decisive factors that prevail in the structure of sports achievement in RG, based on the Rules of Assessment, which accurately considers the difficulty of the elements for assessment of free ensembles, musical accompaniment, and the appearance of the rhythmic gymnast through the artistic impression of the gymnast. In general, it can be said that RG is a sports activity in which a perfect symbiosis of movement and music is achieved, with a high aesthetic impression when performing free ensembles. These characteristics are also present in other sports from this group, with similarities in the methodology of training the elements of technique and the way of assessing the achievements of athletes. Looking at certain segments of the anthropological status of rhythmic gymnasts, the basic determinants of sports achievement are pointed out, viewed, above all, from the aspect of assessment rules, which has undergone major changes in recent years to encourage the rapid development of RG and its inclusion in the Olympic sports family.

Keywords: analysis, development, determinants, success, rhythmic gymnasts

CORRELATION OF BODY COMPOSITION WITH ISOMETRIC FORCE OF SELECTED JUDOKAS

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This research aimed to determine the relationship between body composition and isometric force of selected judokas. The study was carried out on a sample of 25 judokas of the cadet and junior categories, members of the men's national team of Serbia. To analyze body composition the In Body 720 device was used, along with a caliper. Isometric force was measured by using handgrip test and tests for isometric force of back and legs. The basic parameters of descriptive statistics were calculated for each of the variables. The canonical correlation analysis was calculated to determine the correlation between the body composition and tests of isometric force. The research results have indicated that the relation between body composition and the parameters of isometric force has one statistically significant factor with a high canonical correlation of .97 (Canonical R .97), which is explained with 94% of the overall variability (Canonical R^2 .94) and is statistically significant at the $p < .05$ level.

Keywords: body composition, isometric force, judo

IMPROVING PERFORMANCE OF ARCHERS WITH HRV TRAINING

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UDC 799.3:159.9

Archery is a sport in which archer must be very calm, focused, and controlled both physically and mentally. For this reason, archers try to keep their heart rate low and practice breathing techniques to increase their performance. Their goal is always to hit the target 10 points and reach total score of 300. The purpose of this study is to examine the effect of 8 weeks of HRV (heart rate variability) training on archers' training score (they trained 3 days/week for 2 hours/day, on average). To measure their improvement we collected archers' average training shooting score. Data collected from 35 experienced archers (at least four years in sport), 18 male and 17 female archers, with an average age of 15.45. We used Hearth math– Inner balance device for heart rate variability training. Resting coherence 1.1 and heart rate 78. Coherence during practice 0.7, heart rate 105. Shooting score was 272. After 8-week HRV training program an average score was 286, resting coherence 1.5 and heart rate 74; coherence during practice 1.2 and heart rate 93. The 8-week HRV training was effective on average coherence and heart rate, and the average score of archers improved by 14 points. The results shown that HRV training is effective on archers' performance by improving archers' physical and mental abilities and therefore their score.

Keywords: sport, archery, heart rate variability, mental training, sport psychology

Physical Activity and Health

THE EFFECTS OF HIGH-INTENSITY INTERVAL TRAINING PROGRAMMES WITH DIFFERENT FREQUENCIES ON BODY COMPOSITION AND BLOOD LIPIDE PROFILE IN PHYSICALLY ACTIVE MALES

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High intensity interval training (HIIT) is a time-efficient and enjoyable method of exercise improving both health and performance related parameters. Indeed, HIIT has been reported to result in more fat loss compared to traditional endurance training. Possible reasons for this effect are higher metabolic rate up to 48 hrs after training and higher fat oxidation due to increased total energy expenditure during HIIT. It is also well documented that HIIT leads to improvement in blood lipid profile. However, there is limited study comparing the frequency of HIIT sessions on health-related variables. Thus, this study aims to compare the effects of HIIT programme with different frequencies on body composition and blood lipid profile in physically active males. Twenty-six young physically active males [age: 20.1±2 yrs; height: 176.1±5.13 cm; weight: 72.8±7.5 kg; body mass index (BMI): 23.5±2.0 kg/m^2; body fat percentage (BF%): 19.0±4.4 %] were randomly divided into three groups (HIIT2, n=9; HIIT4, n=9; Control, n=8). HIIT2 and HIIT4 groups participated in a 6-week HIIT programme 2 or 4 times per week, respectively. HIIT consisted of standard Wingate protocol with 2 min recovery intervals, gradually increasing from 4 sets/session at week 1 to 9 sets/session at week 6. Control group did not change their routine exercise programme. DXA derived body composition (body weight, fat mass, soft lean mass, BF%) and blood lipid profile (total cholesterol, triglyceride, high-density lipoprotein, low density lipoprotein) were determined before and after the HIIT programme. A 5-day nutrition records were taken at the beginning, middle and end of the programme. Effects of the treatments were compared by Analysis of Covariance (ANCOVA) by inserting the pre-tests as the covariate. Repeated measure ANOVA was used to compare the nutrients and energy intakes throughout the study. No significant difference was found between the experimental groups either in body composition or blood lipid variables ($p>0.05$). Nutrients (protein, fat, carbohydrate) and energy intakes (kcal) were similar at three time points of the study for all three groups ($p>0.05$). Six weeks of HIIT either 2 or 4 times per week did not change body composition or blood lipid profile in physically active young males. Considering that the participants' body composition variables and blood lipid profile at baseline were within the normal ranges this finding is not surprising. On the other hand, considering possible increase in energy expenditure due to HIIT, and that energy intake did not change throughout the study we were expecting an energy deficit and thus weight loss. However, as we did not determine energy expenditure we do not know whether energy deficit occurred during the study or not. In conclusion, short term HIIT training either 2 or 4 times per week did not change body composition or blood lipid profile in physically active young males.

Keywords: blood lipid profile, cholesterol, triglycerides, frequencies, HIIT

RELATIONSHIPS BETWEEN LEVELS OF PHYSICAL ACTIVITY AND MORPHOLOGICAL CHARACTERISTICS OF CHILDREN

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Regular physical activity in early childhood is an important component, crucial for the physical and psychological development of children, for healt maintaining, and it is related to a large number of anthropological characteristics and abilities. The aim of the study was to determine the relationships between the levels of physical activity and morphological characteristics of children aged 12-13 years. The sample of respondents consisted of 97 students (47 boys and 50 girls) from the Elementary School "Bora Radić" from Bavanište, aged 12 and 13. The following variables were used to assess morphological characteristics: body mass, upper arm circumference, lower leg circumference, and body fat percentage. The level of physical activity was assessed using the FELS questionnaire. Data processing was realized using the statistical processing program Statistica 8.0, and canonical correlation analysis was applied to determine the relationship between the level of physical activity and morphological characteristics. Based on the obtained results it can be concluded that there is a negative correlation between low levels of physical activity and morphological characteristics, with the greatest correlation between total physical activity and the percentage of body fat (p=.000).

Keywords: physical activity, morphological characteristics, children

PHYSICAL ACTIVITY IN THE TREATMENT OF DIABETES MELLITUS

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Being engaged in physical activities, particularly those well organized in the form of a training program, can improve the health of people with diabetes mellitus to a great extent. This systematic review is aimed at analyzing recent scientific research data on a given topic and thus gain new knowledge about the benefits of physical activity to provide better control of the disease and hence, the better quality of life of patients. The results of the research analyzed in this paper were collected after searching the following electronic databases: *Google Scholar, PubMed, SCindeks, Medline*. The search was conducted on all the papers published in leading journals, in the medical science and sports science field. Then, the papers were selected based on the frequency of keywords and their combinations: *diabetes mellitus, cardiorespiratory fitness, prevention, training, nutrition* (in Serbian and English). A total number of 132 studies were identified, 20 of which (10 male, 1 female and 9 studies of both sexes) were selected and systematically reviewed and analyzed. There were 1254 respondents in total, 585 females and 669 males who were over 30 years old. Based on the results, we can conclude that in all of the 20 selected studies, there was a positive effect of physical activity, i.e. training, on the health condition of people with diabetes mellitus. Physical exercise of aerobic type, accompanied with a proper and moderate diet, has a strong influence on the prevention and treatment of type 2 diabetes and is the essential tool in the fight against the disease.

