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## MEETING ABSTRACTS

# Abstracts from the 19th Annual Scientific Conference of Montenegrin Sports Academy and “Sport, Physical Activity and Health: Contemporary perspectives”: Dubrovnik, Croatia. 7-10 April 2022

Edited by Dusko Bjelica<sup>1</sup>, Stevo Popovic<sup>1</sup>, Selcuk Akpinar<sup>2</sup>, Damir Sekulic<sup>3</sup>

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MEETING ABSTRACTS FROM MSA DUBROVNIK 2022 CONFERENCE  
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## Invited speakers

### S1

#### RESISTING NON-SPORT BASED INITIATIVES TO PRESERVE THE RELIABILITY OF SPORT

Robert C. Schneider<sup>1</sup>

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Outside pressures placed on sport organizations to modify their governance structures in the interest of non-sport-based initiatives such as commercialization and “wokeness” risk diminishing the inherent benefits of sport. Social and mainstream media, under the influence of corporate support, play a primary role in pressuring sport organizations (Diamond & Radnofsky, 2021) to include non-sport based demands into their structures. Ironically, sport organizations’ acquiescence to non-sport related demands jeopardize the medium of sport in which outside bodies endeavor to express their non-sport agenda. To base sport organization structures on non-sport agendas “alienates” important fan demographics (Malanga, 2020). While sport organizations may acknowledge societal issues, maximizing popularity among its audience calls for grounding its mission in sport-based principles. Such principles intrinsic to sport include fairness, and achieving excellence within the sport (Hardman, Jones, &

Jones, 2010). Resisting the inclusion of policy supporting non-sport based initiatives into the governance of sport is necessary if sport is expected to produce the outcomes and experiences one has come to expect from sport. To maintain its purest form and protect its integrity, sport’s strict adherence to its sport based principles is required.

### S2

#### CONTEMPORARY PLANNING BASED ON RELATIONSHIP BETWEEN LOAD MONITORING AND MATCH PERFORMANCE IN VOLLEYBALL

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Modern volleyball in elite level requires players to perform a large volume of jumps. The ability to measure and monitor load has become an essential part for training planning which is crucial for better performance of the individuals and prevention of players injuries. The aim of our research was to describe the annual training and match plan with the workload of players and the relationship between the number and height of jumps and their performance in the game. Each player wore a device for measuring the load. For the data analysis, the SPSS (Statistical package for Social Sciences) version 20.0 has been used. Descriptive statistics and Analysis of variance (ANOVA) were used

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to describe the load monitoring of different playing positions. For the relationship between the number and height of jumps and their performance was used the Spearman rank-order correlation coefficient. The results highlight the large demands and considerable individual and position-specific load variability present in elite sports. The analysis of jumps shows that there is a correlation between the number of jumps and performance in the game. In addition, low-intensity jumps have no effect on performance and high-intensity jumps are the key to scoring points. Jump demands are high in elite volleyball and performance program should be tailored to the match demands required at each position with emphasis on high-intensity jumps.

**S3****ARTISTIC SWIMMING: IN BETWEEN SPORT AND ART**Mia Perić<sup>1</sup><sup>1</sup>University of Split, Faculty of Kinesiology, Split, Croatia**Correspondence:** Mia Peric (miaper@kifst.hr)

Artistic swimming, former known as synchronized swimming, has been an Olympic sport since 1984. It is defined as a sport that simultaneously combines sport and art, but it actually combines water, body, music, swimming, ballet, modern dance, gymnastics, impressive motor structures characterized by beauty, elegance and harmony of movement. All of the written makes artistic swimming highly complex and demanding sport. Even though it is not a new sport, there is a lack of studies focusing on particular issues within the artistic swimming. Specifically, it is highly challenging to follow up simultaneously the development of the sport itself. Synchronized swimming is not highly profitable sport; the population of swimmers is not large, and therefore, it is not so easy to do the extensive researches. However, looking back at the conducted studies, we can highlight research focuses on: (i) physiology and breathing, (ii) musculoskeletal and injury problems, (iii) eating disorders, (iv) performance tests, and (v) characteristics of the sport itself. Same as in some other competitive sports, there are problems related to development of sport itself, changes of official rules, etc. Collectively, new studies are necessary to protect the health of the swimmers, to assure the improvement of sport, and to bring the artistic swimming closer and more understandable to wider audience.

**S4****HEALTH-BENEFITS OF RECREATIONAL BASKETBALL: CURRENT KNOWLEDGE AND FUTURE DIRECTIONS**Daniele Conte<sup>1</sup><sup>1</sup>Lithuanian Sports University, Institute of Sport Science and Innovations, Kaunas, Lithuania**Correspondence:** Daniele Conte (daniele.conte@lsu.lt)

Physical activity has been considered fundamental for the prevention and treatment of chronic diseases. Recreational endurance and strength-based activities are usually implemented to improve the health profile. However, in the last few years, recreational team sports and specifically basketball have been also adopted with this purpose. A previous intervention study suggests that three months of 3v3 basketball training improved fitness and health-related measures in adult untrained men particularly when playing full court. Descriptive studies indicate that: 1) adding basketball activities produced no negative physical activity compensation in the following days; 2) modulating the number of players (1v1, 2v2 and 3v3) during basketball small-sided games also modify the internal and external load responses in recreationally active college students; 3) older adults basketball players had a quite high physiological responses (only 3% of total match time spent at HR<70% of maximal heart rate) during recreational matches suggesting the use a regular medical-control checks in the population. Future studies should focus on the assessment of the effect of

recreational basketball on different populations (i.e. female players, participants with no previous basketball experience). Moreover, it should be assessed whether recreational basketball played in different modalities (i.e. different number of players, rules, court size) can meet the ACSM guidelines and be useful to improve participants' health profile. Finally, the effect of recreational basketball in comparison with other traditionally adopted gym-based (i.e. HIIT) or endurance (i.e. running, swimming) should be investigated.