Keywords: diabetes mellitus, cardiorespiratory fitness, prevention, training, treatment

HEALTH BENEFITS IN MASTER ATHLETES

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UDC 796.032:613

Age-related declines should be studied in older under ideal conditions– master athletes. The master athlete is typically defined as older than 35 years who either trains for or takes part in athletic competitions. Therefore, we will present results of three studies reporting health benefits of master athletes (Ireland et al., 2020, 2021; Šimunic, Pišot, Rittweger, & Degens, 2018). Alltogether 706 participants (311 men; aged 35–90 years) were recruited. From the 176 male and 151 female master athletes, groups of power and endurance master athletes were formed. Data of non-athletes (N=379) were obtained from the population studies. Studies were approved by the Republic of Slovenia National Medical Ethics Committee and written informed consent was obtained from all of the participants. Muscle tensiomyography was obtained from cross-sectional data in vastus lateralis, biceps femoris and gastrocnemius medialis; whereas, lower limb muscle function was assessed using jumping mechanography. Tibia and fibula bone mineral content was assessed from longitudinal data at distal (4% distal-proximal tibia length) and proximal (66% length) sites using peripheral quantitative computed tomography. From tensiomyography we found an age-related slowing in all muscles, irrespective of discipline, where endurance master athletes had the longest and power master athletes had the shortest contraction time. Jumping data revealed that peak relative power, relative force and jump height declined with time. Peak power, force and height were greater in power than endurance athletes. Tibia and Fibula bone mineral content was affected by time, dependent by sex and discipline. Male gender and participation in power events was associated with better maintenance of bone mineral content at both sites. The longer contraction time, obtained by tensiomyography, in endurance master athletes than in non-athletes suggests that regular endurance sport activity aggravates slowing of skeletal muscles during aging. Here we suggest that this may be related to their high proportion of type I and IIa fibers that have been reported to exhibit an age-related slowing independent of shifts in myosin heavy and light chain composition. Similarly, advantages in lower limb muscle function in power athletes were maintained with time. Results suggest that male athletes and those participating in lower limb power-based rather than endurance-based disciplines have better maintenance of bone mineral content.

Keywords: skeletal muscle, bone mineral content, countermovement jump, tensiomyography

INFLUENCE OF MUSCLE EXERCISE PROGRAMS ON THE FUNCTIONAL STATE OF THE ORGANISM IN OLDER AGE

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In order to determine the impact of the program of exercising muscle abilities on the functional state of the organism in old age, which is the main goal of our study, we reviewed the researches of available journals in the field of sports sciences. The problem of the paper was the collection of literature data and the analysis of the results and conclusions reached by the authors of the research. Muscle strength, muscular (local) endurance and flexibility, as the main components of muscular abilities, are directly related to the health and functional state of the organism in old age. In research on older subjects, the combination of strength training and endurance was equally effective for both strength development and endurance development. The authors conclude that this type of exercise can be more effective, when the most functional physical condition needs to be achieved, in comparison to programs that encourage the development of one ability only. In order to preserve strength and vitality in old age and live well during retirement days, it is best to start maintaining fitness while still young. With regular muscle exercise, a good hereditary basis and a careful diet, one can live a quality and long life.

Keywords: exercise, muscle strength, old people

BODY COMPOSITION IN PE STUDENTS: GENDER DIFFERENCES

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It has been confirmed many times that physically active people are characterized by "positive", i.e. medically desirable body composition. PE students, in addition to being selected from the population of athletes before the start of their studies, they have a lot of practical classes during the studies, so it can be said that these are young people with a physically active lifestyle. The main objective of this research was to examine and compare body composition of 24 male and 59 female PE students, aged 18-25. Their baseline characteristics (age, body height and mass, body mass index and resting metabolic rate) were established, as well as their body composition (percentage of fat and muscle tissue, and visceral fat level). The data were analyzed (descriptive statistics, Kolmogorov-Smirnov test, Mann-Whitney *U* test) using SPSS 21.0. Research results showed the presence of statistically significant gender differences ($p<0.001$) which are in favor of male students when it comes to percentage of muscle tissue (M: 40.6%, F: 28.6%), so as visceral fat level (M: 5.9, F: 3.6), i.e. "in favor" of female students when it comes to percentage of body fat (M: 19.6%, F: 31.9%).

Keywords: fat tissue, muscle tissue, visceral fat

SERBIAN UNIVERSITY STUDENTS' ATTITUDES TOWARDS SPORT INFLUENCE ON HEALTH AND IMPROVEMENT OF MENTAL HYGIENE: A SYSTEMATIC REVIEW

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The aim of this review was to establish the university students' attitudes towards sport influence on health and improvement of mental hygiene among student population in the Republic of Serbia. Gathering of published researches was done in the following electronic databases: PubMed, SCIndeks, PEDro, J-GATE, DOAJ and Google Scholar. The search was limited to articles published from 2011 till 2019 by using the following keywords: university sports, young adult population, health promotion, mental health, life habits. The final analysis included ten researches. Analyzed researches have shown that the complexity of the transition period from high school to university and the accumulation of academic obligations combined with bad life habits (sedentary lifestyle, smoking, alcohol, drug use, improper and irregular diet), may lead to stress and psychophysical disorder of health in student population. Reasons for students` physical inactivity and the existing trend of aerobic fitness decreasing are different- from poor information on sports and recreational activities at university to reduced students` interest for extracurricular and recreational activities.

Keywords: opinion, physical activity, students, university sport, healthy lifestyles

INFLUENCE OF WII BALANCE BOARD ON BALANCE AND RISK OF FALL IN OLDER ADULTS

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Recently there has been an increase in research showing significant improvements and positive effects in maintaining balance and reducing the risk of falls in elderly by exercising through virtual reality in which the WiiFit package, whit Wii balance board included, occupies a very important place. The aim of this article is to identify, evaluate, and summarize the findings of all relevant individual studies over the impact of the Wii Balance Board exercise program on changes in balance and reducing the risk of falls in community-dwelling older adults. The following electronic databases were searched for collecting literature: Google scholar, PubMed, Medline and SCIndeks. Supplementary literature in the form of available textbooks was also used. The searched papers were published in the period from 2010 to 2020. For the purposes of this research, five papers related to the title of this paper were selected. The examined variables were: References, Sample of respondents, Experimental treatment. The number of subjects who were included in a particular treatment ranged from 6 to 41. The age of the subjects ranged from 65 to 84 ±5 years. In all five studies the subjects were both male and female. By analyzing the articles in this systematic review study, it can be concluded that, after the exercise programs, the respondents showed better results in testing variables except in one study where no statistically significant changes were found for any outcome measure.

Keywords: Wii Balance Board, balance, risk of fall, tests, community-dwelling older adults

UNIVERSITY STUDENTS AND THE FIRST WAVE OF COVID-19 LOCKDOWN EXPERIENCE– SLOVENIAN, SERBIAN AND CROATIAN CASE

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The authors present results of a field research conducted among university students, with focus on subjective perceptions of possible changes in daily life practices [physical activity (PA), nutrition, sleep, study, leisure time], caused by restrictive measures during the first wave of the COVID-19 pandemic. A mixed methods (quantitative and qualitative) study was conducted in Slovenia, Serbia and Croatia, as online survey (N=1055) and semi-structured interviews [N=30, 15 males, 15 students of sport-related study programs (SSP)]. The research has been conducted from 15th of April to 27th of July 2020. The results indicate changes in daily practices of the majority of the students interviewed. All students spent most of their time at home with family. This directly impacted the decrease in PA, increase in junk food consumption, and increase in screen time. The results of qualitative research indicate that students went to bed later, woke up later, but also that the quality of sleep was worse than before restrictive measures. The results show significant changes in the students' daily routines. As a negative consequence of such changes, they pointed out a lower intensity of physical interaction with other people, which they "compensated" with communication via online platforms, sedentary with increased consumption of junk food. However, some of students reported that the quality of family relations improved, they had acquired new habits and skills and adopted a healthier eating routine. This study contributes to understanding of psycho-social consequences of the above-mentioned restrictive measures for a group of university students. In terms of methodology the authors emphasize the importance of using of mixed methods in researching the changes in students everyday life, because due to complexity of the topic, using only quantitative or qualitative research techniques would leave certain segment of changes undiscovered.

Keywords: everyday life, habits, university students, Mix method, COVID-19

EFFECTS OF ZUMBA TRAINING ON BODY COMPOSITION OF WOMEN

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As an alternative to the traditional approach to physical exercise, new types of organized physical activity have been developed, designed for attracting as much of population as possible. Zumba fitness is extremely popular among them, with an increasing number of participants. This type of fitness can be considered an effective type of physical activity that can improve aerobic capacity. Small but positive benefits have been reported with weight loss and other body measurements, as well as with muscle strength and flexibility. Further, after Zumba fitness program, other effects were found, including psychological and social benefits on quality of life. The aim of this research review is to determin the impact of Zumba Fitness trainng on body compostion of women. Five clinical databases were searched (Google Scholar, PubMed, SCindeks, Medline, Research Gate), and to be included the articles had to met some criteria: studies published between 2000 and 2020, longitudinal studies, healthy female participants who train zumba, aged 19 to 62. A total number of 248 studies were identified, 15 were included in this research. The results showed that zumba fitness training has a significant effect on reducing the percentage of body fat in women, body mass index, the ratio of waist and hips. However, there is no significant effect on protein mass in overweight women. In relation to the results, it would be interesting to compare the effectiveness of the application of zumba fitness programs in relation to other fitness popular contents.

Keywords: zumba fitness, body composition, effects of exercise

Physical Education

THE CORRELATION BETWEEN MORPHOLOGICAL CHARACTERISTICS AND MOTOR ABILITIES IN NINE-YEAR-OLD GIRLS

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Special interest in scientific research is related to the relations between nutritional status and motor abilities in children of different age. Excess mass and higher development of subcutaneous fatty tissue in children are associated with lower levels of functional motor abilities. The aim of this study was to determine whether there is a connection between morphological characteristics and motor abilities in normal and overweight nine-year-old girls. The sample consisted of 85 third grade female students of elementary schools in the town of Niš. After measuring body height and weight and calculating BMI according to Cole et al. (2000), two sub-samples were formed: normal weight (n=58) and overweight (n=27). The morphological characteristics were determined by measuring 16 parameters of longitudinal, transversal, circular dimensionality and body mass, and subcutaneous fatty tissue by measuring skin fold thickness. For the assessment of motor abilities (explosive strength, coordination and speed), a battery of nine tests was applied. Relations between morphological characteristics and motor abilities were assessed by a canonical correlation analysis. The results of canonical correlation analysis indicate that the connections between morphological and motor areas aren't statistically significant in both groups ($p>.05$). Thus obtained results suggest that the level of motor abilities in normal and overweight subjects doesn't depend on their morphological characteristics.

Keywords: prepubescent age, morpho-motoric status, nutritional status

STUDY REGARDING HOW THE PHYSICAL EDUCATION LESSONS ARE CONDUCTED IN A RURAL ENVIRONMENT, CONSIDERING THE COVID-19 PANDEMIC

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This paper aimed to identify the way in which the physical education classes are conducted in a rural environment during the Covid-19 pandemic. Before the academic year of 2020-2021, solutions were searched to increase the quality of e-learning and face-to-face learning but also to ensure safe conditions for the pupils and the teachers. One of the solutions that were used was the color system, divided into three scenarios. Scenario 1, or green scenario, was used in the areas where the rate of infection was under 1 per thousand population. This scenario let all pupils participate in their classes in person, every day. Scenario 2, or yellow scenario, was used in the areas where the rate of infection was between 1 and 3 per thousand population. This scenario used the hybrid method, meaning the group of pupils was divided in two, and the face-to-face learning is performed by rotation, once every week or two. The pupils who weren't physically in class had online classes. Scenario 3, or red scenario, was used in the areas where the rate of infection was over 3 per thousand population. Here, every class was conducted online. On February 8, 2021, a new model was made to include the scenarios in schools. The first scenario (green) was applied in the areas where the SARS-CoV-2 rate of infection was up to one per thousand population. All pupils are physically present in class. The second scenario (yellow), was used in the areas where the rate of infection was over one per thousand population. Here the children's physical presence is required for kindergarten, primary school and terminal grades (eighth, twelfth). The third scenario (red) was applied in the case of over three per thousand population. Here, the ones whose physical presence is required are kindergarten, primary school and terminal grades (eighth, twelfth) pupils. The classes are conducted 100% online only when the rate of infection is over six per thousand population. One year after the pandemic started, over 168 million children, in Romania, were doing e-learning, while 214 million, meaning 1 in 7 pupils was not able to participate in three quarters of the face-to-face classes.

Keywords: pupils, Covid-19, rural environment

COORDINATION ABILITIES OF CHILDREN IN THE PHYSICAL EDUCATION CURRICULUM FOR ELEMENTARY SCHOOLS

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UDC 371.214.41:796.012:373.3

This article reports about coordination abilities of children in the elementary schools and the reason why physical education curriculum with extracurricular activities is efficient. The scientific research used different groups of female children with extracurricular activities. All of the students attended their obligatory physical education classes twice a week. The sample of participants in this research was 73. The participants were divided into two groups: the first group consisted of 41 and the second of 32 Serbian female elementary school students. The students' age ranged from 10 to 12 years and artistic gymnastics was their sport of choice in elementary school. All of the students participated in their sport of choice for at least one year, and three years at most. The sample of variables consisted of anthropometric and motor variables. For the assessment of motor coordination abilities, a battery of tests consisting of six measuring instruments that cover the field of coordination in rhythm, movement frequency speed, and agility was applied. The differences in anthropometric measurements of the female students from different groups show that there is a statistically significant difference at the significance level of 100% on both tests (VISI= .000, TEZI= .000). The differences in coordination in rhythm among is a statistically significant in 100% for the Rolling and walking exercises along a line accompanied by asymmetrical hand motions (KHAR= .000), while for Arrhythmic hand drumming, there were no statistically significant differences (NBUR= .320). Differences in the movement frequency speed can be seen at the significance level of 100% on both tests (TAPR= .000; TAPN= .000). The differences in agility between the female students from two different groups can be seen at statistically significant level of 100% on both tests (RBNR= .002, LECS= .000). The female school children who opted for an additional class had greater affinities and interest toward training artistic gymnastics, which indicate the obtained results: they all scored better results in five out of the six applied tests. Informed by these findings, we conclude that concept of classes designed for a selected sport in the elementary schools of the Republic of Serbia has proven to be quite successful due to the improvements in physical activity and self-awareness of the concept of sports activities of the female students, which later scored higher results at school competitions.