**S5****PHYSIOLOGICAL RESPONSES OF SOCCER PLAYERS PERFORMING REPEATED MAXIMAL EFFORTS: THERMO-NEUTRAL CONDITIONS VS SIMULATED CONDITIONS OF THE FIFA WORLD CUP QATAR 2022**Pawel Chmura<sup>1</sup>, Hongyou Liu<sup>2</sup>, Marcin Andrzejewski<sup>3</sup>, Jan Chmura<sup>1</sup>, Andrzej Rokita<sup>1</sup>, Marek Konefał<sup>1</sup><sup>1</sup>Wroclaw University of Health and Sport Sciences, Wroclaw, Poland;<sup>2</sup>South China Normal University, Guangzhou, China; <sup>3</sup>Poznan University of Physical Education, Poznan, Poland**Correspondence:** Paweł Chmura (pawel.chmura@awf.wroc.pl)

This study aimed to assessment the relationship between the climatic conditions predicted for the 2022 FIFA World Cup in Qatar and the capacity for repeated maximal effort (RME), of soccer players. Twenty-four semi-professional soccer players participated in the study. The exercise test consisted of ten 6-second maximal efforts on a cycloergometer. A 90-second passive rest interval was used. The test was performed in a Weiss Technik WK-26 climate chamber under two different conditions: 1) thermoneutral (NC - 20.5°C; 58.7% humidity); 2) predicted for the 2022 World Cup in Qatar (QSC - 28.5 ± 1.92°C; 58.7 ± 8.64% humidity). Power-related, physiological, blood, and electrolytes variables were recorded. Comparing both climatic conditions, players achieved higher peak power, need less time to peak power, with higher values of fatigue slope in QSC than in NC (in each repetition of research protocol). Temperature difference between the climatic conditions, which was 8°C, did not significantly affect the physiological responses of the players. The results can be used in the design of training programs to increase players' physiological adaptations by simulating soccer-specific conditions of play in terms of anaerobic capacity, in particular repetitive maximal efforts.

**S6****CRITICAL OXYGENATION: CAN MUSCLE OXYGENATION INFORM US ABOUT CRITICAL POWER?**Andri Feldmann<sup>1</sup><sup>1</sup>University of Bern, Institute of Sport Science, Bern, Switzerland**Correspondence:** Andri Feldmann (andri.feldmann@unibe.ch)

The power-duration relationship is well documented for athletic performance and is formulated mathematically in the critical power (CP) model. The CP model, when applied properly, has great predictive power, e.g. pedalling at a specific power output on an ergometer the model precisely calculates the time over which an athlete can sustain this power. However, CP presents physiological inconsistencies and process-oriented problems. The rapid development of near-infrared spectroscopy (NIRS) to measure muscle oxygenation ( $\text{SmO}_2$ ) dynamics provides a physiological exploration of the CP model on a conceptual and empirical level. Conceptually, the CP model provides two components: first CP is defined as the highest metabolic rate that can be achieved through oxidative means. And second, work capacity above CP named  $W'$ .  $\text{SmO}_2$  presents a steady-state in oxygen supply and demand and thereby represents CP specifically at a local level of analysis. Empirically, exploratory data quickly illustrates the relationship between performance and  $\text{SmO}_2$ , as shown during 3-min

all-out cycling tests to assess CP. During these tests, performance and SmO<sub>2</sub> essentially mirror each other, and both CP and W' generate solid correlation with what would be deemed their SmO<sub>2</sub> counterparts: first, the steady-state of SmO<sub>2</sub> correlates with CP. And second, the tissue oxygen reserve represented in SmO<sub>2</sub>, when calculated as an integral corresponds to W'. While the empirical data presented is preliminary, the proposition of a concurring physiological model to the current CP model is a plausible inference. Here we propose that SmO<sub>2</sub> steady-state representing CP as critical oxygenation or CO. And the tissue oxygen reserve above CO would then be identified as O'. This new CO model could fill in the physiological gap between the highly predictive CP model and at times its inability to track human physiology consistently. For simplicity's sake, this would include acute changes in physiology as a result of changing climate or elevation with travel, which can affect performance. These types of acute fluctuations, but not limited to, would be manageable when applying a CO model in conjunction with the CP model.

## Oral presentations

### O1

#### RELATIONSHIP BETWEEN OFFENSIVE MODALITIES AND RESULTS IN ELITE BASKETBALL GAMES

Aleksandar Selmanovic<sup>1</sup>, Mario Jelicic<sup>2</sup> and Drazen Dizdar<sup>3</sup>

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Basketball game is characterized by a set of alternating offensive and defensive phases generally limited by the change in ball possession - conversion. The aim of this research was to evaluate the difference between the offensive types of the winning and losing teams, noting the variance in game result. When observing the game as a whole, the study shows a high dynamic balance of transitions, set offenses, as well as other forms of offense between opponents in close game situations. A sample composed of 2607 entities representing basketball offense was collected by random selection of 15 Euroleague playoff games. The collected data were processed by the Match Analysis System, and the offense was classified into three basic types: set, transition and early offense. When focusing on the game periods with the highest point differential, there is evident significant change in the distribution and success of the forms of offense. These periods were characterized by one or several "scoring runs" that featured significantly more fast breaks and successful set plays by the winning team, as defined by Chi square test. Despite the fact that the losing team successfully controlled most of the game and perhaps even outplayed the opponent, identified critical intervals proved to be a decisive factor in the final outcome of the game.

### O2

#### CORRELATION BETWEEN GAMING, MOTOR ABILITIES AND KNOWLEDGE OF ENGLISH

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In the last decade, gaming has become one of the activities that many school-aged children have been using daily. As such, gaming has been having bad effect on children's physical activity but, at the same time, it has helped them in the process of learn English. The goal of the study was: 1) to establish correlation between the frequency of gaming with motor abilities and grades in English; 2) to establish correlation

between motor abilities and English. Thirty-four 7th-graders ( $m=19$ ,  $f=15$ ; age  $13.24\pm0.55$ ) of a primary school in Split participated in the study. The subjects were tested in 3 motor and 1 functional ability test. Grades in English were collected. The participants also filled out the questionnaire on the frequency and manner of gaming. The questionnaire is reliable (Cronbach's alpha=0.69 average inter-item correlation  $r=0.42$ ). There is no statistically significant correlation between the frequency of gaming and better grades in English. Girls game less than men (MWU Test, daily  $U=42.50$ ,  $p<0.01$ ; monthly  $U=37.50$ ,  $p<0.01$ ), have better grades in English and achieve less in certain motor abilities (MWU Test trunk lifting  $U=62.50$ ,  $p=0.01$ ; 6-min running  $U=54.00$ ,  $p<0.01$ ). The findings suggest that by gaming we do not improve our knowledge of English but that gaming is statistically negatively correlated with motor abilities. Since boys game significantly more, future preventive measures should be more focused on them.