Keywords: coordination abilities, elementary school, extracurricular activities

TWELVE WEEKS OF GAME-BASED SCHOOL INTERVENTION IMPROVES PHYSICAL FITNESS IN 12-14 YEARS OLD CHILDREN

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796.034.4

The level of physical fitness among children of young age has significantly reduced over the years. The purpose of this study was to determine the effects of a 12-week game-based school intervention on physical fitness in adolescents. Sixty-four adolescents from different school classes were included in the study, of whom 32 (age: 12.7±0.6 years) went to a game-based training group and 32 (age: 12.8±0.5 years) to a control group that maintained their usual physical education (PE) activities. The test battery consisted of anthropometric measurements (body height, body mass, BMI), and a number of physical fitness tests (vertical jump, standing long jump, throwing medicine ball and bent arm hang). A game-based training program was applied during the PE classes under the supervision of assistants. One session of game-based training included combination of small-sided games from football, basketball, handball and volleyball. Each station consisted of playing different sport lasting from 8 to 10 minutes. No significant changes were observed in both groups for body mass and BMI after the training intervention. However, after the training intervention, game-based group showed significant ($p<0.05$) improvements in all the parameters analysed, vertical jump ($p=0.01$), standing long jump ($p=0.01$) medicine ball throw ($p=0.01$), and bent arm hang ($p=0.01$), compared to the control group. The present study mainly aimed to evaluate the fitness effects of school game-based intervention program compared with an established standard PE programme in school children. The results indicate that in comparison with normal PE classes, game-based training resulted in an improvement of physical fitness in school children. There were no changes in body weight status, which could be due to a very short program the students were involved in.

Keywords: small-sided games, adolescents, class, effects

PHYSICAL EDUCATION TEACHERS WORK ALIENATION DURING THE CORONA PANDEMIC

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This research was carried out to examine the perceptions of work alienation of physical education teachers in Turkey according to different variables during the covid-19 pandemic that affected the whole world. The data were obtained from 442 volunteer physical education teachers working in different provinces of Turkey in the 2020-2021 academic year, and collected with the "Physical Education Teacher Work Alienation Scale" developed by Temel, Mirzeoğlu and Mirzeoğlu (2010). The research was carried out in the survey model. The scale, which consists of 38 items in total, consists of the sub-dimensions of meaninglessness, powerlessness, alienation from physical education teaching and professional isolation. In the analysis of the data, t-test was used for pairwise comparisons and one-way analysis of variance (ANOVA) for multiple comparisons. According to the research findings it has been determined that physical education teachers' work alienation levels ($\bar{X}$ 2.046) have been low. When the sub-dimensions were examined, it has been determined that the levels of work alienation in the dimensions of occupational isolation and powerlessness are higher than the other sub-dimensions. It was found that the level of work alienation of the participants did not differ statistically in terms of gender, marital status, and the school they worked at. However, it has been determined that the level of Meaninglessness and Occupational Isolation increases as the age progresses, and the level of Meaninglessness dimension increases as the service year progresses. When the education status variable was examined, it has been determined that the level of work alienation is higher for those who have completed postgraduate education in the dimensions of Powerlessness, Alienation from Physical Education Teaching and Professional Alienation. Considering the results of a similar study conducted before the Covid-19 outbreak, it can be stated that the covid-19 pandemic did not have a significant effect on the alienation of physical education teachers from work and that the alienation from work in physical education teachers was caused by structural problems rather than events covering a certain period of time such as pandemic.

Keywords: work alienation, physical education teacher, covid-19

Interdisciplinary

CANNABIS USE IN ATHLETES: A 2021 PERSPECTIVE

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UDC 796.42:615.035.3"2021"

Cannabis contains in excess of 100 cannabinoids, phytocannabinoids, naturally occurring terpenes, flavonoids, and other chemical compounds, but its most important constituents are two cannabinoids: tetrahydrocannabinol (THC) and cannabidiol (CBD). According to the Code and List of Prohibited Substances and Methods for 2021, all cannabinoids except for cannabidiol are prohibited for use in competition. The detection of tetrahydrocannabinol in urine at a concentration greater than 180 ng/mL during analytical testing represents an adverse analytical finding, or so-called "a positive doping test". Existing research has shown that cannabidiol has anti-inflammatory, immunomodulatory, anxiolytic, antidepressant, and neuro-protective effects, which is why it could potentially be useful for athletes. However, the currently available scientific evidence is preliminary, at times inconsistent, and mainly based on preclinical studies carried out on lab animals. Using products containing cannabidiol in the field of sports medicine is at this time risky, since there are no sufficiently clear standards in the production process that would guarantee the purity and quality of the product. This is particularly important for athletes taking part in competitions, as well as for antidoping activities. We believe that the best strategy for prevention is the avoidance of all products which contain cannabidiol, since this prevents any unintentional doping caused by contaminated products.

Keywords: cannabidiol, analytical testing, antidoping

EFFECTS OF ORAL SUPPLEMENTATION WITH PLANT SUPEROXIDE DISMUTASE EXTRACT ON COUNT OF LEUKOCYTE AND ITS SUBPOPULATION IN ELITE ROWERS: A PILOT STUDY

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UDC 797.123:616.1:678.048

The aim of this study was to investigate effect of supplementation with plant origin superoxide dismutase (SOD) on counts of leucocytes and its subpopulation, as important part of immune system, in elite rowers. Twenty young elite rowers were included in double-blinded study. Participants were randomly divided to experimental group who received 2 capsules (500mg) of plant origin SOD (GliSODin) and control group who received placebo i.e. same 2 capsules without active ingredient. Study was conducted during 6 weeks of preparation period. Blood samples was taken from antecubital vein in morning hours and used for on counts of leucocytes and its subpopulation. At the begging of a study all measured parameters were within normal range of values. However, there was some positive tendencies in supplemented group. It was concluded that more studies with large number of participant is needed to confirm if GliSODin can be considered as potentially good supplement in prevention of deleterious effects of intensive physical activity on leucocytes and its subpopulation.

Keywords: antioxidants, athletes, leucocytes

THE CONNECTION BETWEEN THE SPECIFIC NUTRITION OF ATHLETES BEFORE THE COMPETITION AND THE IMPORTANCE FOR ENERGY, MOTIVATION AND ATTENTION

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UDC 613.2:796.071.2

The aim of this study is to investigate and find the most effective ways of specific nutrition in athletes before training or competition, which can have a significant impact on increasing their energy, motivation and attention during physical activity. Energy, motivation and attention during training or competition are, among other components of preparation, very important details on which success in sports can depend. The paper will use the method of theoretical analysis of the content of scientific and professional literature and the causal method with the systematization of the professional experience of the author in the field of sports, with the application of logical inductive and deductive reasoning. PubMed database, Kobson, and Google web search were used to search for scientific studies and papers, as well as Internet articles. The nutrition before training or competition should be based on raising excitatory neurotransmitters in the brain (dopamine and acetylcholine), which are responsible for the mental energy, muscle contraction, attention and memory of the athlete and are necessary during the competition. In order to get these effects, it is necessary that the diet contains certain nutrients (proteins, amino acids, and vitamins) that are precursors of biochemical molecules dopamine and acetylcholine, that raise mental energy, improve muscle contraction, affect better attention and memory. In modern sports nutrition, it is important to take into account that the athlete has adequate nerve stimulation before training or competition, which, in addition to training methods, can be achieved with a specific diet before physical activity. The neurotransmitters dopamine and acetylcholine have a strong effect on improving mental energy, motivation, and attention in humans and can obviously contribute to the best results in training effects. Otherwise, if the diet contains nutrients that are responsible for raising inhibitory (calming) neurotransmitters (serotonin and GABA), such as food with lots of carbs, there may be a lack or decrease in mental energy, motivation and attention, and thus the lack of adequate competitive charge of the athlete.

Keywords: food, dopamine, acetylcholine, neurotransmitters, amino acids

INFLUENCE OF HYPERBARIC CHAMBER ON PERFORMANCE AND RECOVERY

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UDC 796.615.8

The recovery of athletes following training is a constant concern for coaching staff since inadequate recovery can lead to chronic fatigue, decreased performance and increased potential for injury. Hyperbaric oxygen therapy is a treatment where 100% oxygen is administered under pressure, where the primary function is to accelerate the recovery of soft tissue by means of reducing local hypoxia, inflammation and edema. The aim of this study was to identify and summarize relevant literature on hyperbaric chamber influence on performance and recovery. For the identification of studies, the following electronic databases were searched: Google Scholar, DOAJ, J-GATE, Science Direct and Scopus. The inclusion criteria were: studies published in English between 2000 and 2021, the sample of participants can be both male and female adults and hyperbaric chamber as an experimental program. Inclusion criteria were not applied when it comes to the basic level of fitness of the participants, as well as sports experience. The results are showing that in initial database search 97 studies were identified as relevant, but only 10 studies were included in the systematic review, with a total of 236 participants, both male and female. Based on identified relevant studies most of them showed improvements in performance and recovery. However, there are some studies with different outcomes- no influence of hyperbaric chamber. Therefore, the authors can only agree that there is a great need for further investigations. Future studies should provide new useful information regarding effects of different protocols and populations.

Keywords: treatment, hyperbaric therapy, recovery, muscle injury

PREVALENCE OF POSTURAL DISORDERS IN THE SAGITTAL PLANE AMONG SCHOOL-AGED CHILDREN IN SERBIA: A SYSTEMATIC REVIEW

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UDC 613.71/.72-053.5(497.11)

The aim of this study was to determine the prevalence of postural disorders in the sagittal plane among school aged children on the territory of the Repubic of Serbia in the past 10 years, based on the analysis of existing research. Initially, databases were used to search through more than 500 papers based on key words. The inclusion criteria identified 15 papers which were further analyzed in detail. The total sample of participants in the analyzed papers was 5329, all school age children of both genders. The analysis of existing research led to the conclusion that approximately 27% of school-aged children have a postural disorder in the sagittal plane, that is, either kyphosis or lordosis, whereby kyphosis is more prevalent. The importance of this study lies in the fact thtat it provides information on the postural status of children and indicates the importance of proper focus and planned physical exericse for the prevention of poor posture among school age children.

Keywords: lordosis, kyphosis, poor posture, deformity, physical exercise

EFFECT OF ERGONOMIC ARMREST® FOREARM SUPPORT ON WRIST POSTURE RELATED TO CARPAL TUNNEL PRESSURE DURING COMPUTER MOUSE WORK

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UDC 616.8-009.18

The use of the computer mouse has been increasing over the years and it has been identified as one of the occupational activities related to carpal tunnel syndrome (CTS). The main mechanism for CTS is carpal tunnel pressure (CTP) that could be estimated from the wrist posture. Using an electronic goniometer, we assessed wrist extension/flexion and ulnar-radial flexion in 15 participants (Age: 34.8±8.7 years) and calculated the time the wrist posture was outside the threshold values previously related to CTP. Specifically, we estimated time when wrist posture yielded >25 mmHg of CTP: wrist extension > 32.7°, wrist flexion < −48.6°, wrist ulnar flexion > 14.5° and wrist radial flexion < −21.8°. Average wrist extension/flexion tends to be 13.4° lower (p=0.063), while radial-ulnar flexion was 13.2° lower (p=0.025) when Armrest® forearm support was used in comparison to fixed forearm support. Furthermore, the time spent outside the threshold wrist extension was 25.8% lower (p=0.018) and ulnar flexion was 37.2% lower (p=0.017) when using Armrest® compared to a fixed forearm support. Results were independent from tasks. Armrest® diminished the time spent outside the threshold values related to 25 mmHg of CTP indicative of CTS. A moveable arm support is a simple and effective way to increase occupational health during computer mouse work.

Keywords: wrist angle, carpal tunnel syndrome, goniometer, computer mouse

DOES CAFFEINE HELP REACTIVE-AGILITY PERFORMANCE?

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UDC 796.011.5:178

It is well known that the effects of caffeine intake on the central and peripheral nervous system have positive effects on psychomotor function performace. However, studies examining the effects of caffeine on reactive agility are limited in the literature. The main purpose of this study was two fold: 1) to evaluate the effects of acute caffeine ingestion on reactive-agility performance, 2) to examine the effect of acute caffeine use on HR_{peak} values. A total of 49 healthy, physically active students (n_M=25; n_F=24) who were studying at Faculty of sports sciences attended the research ($\bar{x}_{age}$ = 21.8±2.3 years, $\bar{x}_H$ = 165.6±8.5 cm, $\bar{x}_{BM}$ = 60.1±10.2 kg). Following familiarization session, all participants was attended to Agility Star Drill Test (ASDT). ASDT was repeated three different times, 48h apart. During each trial, participants consumed 4 mg/kg either regular instant coffee (CAF), or a decaffeinated instant coffee (PLA). While measuring the baseline, the participants were not given any coffee or caffeine-containing food and beverage. Friedman test and Mann-Whitney *U* tests were used in the analysis of the data. The significance value was accepted as $p<0.05$. The primarly result of the study showed that caffeine was more effective in reactive-agility test reaction time (RT), than base results ($p<0.05$), but it was not different than PLA. Secondly, there were no differences in HR_{peak} values between the trials ($p>0.05$).

Keywords: agility, blazepod, caffeine, reaction time, reactive agility

IMPACT OF BODY DISSATISFACTION ON EATING DISORDERS DEVELOPMENT IN FEMALE ATHLETES

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In the world every third person is directly affected by insufficient body weight, lack of vitamins and minerals, or by overweightness, obesity and diet-related diseases. About 10 million women in the United States struggle with eating disorders such as anemia and bulimia, and mostly those women are dissatisfied with their appearance. The aim of this study was the assessment of body dissatisfaction in female athletes and whether this dissatisfaction leads to eating disorders. The sample consisted of 36 female respondents, taken out from around the Serbia. The variables used were: age, body height, body mass, body mass index (BMI) as well as the duration of their active involvement in sports. Respondents completed an Eating Attitudes Test (EAT-26) questionnaire online and a modified Body Shape Questionnaire (BSQ) for the assessment of their dissatisfaction with the appearance. Based on the EAT-26 diet questionnaire, the results show that there are no eating disorders among respondents. In the sample, there are 31 well-nourished respondents, which makes 86.1% of the sample, while five (13.9%) are over-nourished. There are no malnourished and obese respondents. Among the respondents, eight of them (22.2%) said that they were satisfied, 25 (69.4%) expressed mild dissatisfaction, and three (8.3%) expressed moderate dissatisfaction with their body. There were no respondents completely dissatisfied with their body. Nonparametric correlation analysis (Spearman's correlation coefficient) shows that correlation between the absolute value of body dissatisfaction score and the results of the dietary attitude test is statistically significant ($p=0.412$, $p=0.012$, respectively). The results of the linear regression analysis indicate that an increase of absolute value of body dissatisfaction score leads to an increase in dietary attitude score, and this increase is statistically significant. The results of regression analysis showed that BMI is a significant predictor of body dissatisfaction, which was expected and previously reported. Numerous studies have shown that engaging in physical activity leads to increased satisfaction with one's own appearance.