### O3

#### PERFORMANCE OF PROFESSIONAL SOCCER PLAYERS BEFORE AND AFTER COVID-19 INFECTION; OBSERVATIONAL STUDY WITH AN EMPHASIS ON GRADUATED RETURN TO PLAY

Anamarija Jurcev Savicevic<sup>1,2</sup>, Jasna Nincevic<sup>1</sup>, Mia Peric<sup>3</sup>, Sime Versic<sup>3,4</sup>, Sarah Cuschieri<sup>5</sup>, Ante Bandalovic<sup>4</sup>, Ante Turic<sup>4</sup>, Boris Becir<sup>4</sup>, Toni Modric<sup>3</sup>, Damir Sekulic<sup>3</sup>

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The influence of COVID-19 infection on performance of professional athletes is rarely reported. The aim of this study is to evaluate the changes in match running performance (MRP) of professional soccer players after COVID-19 infection following all prerequisites for a safe return to play (RTP). This study was performed during the 2020/2021 soccer season in Croatia on 47 professional soccer players from first division team. Total sample was divided into two subgroups based on the results of a PCR test for COVID-19, with 31 positive (infected—INF) and 16 negative players (non-infected—NONINF). We observed (i) COVID-19 variables (PCR test results, the number of days needed to return to team, and number of days needed to RTP after the quarantine and isolation), and (ii) MRP (measured by global-positioning-system). The 57.4% players were tested positive on COVID-19 infection, with 74% being symptomatic. The number of days the infected players were not included in the team ranged from 7 to 51 (median: 12). The significant pre- to post-COVID differences in MRP for INF were found only for high-intensity-accelerations, and high-intensity-decelerations ( $t$ -test = 2.11 and 2.13, respectively;  $p < 0.05$ , moderate effect size differences), with poorer performance in post-COVID period. There was no significant decline in MRP in soccer players due to COVID-19 infection as changes were noted only in high-intensity accelerations. We can emphasize that the applied RTP was relatively well designed, but further adaptations are needed with regard to activities of high intensity.

### O4

#### GENDER COMPARISON FOR ANTHROPOMETRIC PARAMETERS IN ALBANIAN YOUTH BASKETBALL PLAYERS

Andi Spahi<sup>1</sup>, Rando Kukeli<sup>1</sup>

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Anthropometric parameters play an important role in basketball.

The purpose of this study was to find out possible differences for anthropometric parameters by gender in U16 and U18 basketball category. In total 149 youth basketball players did the measurement for body weight, height and waist circumference (U16- 52 boys and 26 girls; U18- 40 boys and 31 girls). Results for U16 team ages for body height, (boys- mean= 1.76 m, SD 0.09; girls- mean= 1.73 m, SD 0.11), body weight, (boys- mean= 68.2 kg, SD 10.63; girls- mean= 60.3 kg, SD 10.93) and waist circumference (boys- mean= 78.1 cm, SD 9.67; girls- mean= 76.3 cm, SD 10.07). Data for U 18 show body height, (boys- mean= 1.79 m, SD 0.09; girls- mean= 1.62 m, SD 0.10), body weight, (boys- mean= 74.9 kg, SD 10.6; girls- mean= 64.0 kg, SD 6.14) and waist circumference (boys- mean= 83.8 cm, SD 9.32; girls- mean= 70.4 cm, SD 5.5). In conclusion, for U16 category there are no significant changes for anthropometric variables by gender while for U18 category there are statistical significant changes for measurement performed in this study by gender. Boys in U18 category have higher results for anthropometric parameters.

**05****CONSTRUCTION AND VALIDATION OF NEWLY DEVELOPED SPORT-SPECIFIC GYMNASTICS BALANCE TEST**Antonela Karmen Ivisic<sup>1</sup>, Sime Versic<sup>1</sup>, Nikola Foretic<sup>1</sup>, Suncica Delas<sup>1</sup><sup>1</sup>University of Split, Faculty of Kinesiology, Split, Croatia**Correspondence:** Antonela Karmen Ivisic (nela.ivisic97@gmail.com)

The performance of systematic exercises in gymnastics consists of various gymnastics skills, including turns, rotations, jumps and specified positions. Balance assessment is a key when performing numerous associated elements. Due to deficiency of reliable specific gymnastics tests, new specific gymnastics balance tests needs to be constructed and validated. Considering complexity of gymnastics and highly developed balance ability in gymnast, this represents difficult process. The aim of study was to create and validate newly developed specific gymnastics balance test. 22 female students performed the newly constructed gymnastic balance test on gymnastic beam. Reliability was assessed by coefficient of variation, Crombach-alpha coefficient and inter-item correlation. Pearson's correlation and analysis of variance were used for homogeneity assessment. Validity of the test was assessed by calculation of correlation between specific gymnastics balance test and unilateral Bidex postural stability test. The study results show low reliability of newly constructed test to all three reliability coefficients. There are no significant differences between trials confirming good homogeneity of newly constructed test. Significant correlation was noticed between the 2nd and the 3rd trial. Results show weak correlation between new test and unilateral Bidex stability test. Validation of newly developed specific gymnastics balance test showed weak reliability and good homogeneity. Study confirmed difficult process of constructing high valid test with the aim of assessing a specific balance in gymnastics.