Keywords: EAT-26, BSQ , eating disorder, body dissatisfaction

PRIMARY REPRESENTATION SYSTEM IN STUDENT-ATHLETES

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People receive information about the environment through senses, i.e. visually, auditory, kinesthetically and through the senses of taste and smell, and then process it in a unique way in the brain and thus create personal reality. While we use all sensory-based representational systems as a means for learning, each one of us has got a dominant preferred system that we use more than others. In context of sports it is important for coaches to recognize that system in athletes, in order to improve communication and find methods of learning and correcting sports skills in accordance with that system. The aim of this research was to determine the primary representation system of student-athletes, as well as the correlations between the representation systems. The sample was consisted of 80 student-athletes. The NLP questionnaire for the representative system was used, but the questions were adjusted to the context of sport. SPSS version 20.0 was used for data processing (descriptive statistics and correlation analysis). There were 39 students-athletes who are visual type, 26 auditory and 15 kinesthetic type. It was found that there is a statistically significant correlation between visual and auditory type (.316), as well as between auditory and kinesthetic type (.421). There was no significant association between visual and kinesthetic type. This means that primarily visual learning tools would not have an impact on this type of athletes, but it is necessary that there is at least an auditory monitoring of such content– sound or oral explanation. Previous researches were mainly focused on improving sports performance, while in our research the aim is to enable students-athletes to understand better and acquire knowledge in the field of complex motor skills, sports, physical education and recreation. Recognition of their dominant system enabled the adaptation of later lectures and exercises, in accordance with their systems. More precisely, since all three types were among them, as expected, different audio-visual means (presentations, recordings, and pictures) were used in the lectures, but also in the process of exercising, in order to cover all three systems of presentation, especially in the kinesthetic type, because it is most often neglected during training and lectures.

Keywords: neuro linguistic programming, visual system, auditory system, kinesthetic system, students

THE INFLUENCE OF YOGA PROGRAM ON THE BALANCE OF PRESCHOOL CHILDREN

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UDC 615.851.86-053.4

Preliminary evidence presented in earlier studies suggests that yoga may be beneficial for physical fitness and cardiorespiratory health in children. The aim of this study was to determine the impact of a six-week yoga program on the balance of preschool children. The sample consisted of 50 typically developing children (Age: 4.74±0.83 years, Body height: 108.54±4.44 cm, Body mass: 19.99±2.92 kg), of which 28 were girls and 22 boys. A subtest from the BOT-2 battery was used to assess static and dynamic balance (nine variables in total). The obtained t-test results for dependent samples indicate that after a six-week yoga program there was a statistically significant improvement in static ($p<0.001$, $d=0.95$) and overall balance in boys ($p<0.05$, $d=0.86$), in girls ($p<0.001$, $d=1.05$) and in the total sample ($p<0.001$, $d=0.97$). These improvements were achieved with great effect except for static balance in boys- with moderate effect ($p<0.05$, $d=0.72$). Timely development of balance abilities could have a positive effect on all-round motor development, and yoga may be an option for children to increase physical activity and fitness.

Keywords: static balance, dynamic balance, motor development, motor abilities

THE INFLUENCE OF MORPHOLOGICAL CHARACTERISTICS AND BODY COMPOSITION ON STRENGTH PARAMETERS OF PHYSICALLY ACTIVE WOMEN IN FITNESS

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Morphological characteristics and body composition, to a greater or lesser extent, can influence certain anthropological characteristics and abilities. The aim of the research study was to determine whether there is any influence of the morphological characteristics and body composition on strength parameters in physically active women in fitness. The sample consisted of 94 female subjects of average age 32.8±10.6 years, who are physically active and engaged in fitness. A set of 21 measures was used for the assessment of morphological characteristics (14) and of body composition (7) which was determined by the indirect method, i.e. by using bioelectric impedance (InBody 720). Strength assessment was determined using countermovement jump and squat jump. Data processing was performed by SPSS 20.0. Regression analysis was applied to determine the influence of the morphological characteristics and body composition on strength parameters. The obtained results have shown that there is a statistically significant influence of the morphological characteristics on strength parameters (p=.000), as well as body composition (p=.000).

Keywords: fitness, strength, body composition, morphological characteristics, women

THE IMPACT OF ELECTROMYOSTIMULATION ON THE ATHLETES VERTICAL JUMPING PERFORMANCE: A SYSTEMATIC REVIEW

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Electromyostimulation (EMS) represents an artificial muscle stimulation with a well-defined protocol that is precisely designed to reduce discomfort during unnatural muscle activation. The main goal was to find new information on the basis of systematic review of many studies which examined the impact of EMS on athletes' vertical jumping performance, as well as to expand the already known conclusions. Electronic databases (Google Scholar, Pub Med, Web of Science and ResearchGate) were searched for the original scientific research projects on the topic of the impact of EMS on athletes' vertical jumping performance. The last search was conducted in June 2020 with a limitation to study published in English. As many as 415 scientific studies were identified and only 15 of them were selected and then systematically reviewed and analyzed. The results of the research projects with the total sample size of 445 athletes showed that the treatment of global and local EMS, in combination with another types of training, is an effective method for the development of explosive strength, such as vertical jumping. It has been proven that the EMS represents an effective strategy for improving vertical jumping performance, as well as for improving physical performance of athletes in general.

Keywords: athletes, electromyostimulation, jump performance, physical performance

MORPHOLOGICAL CHARACTERISTICS AND FLEXIBILITY OF ATHLETES WITH DIFFERENT SPINE INJURIES

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The aim of this study is to determine the differences in morphological characteristics and flexibility of athletes with different spinal injuries. The sample consisted of 23 athletes with spinal injuries. Respondents were divided into two groups. The first group (A) consisted of athletes with high spinal injuries, i.e. without pelvic sensation (n=12), while the second group (B) consisted of athletes with low spinal cord injury, i.e. with pelvic sensation- in other words persons with less pelvic mobility (n=11). Six parameters were used for the evaluation of morphological characteristics, and the sample of flexibility variables was represented by seven parameters. The results of the t-test for independent samples show that there are no statistically significant differences in morphological characteristics and flexibility indicators between athletes with paraplegia and paraparesis, i.e. with different degrees of spinal cord injury. The lack of difference in the selected indicators of morphological characteristics can be explained by the fact that no indicator was selected "below" the spinal cord injury- we only took morphological measures from parts of the body that are fully functional. For further research it is necessary to expand the number of respondents and the number of variables, as well as to take into account other segments of the anthropological status that should be explored among athletes with spinal injuries, as well as athletes with disabilities in general.

Keywords: morphology, flexibility, spine injury

DEFINING AND COMPARING OF ANTHROPOMETRIC STRUCTURE IN MALE AND FEMALE STUDENTS WITH DIFFERENT METHODOLOGICAL AND STATISTIC APPROACHES

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UDC 796.01
796.012.1-055.2

The research was conducted on a sample of 400 (M=200, F=200), 11 years old entities from Skopje. A set of 11 anthropometric variables was applied and the data were analysed: basic statistic parameters (mean, standard deviation, minimum and maximum value, skewness, kurtosis and Kolmogorov-Smirnov test), multivariate, discriminative, regression (in manifest, combine and latent space), canonical correlation, component and factor analysis (varimax and oblivion rotations). The oblivion rotations were defined as parallel (pattern matrix) and orthogonal projections (structure matrix). The data obtained from all statistic procedures were compared with the suitable relations. A comparison showed that male and female students differ to a great extent in their manifest and latent anthropometric structure, but some relations have significant similarity. The application of different statistic procedures on data with same anthropometric characteristics, with male and female, showed that completely identic results are not recognized. Therefore, in order to get the greater exactness and generalization of the obtained data, more different statistic methods are necessary to be used.

Keywords: anthropometric measures, latent dimensions, male students, female students, statistics

ANALYSIS OF SERBIAN MEDIA REPORTING ON NATIONAL MALE AND FEMALE BASKETBALL PLAYERS DURING THE OLYMPIC GAMES 2016

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796.032.2(497.11)

This paper aimed to gain new insights into how and to what extent the domestic media reported on basketball players at the 2016 Rio de Janeiro Olympic Games, as well as to identify reporting differences by gender of athletes. The subject of this article was basketball newspaper articles in electronic newspaper publications, which influence the formation of a media image of female athletes and which can contribute to the affirmation or marginalization of women in sport. The method used in the research is the content analysis of the selected articles. This method is widely accepted in these types of research and enables a large number of texts to be viewed by systematic quantification of media content, using predefined categories and data to be analysed statistically. Content analysis as a quantitative method, counts and measures categories such as words, phrases or pictures. This is a popular method for studying gender differences in media representation, as it can reveal recurring patterns that can shape our attitudes, values and beliefs. The sample of the research material was based on the Serbian media in the electronic edition: Politika, Kurir, Večernje Novosti, as well as the portal of RTS media public service, from 5th of August, 2016 to 21st of August, 2016. The data included information on the number of articles dedicated to male and female basketball players; the number of words in the text; the number of photos and gender of the actors in the photos; the active or passive representation of basketball players, as well as representation of basketball players on and off the field; the camera's shooting angle; the emotions in the photos and the level of the exposure of the bodies in the photographs. The results showed that the surveyed media paid almost twice as much attention to male basketball players, but that texts on male basketball players were slightly shorter on average. Basketball players were also visually represented with more photos (52% men, 37% women, 4% both, 7% something else about basketball). Male basketball players were more off-field (50%) in the photos, while female athletes were more represented on the field (27%). Overall, the obtained results showed that there is still an imbalance in the way men and women are portrayed by media and that there is a need for some changes regarding this topic.

Keywords: basketball, women, Olympic Games, Serbia

FEASIBILITY OF A NOVEL TEST TO ASSESS REACTION TIME IN PROFESSIONAL MILITARY PERSONNEL

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UDC 796.01:159.9:355.11

Different tests have been validated to evaluate the reaction time (RT) of military personnel. However, all these tests present an important limitation- both the stimulus and the motor response do not resemble the tasks that combatants potentially have to face. Therefore, the objectives of this study were to develop and evaluate the reliability and sensitivity of a novel RT test in military personnel. The simple RT (one stimulus and one response) and the Go, No-Go RT were evaluated in 15 professional Spanish soldiers (28.9±5.3 yrs) and in 10 sports science students (24.4±3.3 yrs). Participants were instructed to respond as fast as possible (pressing a trigger of the gun-shaped mouse) when they perceive an "enemy" (i.e., soldier with a riffle pointing towards them) appearing on the video which was presented through virtual reality glasses. The reliability of the Simple RT was acceptable both in military personnel [Simple RT: coefficient of variation (CV)=9.34%, intraclass correlation coefficient (ICC)=0.724; Go, No-Go RT: CV=7.37%; ICC=0.637), and in the group of sport science students (Simple RT: CV=4.67%; ICC=0.737; and Go, No-Go RT: CV=4.72%; ICC=0.564). The Simple RT was lower than Go, No-Go RT in both groups ($p \leq 0.001$; $ES \geq 2.02$), and lower in military personnel compared to sport science students ($p \leq 0.001$). Novel RT test has obvious face validity (both the stimulus and the response are specific), acceptable reliability, and the results indicate that it is sensitive to discriminate between different conditions (Simple RT *vs.* Go, No-Go RT) and populations (military personnel *vs.* sport science students). Therefore, novel test can be confidently used for assessing RT in military personnel.

Keywords: validity, reliability, sensitivity

FAIR SPORTS LITERATURE DISCOURSE REPRESENTATION OF DISABILITY

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Science functions through linguistic forms and content. However, one particular Paralympic community needs to efficiently communicate scientific "facts" through words, but also through images or photographs to bring to light Paralympians' ordinary and sporting life and achievements. Hardin (2007) analyzed photographs in 59 general PE textbooks via content analysis concluding that general PE physical textbooks do not usually include photographs of persons with disabilities, but noninclusive general physical education environment. However, printed mediated sports literature needs analyzing to reveal fair or biased reporting on the Paralympian sports and athletes. A more detailed content analysis of the focused disabled athletes' literature was investigated through "Google Scholar", "PubMed", "Kobson", "SCIndex" and "Hrcak" using key words - *sports, Paralympic Games, sitting volleyball, quality of life,* published from 2006 to 2016. Research methods of selection, description and synthesis were applied. Content analysis of the sports literature totalling 35 scientific papers focusing on the Paralympians (mostly on sitting volleyball), has revealed following Paralympians' sport participation factors: motivation, promoting war veterans, improving physical conditioning, improving functional abilities, changing attitudes and promoting positive attitudes to Paralympic sports in general. Motivation was found in nine papers as a leading topic, four papers focused on the war veterans and their sports participation, four papers were dealing primarily with functioning abilities, all other papers combined the above-mentioned elements. Arbitrary terminology related to disability was mostly used, showing a pressing need to standardize disability terminology since domestic scientific literature heavily relies on the Anglophone Paralympians literature. From the analysed literature we find out that Paralympian sports (sitting volleyball) emerge as a new approach to the treatment of patients where sport is presented equally as part of a medical treatment and a complete rehabilitation of persons with physical disabilities. All the more important is the component of general resocialization of such persons-athletes which helps erasing all religious, racial and other differences, thus alleviating their already damaged health status. Impartial and fair reporting language in scientific literature was shown to be equally important.

Keywords: discourse, bias, sports, Paralympics, disability, scientific literature coverage

ORGANIZATIONAL PROCEDURES IN THE REALIZATION OF CAMPING TO OBTAIN A PREFIX “ECOLOGICAL”

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Certain field tasks in the field of outdoor activities are solved within the camps. The trend is that the camps are realized in such a way as to leave a minimal ecological footprint on the natural environment, i.e. to be established according to ecological standards. The aim of this paper is to define the factors that are a condition for a camp to receive the prefix "ecological". The paper will use the method of theoretical analysis of available literature, as well as the method of terrain research. Most of the educational camps that are conducted on the territory of our country (Serbia) are not established according to eco standards. Through this research, an analysis of all organizational details (transport of participants, logistics, type of food, economical and rational use of available resources, energy independence, adequate choice of activities) as well as other supporting elements was performed. All these elements are links of a complex "ecological chain" in which it is necessary to integrate additional finesse defined according to ecological standards, and consequently this would in practice reduce the value of the eco-footprint and justify the prefix "ecological".