**06****TEST-RETEST RELIABILITY AND VALIDITY OF THE VELOCITY-BASED TRAINING DEVICE FOR MEASURING KINETICS AND KINEMATICS VARIABLES IN YOUTH SOCCER PLAYERS**Barbara Gilic<sup>1,2</sup>, Goran Gabrilo<sup>1</sup>, Vlade Bendic<sup>1</sup><sup>1</sup>University of Split, Faculty of Kinesiology, Split, Croatia; <sup>2</sup>University of Zagreb, Faculty of Kinesiology, Zagreb, Croatia**Correspondence:** Barbara Gilic (barbaragilic@gmail.com)

Velocity-based training (VBT) is a method for prescribing training load. The aim of this study was to investigate reliability and validity of the PUSH Band for measuring kinetics and kinematics variables during deadlift exercise. 16 soccer players (16-18 years) underwent

1 repetition maximum (1RM) protocol over two testing sessions. PUSH Band2.0 was used for measuring VBT-variables during deadlift at different 1RM percentages. Test-retest reliability was determined by Pearson's correlation coefficients and Bland-Altman plots. Validity was determined by correlating VBT-variables with Broad jump test (BJ). Average-power, average-, and peak-velocity at 45%1RM, peak-power at 55%1RM, average-force and peak-power at 65%1RM, average- and peak-power at 75%1RM displayed test-retest reliability (>50% of shared variance), confirmed by Bland-Altman plots. Average-power, average- and peak-velocity at 45%1RM displayed the highest correlations with BJ ( $r=0.78, 0.73$ , and  $0.76$ ), indicating proper validity. VBT-variables at moderate loads were more reliable, which could be explained by low experience in resistance-training of players. Variables at low intensity displayed the highest correlation/validity with BJ and could be recommended for developing jumping performance in youth players.

**07****THE EFFECT OF NARSSISTIC PERSONALITY FEATURES OF ATHLETES ON THEIR PROSOCIAL AND ANTISOCIAL BEHAVIORS**Bilge Gunu<sup>1</sup>, Anil Turkeli<sup>1</sup><sup>1</sup>University of Binali Yildirim, Healthy Science Institute, Department of Physical Education and Sports, Erzincan, Turkey**Correspondence:** Bilge Günü (gunubilge96@gmail.com)

The aim of this study is to examine the narcissistic personality traits and prosocial and antisocial behavior levels of national athletes living in various branches and in various regions. In this study, the relational survey model, one of the quantitative research methods, was used. The research sample consists of a total of 206 active athletes, 121 male (58.7%) and 85 female (41.3%), aged between 17 and 34 in different sports branches in Turkey. T-test and Anova test were used to analyze the data. In order to examine the effect of the narcissistic personalities of the athletes on their prosocial and antisocial behaviors, multiple linear regression analysis was performed level was determined as 0.05. There is no significant difference between the variables of gender, age, marital status, education level, persuaded income level, being a national athlete and the region they live in and their narcissistic personalities. It was determined that narcissistic personality total score was effective on prosocial and antisocial behaviors. As the narcissistic level increased, the antisocial teammate dimension increased. Narcissistic personality explains 0.005 of prosocial and antisocial behavior alone. As a result of the study, it was seen that the educational status of the athletes did not affect their narcissistic personalities, and the age of the athletes did not show any change in their narcissistic personalities. It was observed that the narcissism levels of male athletes were higher than female athletes.

**08****EFFECTS OF CROSSFIT TRAINING ON MORPHOLOGICAL CHARACTERISTICS OF MEN**Bogdan Zivanovic<sup>1</sup>, Jelena Obradovic<sup>1</sup>, Mila Vukadinovic Jurasic<sup>1</sup>, Ljubomir Kicanovic<sup>1</sup><sup>1</sup>University of Novi Sad, Faculty for Sport and Physical Education, Novi Sad, Serbia**Correspondence:** Bogdan Zivanovic (bogdanzivanovic97@gmail.com)

Physical fitness of people is very important for determining health status and educating people about their level of physical activity. The aim of this study was to determine whether CrossFit training has an impact on morphological characteristics and whether this impact differs from the control group. Data consisted of 50 participants who were divided into two groups, 22 participants who practiced CrossFit ( $28.64 \pm 2.04$  years), and 28 participants who were not in

the CrossFit program ( $26.89 \pm 2.99$  years). A total of ten anthropometric parameters (Height; Weight; BMI; Subscapular, Abdominal, and Upper arm skinfolds; Mean chest, Extended forearm, Outstretched upper arm, and Thigh circumferences were monitored before and after twelve weeks. The statistical significance of the effect independent variable was tested by ANCOVA and MANCOVA. The results indicate the positive effects of CrossFit training on the entire morphological space. The effects of the treatment had the greatest effect on the differences in body volume in favor of the experimental group. There were statistically significant differences in arm ( $p=0.02$ ), leg ( $p=0.00$ ), subscapular skinfold ( $p=0.00$ ) and even the middle circumference of the chest ( $p=0.03$ ). The most significant differences were observed in body volume. In accordance with these findings, the changes in morphological space are possible even after participating in the CrossFit training program for twelve weeks.

**O9****FITNESS PROFILING IN TOP-LEVEL YOUTH SPORT CLIMBING; GENDER DIFFERENCES**

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Sport climbers should possess specific anthropometric characteristics and conditioning capacities (fitness status) to achieve an elite level of the sport. This study aimed to determine gender differences in fitness status of the top-level youth sport climbers. The study was conducted on 20 elite youth Croatian sport climbers (all members of the National team, 10 females; 13-18 years of age). Variables included anthropometric status (mass, height, arm span, and body fat percentage), generic- (countermovement- and squat-jump, grip strength), and specific-fitness tests (power slap test and Draga foot lift). Boys were taller than girls ( $t$ -test= $2.51$ ,  $p=0.02$ , moderate effect size (ES)), and had lower body fat percentage ( $t=-5.66$ ,  $p=0.001$ , very large ES). Boys achieved better results in countermovement- ( $t=5.39$ ,  $p=0.001$ , very large ES) and squat-jump ( $t=2.19$ ,  $p=0.04$ , moderate ES), while there were no differences between genders in specific fitness tests. Gender differences were observed in generic but not in specific fitness, which could imply that climbing is a specific sport that demands and develops specific abilities similarly in boys and girls.

**O10****CHANGES IN TRUNK AND LOWER EXTREMITY MUSCLE STRENGTH FOLLOWING A TARGETED EXERCISE PROGRAM IN PATIENTS WITH PATELLOFEMORAL PAIN**

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Strength asymmetries are associated with knee malalignment during functional tasks that contribute to increased loading of the patellofemoral joint and may be linked to patellofemoral pain (PFP). The aim of this study was to identify changes in trunk and lower extremity muscles strength symmetry occurred during a targeted exercise program in patients with PFP. Eighteen patients with PFP, aged  $24.17 \pm 12.52$  years, participated in an eight-week supervised exercise program. Trunk and lower extremity muscle strength outcomes were assessed in a pretest-posttest design to identify changes in symmetry indexes that occurred during the intervention period.

The results indicate a significant increase in both ankle extension ( $p = 0.003$ ,  $d = 0.32$ ) and flexion ( $p < 0.001$ ,  $d = 0.46$ ) muscle strength symmetry indexes, along with an increase in hip flexion strength symmetry index ( $p = 0.049$ ,  $d = 0.10$ ). Furthermore, the Nordic hamstrings showed a significant increase in inter-leg symmetry ( $p = 0.010$ ,  $d = 0.28$ ). No further difference of the trunk and lower extremity muscle strength symmetry indexes were noticed during the intervention period. The findings suggest that a targeted exercise program may influence individual strength symmetries in patients with PFP and result in a more effective and time efficient clinical practice.

**O11****CORRELATION BETWEEN VOLLEYBALL RECEIVE PARAMETERS AND LEAGUE POSITION IN ELITE SERBIAN CLUBS**

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The game of volleyball, by its functional dynamics profile and regulatory compliance, is considered a game of unpredictable nature even though it possesses a relatively deterministic logic. Volleyball is organized into six game skills and in a sequential and chronologic logic: service, reception, setting, attack, block and dig. The aim of this study was to examine the correlations of individual statistical parameters of serve reception and ranking men's and women's teams in league. Twenty volleyball clubs ( $M=10$  and  $F=10$ ) in 180 matches were analyzed, that are competing in the Serbian Super League, after the end of the first half 2021/2022. Data were collected using the statistics program Data Volley 2007. Additional statistical analysis was performed using the SPSS Statistics. Most of parameters related to volleyball receive were in correlation with league position in elite Serbian clubs. Moreover, correlation was high, and statistical significant on level  $p \leq 0.01$  in number of serve receptions, faults of serve reception, negative reception and reception the serve efficiency as well as percentages of ideal reception on significant level  $p \leq 0.05$ . This study indicates significant correlations and that better placed teams are those that have less overall reception, less reception faults, less negative reception, a higher percentage of reception efficiency.

**O12****MULTIPLE IDENTITY THEORY: A LOGICAL STUDY ON THE DEVELOPMENT OF FOOTBALL CULTURE IN THE CONTEXT OF GLOBALIZATION**

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Any profound history and culture of a country will combine their own spirit and concept to illustrate football art. Along with the historical process of the development of football culture, this paper expounds the ecological nature of the development of world football from the aspects of regional identity, national identity, religious identity and national identity, and provides new references and suggestions for the development of football in the future. From the perspective of anthropology, psychology, sociology and other disciplines, this paper takes football culture as the research object and uses the methods of literature, historical comparison, logical analysis and so on. Football culture is the projection of national self and the reason why football can last for a hundred years and spread around the world. The context of globalization, the different football culture inevitably approach, weaken the national identity

consciousness, sense of identity and belonging, is not conducive to the sustainable development of football sports, so the development of football should be to foster football culture of our nation's soil as the basis, to strengthen the "cultural consciousness" and strengthen the identity, guide and arouse the diversity and nationality of world football.

**O13****DIFFERENCES IN THE MORPHOLOGICAL CHARACTERISTICS AND BODY COMPOSITION BETWEEN ELITE MONTENEGRIN KATA AND KUMITE KARATEKAS**

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Elite karate athletes should have specific morphological characteristics and body composition suitable for their specializations. This study aimed to determine the differences in morphological characteristics and body composition of elite Montenegrin karate athletes according to different specializations. This study consisted of a total of 16 male karate athletes divided according to specialization on Kata (form or movement pattern) and Kumite (fighting) disciplines. The subject sample included healthy, black belt karate senior athletes, with no prior injuries divided to Kata (n=6, 19.83±4.71 years) and Kumite (n=10, 20.4±5.21 years) athletes. Morphological characteristics and body composition were evaluated by a battery of 11 variables: body height (BH), body mass (BM), triceps skinfold (TS), biceps skinfold (BiS), back skinfold (BS), abdominal skinfold (AS), upper leg skinfold (ULS), lower leg skinfold (LLS), body mass index (BMI), fat percentage (FP), and muscle mass percentages(MP). The differences in morphological characteristics and the composition of the body between Kata and Kumite karatekas were determined by using a statistic procedure with a t-test for small independent samples. It was determined that the Kumite had a higher body height (.017), body weight (.049), as well as a higher percentage of muscle mass (.017) than Kata karatekas. In other parameters concerning the distribution of subcutaneous adipose tissue, as well as the percentage of body fat, there was no difference between the groups. The results suggest that there is some difference in morphological characteristics between Kata and Kumite karatekas, but for more complete conclusions an analysis should be performed on a larger sample of high-level karate athletes.

**O14****THE PHYSIOLOGICAL AND PERCEPTUAL DIFFERENCE BETWEEN NORMOBARIC AND HYPOBARIC HYPOXIA**

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The difference on physiological responses between simulated and terrestrial altitude are not exactly known. The aim of this study was to investigate the difference between normobaric hypoxia (NH) and a two-day stay at hypobaric hypoxia (HH1 and HH2) and to compare it to normobaric normoxia (NN) on cognitive performance, physiological and perceptual response during submaximal exercise and on the autonomic nervous system. 20 healthy (f&m) participants com-

pleted 4 experimental trials under NN ( $\text{PiO}_2=146.0\pm1.5\text{mmHg}$ ), NH ( $\text{PiO}_2=100.9\pm1.3\text{mmHg}$ , HH1 ( $\text{PiO}_2=105.6\pm0.4\text{mmHg}$ ) and HH2 ( $\text{PiO}_2=106.0\pm0.5\text{mmHg}$ ). During the cognitive test, cTOI was higher in NN vs NH ( $\Delta\text{cTOI } 5.03\pm1.4\%$ ,  $p=0.001$ ) and higher in NN vs HH1 ( $\Delta\text{cTOI } 5.14\pm1.4\%$ ,  $p=0.001$ ). During the step task, SpO2 was higher in NN vs all hypoxic conditions ( $p<0.05$  for all). SpO2 was higher NH vs HH1 ( $\Delta\text{SpO}_2 1.7\pm0.6\%$ ,  $p=0.008$ ). HR was lower in NH vs HH2 ( $\Delta\text{HR } 5.8\pm2.6 \text{ bpm}$ ,  $p=0.03$ ). At rest, the autonomic nervous system was more negatively affected in HH2 vs NH ( $p<0.05$ ) and symptoms of acute mountain sickness were higher at HH1 vs all other conditions ( $p<0.01$ ). In conclusion, the physiological responses at ±3000 m of altitude are different between NH and HH.