Keywords: ecological footprint, “ecological chain”, criteria

EUROPEAN PERSPECTIVES OF DUAL CAREER– SUCCESFUL MODES OF DUAL CAREER OF ATHLETES

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UDC 35.071.1:796

The dual career of an athlete implies the harmonization of the obligations of athletes in the field of sports (training and competition) with the academic obligations at school or university. The problem of the athlete's dual career has been present since sport became a profession requiring the athlete's full commitment to training and competition, with very limited time devoted to education and regular school obligations. By the way, the term dual career of an athlete has been a well-established and well-known term in the EU for almost 20 years. To date several different models have been found in the implementation of the dual career of athletes. This model continues to improve and harmonize with the ultimate goal of enabling athletes to acquire an adequate academic degree that would allow them to be included in the usual social flows and the possibility of employment outside the sports sector after finishing their sports careers. The aim of this paper is to determine the current status of dual careers of athletes in Europe by qualitative analysis of existing guides, rules and regulations, as well as to present and compare models of conducting dual careers of athletes in different European countries. This study was conducted as qualitative narrative review based on the qualitative analysis of available guidelines, legislative documents, manuals and scientific articles related to the dual career of athletes. The initial search of databases was conducted using the Google Scholar, Web of Science, SportDiscuss and Scopus. In the second step the references of the selected scientific articles were analysed. Finally, the available guidelines and legislative documents related to the dual career of athletes were collected and analysed. One of the key moments in the development of a dual career of an athlete is the establishment of a European network called European Athlete as Student (EAS). The network was established with the support of the European Union in 2004, which was declared the European Year of Education through Sport. The design of dual career programmes across the Europe should meet athletes' individual needs taking into account their age, sport specialisation, career stage and financial status, with the athletes themselves taking increasing responsibility as they progress through their careers. There is no single model to be recommended on how to include all related policy domains in the dual career framework, nor can it be said which sector should take the lead in this coordination process but it is important to identify the stakeholders in dual career of athletes.

Keywords: dual career of athletes, education, sports competition, sports career

MOTIVATION FOR ACHIEVEMENTS IN SPORTS- THEORETICAL FRAMEWORK AND RECOMMENDATIONS FOR PRACTICE

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Motivation is a set of processes that encourage, direct and maintain human behavior towards a specific goal. It represents a willingness to do something. Motivation can be defined as the readiness of an individual to take action to satisfy his need. The aim of this paper was to collect relevant data related to the motivation for achievement in sports and physical education, i.e. theories, as well as recommendations for practice. The analyzed works showed that athletes with a dominant trait of achievement express strong energy aimed at achieving the goal, perceive their competence as high and feel that the achievement is under their control, are willing to take risks that motivate them, are realistic and do not try to achieve the impossible. Numerous studies have shown that motivation, especially in conjunction with motor skills, has probably the most decisive influence on student success. The best motivation for student work is if the contents are adjusted to the possibilities, abilities and interests of each student individually. Students with intrinsic motivation stay attached to what they do longer, even in the absence of material reward. Research conducted on athletes has shown that motivation is especially present in the cadet age (age 14 to 16) of young football players. The decrease in intrinsic motivation is due to pressure and anxiety due to external recognition and success.

Keywords: motivation, theories of motivation, sport, physical education

EFFECT OF RESISTANCE TRAINING ON HORMONAL STATUS: A HISTORICAL REVIEW

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UDC 796.015.57:577.17

The cult of good physique and symmetrical body image dates back to the ancient civilizations of Greece and Egypt. Greeks gave great importance to physical exercise, and this was a significant aspect of their educational, economic, social, and political life. By exercising in the gymnasium (an institution where young Greeks trained and also a place where all the free citizens of Athens gathered) and palestra, young Athenians strengthened their body and spirit and prepared for important events, such as the Olympic Games and the military profession. With the development and availability of technology in the early 1970s, the potential effects of weighted training on the endocrine system intrigued scientists to examine this problem more thoroughly, based on the assumption that strength training can have inherent significance on cell homeostasis, metabolism, and tissue architecture. The first research in strength training focused on hormonal response, which personifies the body's anabolic-catabolic status. To a certain extent, this was established on an already known anabolic effect in developing muscle strength. As a result, there was a desire to learn more about our own endogenous anabolic and catabolic systems in order to attain the desired results of strength training. The following databases were used to gather adequate literature for this research: Google Scholar, PubMed, Cobson, SCIndeks. In total, 24 studies met the inclusion criteria for the review. A search terms included 'resistance training', 'testosterone', 'growth hormone', 'cortisol', 'muscle hypertrophy', 'hormonal responses'. The works that were sought were published between 1973 and 1980, all until 2014. The selected books or summaries were read and analyzed thoroughly. The basic requirements that needed to be completed for detailed analysis were that the research was published as original or systematic examination research or as theoretically application (historical). The outcome of this study suggests that the volume and intensity of training have a significant impact on hormone secretion. In addition, hormonal responses vary significantly depending on the gender and age of the respondents. Some researches show noteworthy impacts and changes in the level of anabolic hormones. However, not so significant changes in the hormone cortisol have also gone under observation. Hormone secretion responses also vary depending on the type of training load and the length of the training protocol. Experts in the field of sports science strive to explore signaling pathways and Acuna responses in hormone secretion. However, there is no clear evidence that indicates a difference in acute responses in hormone concentration in athletes and recreational athletes. Further researches are required in this field. The importance and role of anabolic hormones, associated with muscular hypertrophy and the impact on acute changes, are a significant strategy to improve sports performance.

Keywords: history of resistance training, hormonal responses, testosterone

ACUTE EFFECTS OF 15-SECOND SELF-ADMINISTERED VIBRATION MASSAGE ON PLANTAR EXTENSORS' MUSCLE STRENGTH PROPERTIES IN ADULT MALES: A PILOT STUDY

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Foam rolling as a technique of self-massage has been reported to induce different changes in muscle properties. Many of those changes found in literature are of confounding effects. Recent development of other types of exercise aids such as a foam roller with vibration presents a new and interesting way in exercise practice of targeting certain muscle properties and therefore requires better scientific understanding before it becomes a standard safe and useful tool in everyday practice. The aim of this study was to determine how a single short session of vibrating foam rolling affects certain muscle contractile properties, more specific, strength properties such as MVIC-maximal voluntary isometric contraction (F_{max}) and time for MVIC (tF_{max}). Twenty three recreationally active male subjects participated in this study (Age: 25±5.1 years, Height: 185.3±6.3 cm, Weight: 81.8±8 kg). After a warmup and baseline measurements subjects performed pretest, vibration foam rolling treatment and three posttests separated by 5 minutes rest intervals analyzing F_{max} and tF_{max} for both lower limbs. Subjects foam rolled with low frequency vibration (29Hz) the calf muscles of each leg for 15 seconds between the pre and posttests. No significant changes were found for F_{max}. Significant changes were found for tF_{max}. Data suggest that foam rolling as a technique of self-administered massage of short duration with low frequency vibration is a safe way for use in recreational exercise practice.

Keywords: foam roller, vibrating foam roller, MVIC, tMVIC

THE INFLUENCE OF SOME PSYCHOSOCIAL FACTORS ON PHYSICAL AND SPORT ACTIVITIES IN STUDENTS 11 TO 15 YEARS OF AGE WHO SHOWED DEVIATION IN BEHAVIOR

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Determining the psychosocial factors that influence behavior when using physical and sports activities can help a lot from a sociological, educational, health and social point of view. The influence of physical, sports activity on behavior has been proven in many studies so far. The study was conducted on a sample of 323 students of both sexes (169 male and 152 female) divided into two sub-samples (group of students who did not show deviation in behavior and a group of students who showed deviation in behavior) aged 11 to 15 years. The purpose was to determine the impact of psychosocial factors on physical and sport activity in two municipalities in the Republic of North Macedonia. To meet the objectives of the test, five variables were used to assess physical and sports activity. The primary interest is the causal analysis of the relationship between the psychosocial factors, sport participation and behavior, as well as the even bigger question about the role of sports participation in the socialization process among students from fifth to eighth grade.

Keywords: physical activity, sports activity, students, behavior, psychosocial factors

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