**O15****A COMPARISON STUDY FOR FLEXIBILITY AND SPEED BETWEEN U19 AND U21 SOCCER TEAM IN ALBANIA**

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Bio motor parameters play a special role in football. There is evidence that with increasing age to young footballers these parameters will change. The purpose of this paper is to present a clear overview if there are changes in flexibility and speed in footballers in the city of Shkodra within teams U19 compare to U21. The measurements of this study were performed in four football teams in the city of Shkodra (N = 60). In the U19 age group participated in the measurement N= 32, while in the U21 age group N = 28 athletes participated. The Sit and Reach test was performed to measure flexibility, while the sprint 20m and 30m tests were performed to measure speed. Results from data comparison for flexibility show no significant difference ( $F=2.358$ ;  $\text{Sig}= 0.13$ ) between U19 (mean= 26.1 cm) and U21 (mean= 28.2 cm). Results obtain from comparison for speed (sprint 20m) show no statistical difference ( $F=3.861$ ;  $\text{Sig}= 0.06$ ) between U19 (mean= 2.98 sec) and U21 (mean= 3.26 sec). The same data results were obtaining for speed (sprint 30m) show no statistical difference ( $F=2.02$ ;  $\text{Sig}= 0.16$ ) between U19 (mean= 4.30 sec) and U21 (mean= 4.43 sec). The findings suggest that in U19 and U21 soccer team there are no difference with regard to flexibility and speed.

**O16****THE TRAINING CHARACTERISTICS OF ONE OF THE WORLD'S TOP FEMALE TENNIS PLAYERS**

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Elite tennis players include different types of intensity distribution in their training programs. One of the most used formats is the traditional piramidal distribution of intensity. Current findings suggest that polarized distribution of intensity can be an effective method for improving sports performance. The main aim of this study was to investigate the training characteristics of one of the best female tennis players during her off-season training block. Training data was systemized by training form (technical, tactical, and match-play) and intensity (low, moderate, and high-intensity training). A heart rate monitoring device was used during regular tennis training sessions. Training intensity was separated into three different zones based on heart rate. Light intensity training was from 55% to 85% of their maximum heart rate (HRmax) (or 45%-80% maximum oxygen uptake VO2max), moderate intensity training was from 85% to 90% FSmax (or 81%-87% VO2max) while high-intensity training was classed as any reading above 90% FSmax (or >88% VO2max). The

total number of light intensity training remained stable throughout the off-season period, whilst the total light intensity training time was gradually reduced from the general preparation period to the competitive period. This lower training intensity is mostly used when conducting technical or tactical training sessions. The amount of moderate intensity training also decreased from the general preparation period to the competitive period, while high-intensity training showed the opposite pattern, which all together induced a gradual polarized training pattern toward the competitive period. This study provides unique data on one the best professional female tennis players short-term training process, including information about the distribution of and the interplay between sessions of different forms, intensities, and exercise modes throughout the off-season training period.

**O17****THE EFFECT OF CROWD SUPPORT ON HOME ADVANTAGE IN CROATIAN SOCCER**

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The home advantage is a frequently discussed issue in the sports literature. Some previous studies suggest that crowd support have a positive influence on the home teams, on soccer team performance and the final result of the game. The main goal of this paper was to determine the differences between the games with crowd support and the games without crowd support on home advantage in soccer. We used the term "home field advantage", meaning that the fans bring the home team an advantage at the game. The study sample consists of 380 matches in seasons 2019/2020 and 2020/2021 in the 1st Croatian league. There were a total of 179 games with audience before Corona. The sample of variables consisted of: total points won, shots on target home/away, yellow cards home/away, red cards home/away, fouls home/away and visitors attendance. Due to the situation with the COVID-19 pandemic during the 2020/2021 season, almost all matches were played without spectators, so the hypothesis of the relation between the "home field advantage" and the crowd attendance could be tested. The statistic package Statistica 13, were used to calculate the basic descriptive parameters and T-test. The analysis of the obtained results showed a statistically significant difference in four variables: points won by the host, free kicks by hosts and guests and shots on target by hosts. Statistical analysis indicated that with the presence of audience, the home team won 1.76 points, while in the period without crowd support it was 1.44 per game. The results of this study confirm that audience contributes to the performance of the home team and inferior performance of visiting team, also on performance and decision-making of referees.

**O18****STRENGTH TRAINING STRATEGIES IN SOCCER : AN OVERVIEW OF THE MOST EFFICIENT METHODS AND THEIR APPLICATION FOR BETTER PERFORMANCE**

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Football is a sport where high intensity bouts, quick turns of the body and explosive movements are occurring frequently on the playing ground and in many occasions those abilities determine the result of the game. In addition the sport is characterized by many injuries happening during game days and training sessions. Strength

training can be a really useful tool when we aim to improve performance and decrease injuries. The purpose of this study is to show the beneficial effects that four strength training routines have, regarding injury prevention and performance improvement. Standard systematic review methodology was modified and adopted for this review and electronic-searching tools were used to locate the papers needed. We have isolated 4 performance improvement and injury prevention strategies developed by researchers as the most effective to reduce the number of injuries and to enhance performance to a certain degree: Maximal Strength, Power, Strength Endurance and Blood Flow Restriction training. We evaluated these in relation to their scientific substrate and to their applicability in the training programs introduced by sports scientists as well as strength and conditioning coaches on the pitch. Our present systematic review revealed those four strategies as the most effective and popular ones today.

**O19****INFLUENCE OF PHYSICAL ACTIVITY ON TOLERANCE TO NORMOBARIC HYPOXIA**

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Normobaric hypoxia is a novel training method in which the athlete breathes with a decreased oxygen ratio. Prior to the training sessions, it is necessary to know the tolerance to hypoxia in order to establish a personalized protocol and to carry it out in safe conditions. Purpose is to analyze the influence of physical activity on a normobaric hypoxia tolerance test (NHTT). 21 subjects (8 regular athletes and 13 non-athletes) make up our study ( $23.5 \pm 2.9$  years). A NHTT was performed with the iAltitude® simulator, with 11% FiO<sub>2</sub> (5050m). The NHTT was terminated at 10 minutes duration or when arterial oxygen saturation was below 83%. The weekly hours of physical activity and the duration of each participant's NHTT were recorded. The tests had an average duration of  $6.8 \pm 2.8$  minutes. According to the level of physical activity, athletes had a significantly ( $p=0.012$ ) longer duration ( $8.8 \pm 2.4$  minutes) than non-athletes ( $5.7 \pm 2.6$  minutes). A positive correlation (Pearson's r) was observed between weekly hours of physical activity and minutes in the NHTT. Subjects who practice physical activity on a regular basis have a higher hypoxia tolerance time than non-athletes.

**O20****STANDARD PHYSICAL FITNESS TESTS FOR EMPLOYEES OF THE MINISTRY OF INTERIOR OF BULGARIA**

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A high level of physical fitness correlates with high efficiency of work for the officers engaged in crime prevention and counteraction, social order maintenance and population protection, i.e. the employees of the Ministry of Interior. The aim of the study is to analyze the methodology of physical education and control of the Bulgarian police forces that is currently in use and to compare it with similar international methodologies. We studied 164 officers aged 40 years on average by a pedagogical testing protocol. We included 4 standard test queries that are approved by the Ministry of Interior. Analyzing the results by cohorts, we found that officers in cohorts under the age of 30 and those between the ages of 30 and

40 most easily cover the requirements of the tests. Participants over the age of 50 find the tests of coordination and endurance difficult. Based on our results, we can conclude that the physical fitness tests, which are currently approved by the Ministry of Interior, are not in accordance with the biological status of officers. The standard requirements need adjustments by age cohorts, and those for officers under the age of 40 should be updated and increased.

**O21****EFFECTS OF UNIVERSITY-BASED PHYSICAL ACTIVITY AND PUBLIC HEALTH COURSE ON STAGES OF CHANGE FOR PHYSICAL ACTIVITY, PERCEPTIONS OF EXERCISE BENEFITS/ BARRIERS AND TECHNOLOGY ADDICTION: PRE-TEST RESULTS**

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Classroom-based health education programs are part of informational approaches for promoting physical activity. The purpose of this study was to examine the effects of a 13-week Physical Activity and Public Health Course on stages of change for physical activity, perceptions of exercise benefits/barriers, and technology dependency of university students. The total number of participants was 61 students (Nexperimental group=31, Ncontrol group=30) from an urban public university. The pre-results showed that there was no significant effect of groups on two dependent variables Wilks'  $\lambda = .98$ ,  $F(2, 58) = .585$ ,  $p > .05$ . In the main effect, The results showed that there was no significant effect of groups on exercise benefits/barriers in experimental ( $M=141.77$ ,  $SD=17.30$ ) and control group ( $M=138.77$ ,  $SD=16.32$ )  $F(1, 59) = .487$ ,  $p > .025$  and there was no significant effect of groups on technology addiction in experimental ( $M=58.13$ ,  $SD=17.22$ ) and control group ( $M=54.77$ ,  $SD=17.06$ )  $F(1, 59) = .587$ ,  $p > .025$ . Regarding stages of change for physical activity, students in the experimental group located more in the action stage ( $n=15$ ) than the control group ( $n= 10$ ). In other words, students in the control group were more inactive ( $n= 20$ ) than students in the experimental group ( $n= 16$ ). When the post-tests are completed, the effect of the physical activity and public health course on university students' stages of change for physical activity, perceptions of exercise benefits/barriers, and technology addiction will be revealed.

**O22****KINESIOLOGICAL ACTIVITY OF STUDENTS IN LOWER CLASSES OF ELEMENTARY SCHOOL**

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The purpose of this paper was to determine quantity of kinesiological activity in children in lower classes at elementary school. The sample of respondents included 51 students, 21 girls and 30 boys. All students attend Antunovac elementary school. The sample was taken on students born in 2004, 2005 and 2006. The sample of variables consists of answers to questions that were intended to assess the kinesiological activity of children. Data were processed by descriptive statistics method. Cronbach reliability coefficient was calculated as well as average correlation among particles. The analysis proved reliability of survey and the connection with test-retest. Data have revealed a large quantity of ki-

nesiological activity in children who play different sports, but, on the other hand, a large quantity of kinesiological inactivity among respondents. We may draw a conclusion that respondents play certain sports in their free time, but still there are a great number of children who spend most of their time sitting. These data are rather disturbing considering the fact that the children involved attend lower classes.

**O23****DIFFERENCES IN PHYSIOLOGICAL LOAD OF STUDENTS DURING NORDIC WALKING AND JOGGING**

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Physical activity is important for the physical and mental health of almost everyone. Nordic walking is a physical activity in which participants use specially designed poles while walking, while the term jogging implies light running at speeds less than 10 km/h. The aim of this research is to monitor the load intensity in real conditions, using a heart rate monitor Team Polar System, during nordic walking and jogging and comparing possible differences in heart rate responses after the fifth minute of activity, at an average speed of 7.5km / h. The assessment of heart rate responses for this research was conducted on the 30 male students, at 2 separate days. The results of the variables used in this study show statistically significant differences at the level of significance  $p=.000$ . From the mean value results ( $M$ ) it is obvious that the respondents achieved higher results of heart rate responses during nordic walking compared to the identical tests applied during jogging. The results of this study indicate that both Nordic walking and jogging are beneficial but Nordic walking contributes more in achieving higher body loads resulting in increased oxygen consumption and thus calories.

**O24****REGRESSION MODELING OF ACHIEVEMENTS IN THE DISCIPLINE OF SHOT PUTTING OF TOP ATHLETES**

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Until recently regression modeling has rarely been used in kinesiological research, so this paper aimed to apply regression modeling to the results in shot putting. The research was conducted on a sample of 24 shot putters (Cup Winter Throwing) whose best shots were analyzed. The predictor variables set consists of 12 kinematic variables and two anthropometric measures. The criterion variable is the shot putting result. A high-frequency camera recorded the performances and the best result was analyzed with the 3D motion analysis system (APAS). Stepwise regression analysis and correlation of calculated and achieved results in shot putting for cross-validation subsamples of subjects were applied. The results indicate a high percentage of explained variance (97%). Therefore, the regression equation is: Result = -41.17 + 2.12 \* TVEL (throwing moment ball velocity) + 0.74 \* TANG (throwing angle) + 2.82 \* Thgt. (throwing height). The regression equation was applied to the cross-validation subsample, and the respondents' expected results were calculated. The calculated 0.96 correlation coefficient is almost identical to the validation sample coefficient (0.98). The

results confirmed that with this procedure and the selected predictors, a highly predictive regression equation can be defined for top male competitors' shot putting results. What directly determines the result, regardless of the throwing technique, are the ball velocity at the moment of throwing, the angle, and the height of the throwing.

**O25****PERFORMANCE ANALYSIS IN VOLLEYBALL: PROBLEM OF DEFINING THE SET SCORE**

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The purpose of this study is to present the relative point difference as the most adequate methodological variation of a score definition in a volleyball set. A sample of 40 volleyball sets played in the Men's European Volleyball League in 2011 and 2012 were randomly selected. The predictor variables were efficiency coefficients of the five phases of volleyball game (serve, reception, spike, block and dig) while a criterion variable was the set score. The set score was defined in four different manners, victory - defeat, category according to the range of point difference, the point difference and the relative point difference. A series of four multiple linear regression analysis was conducted to determine the relationship between the efficiency coefficients of the game phases and the set score, each for differently defined set score. The relative point difference is a variation of the set score that has 75.2% of common variance with the game phases. Next is the point difference with 70.7%, then the category with 69.0%, and the victory - defeat with the lowest amount, only 47.5%. Relative point difference additionally differentiates the entities with the same point difference and different overall rallies played in a set. An inadequately defined set score could enable the determination of the phenomenon that actually exists.

**O26****ANALYSIS OF ASSOCIATION OF THE ANTHROPOMETRIC, MOTOR AND FUNCTIONAL PARAMETERS ON COMPETITIVE EFFICIENCY IN YOUTH FOOTBALL PLAYERS**

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In a complex team sport setting, such as in football, match outcome is determined by numerous factors such as technical, tactical, physical and psychological preparedness of all players who have to act like a unit. The aim of this study was to identify anthropometric characteristics and motor and functional abilities that affect competitive efficiency of the U-15 football players. 20 football players, classified either as starters (N=10) or non-starters (N=10) underwent morphologic measurements comprised of body height and body weight, testing of functional capacity and motoric assessments: 5-meter sprint, 10-meter sprint, 20-meter sprint, broad jump, medicine ball throw and triple jump on left and right leg. Also, age of peak height velocity (APHV) was calculated for each participant. Statistical analysis included T-test and binomial logistic regression. Results showed that body weight (OR:0,86; 95%CI:0,75-0,99) and medicine ball throw ( $t=2,24$ ;  $p=0,02$ ) are only significant predictors of the competitive efficiency in observed sample of young football players. Since upper body power is highly influenced by anthropometric characteristics in this age, starters will most likely receive more playing time and have superiority over their peers due to morphologic advantages. This study once again confirmed

that early maturing players are in precedence over others because of their body size that seems to be significant determinant of success in that age.

**O27****EFFECTS OF INTRAABDOMINAL PRESSURE ON FUNCTIONAL SPINE STABILITY DURING HIP FLEXION**

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Stability (or stiffness) of the spine is dependent on the dynamic coordination of numerous synergist and antagonist muscles for precise control of excessive joint motion while allowing for the generation of necessary torques for desired multi-joint movement. One parameter for influencing spinal mechanics and stiffness is intra-abdominal pressure (IAP). The aim of this study was to define effects of IAP on spine stability during standing unilateral hip flexion movement. Psoas major functions as a hip flexor with minimal mechanical impact on the spine when the spine stability functioning sufficiently, however, in the event of inadequate spine stability, the pull of the psoas major may result in anterior shear stresses on the lumbar segments. IAP was measured with non-invasive measurement pressure belt during the hip flexion movement. Pelvic tilt, sacral angle and angle of hip flexion, knee flexion and dorsiflexion were measured on photo - video analysis. Greater IAP is in positive correlation with smaller changing of pelvic tilt and sacral angle movement during standing unilateral hip flexion movement. IAP regulation spine stability can be disrupted by insufficient postural function of the diaphragm, often resulting in increased compressive forces on the spine due to compensatory activity of the superficial spinal extensors, and abnormal position of the chest or ribcage due to an imbalance between upper and lower chest musculature. Spine stability provides the "punctum fixum" (fixed stable base) from which muscles can generate movement and provide centred joints.

**O28****DEVELOPMENT OF AGILITY PERFORMANCE AMONG ADOLESCENTS: THE MULTI-SPORT APPROACH**

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The multi-sport approach is suggested as a natural method towards developing physical fitness among young athletes. Coaches were urged to apply this approach with emphasis on a fun activity, active play and small-sided games in order to maximize the benefit of this approach. The purpose of this study is to investigate the effects of a multi-sport approach towards the development of agility performance among adolescents. A quasi-experimental design was used for the study. Forty adolescents (n= 40), age between 13 to 14 years old randomly assigned to the control group (CG) (n= 20) and experimental group (EG) (n= 20). The EG multi-sport approach consisted of playing football, futsal, sepak takraw, volleyball, basketball and netball. While, the CG performed football and futsal training only, thrice for 12 weeks. The agility performance was assessed three times using the Quadrant Jump test. One during pre-test (baseline), second on post-test 1 (week 6) and third on post-test 2 (week 12). In the EG group, the agility performance increased significantly compared to CG with

$F(1, 38) = 64.53$ ,  $p > 0.0001$ . The agility performance was improved by 5.85 mean total of jumping in the EG in week 12. The multi-sport training approach increased the agility performance among adolescents. In a conclusion, this training approach is more effective and should become a training routine at any level of sport development.

**O29****CONSTRUCTION OF A SPECIFIC TEST FOR FLEXIBILITY ASSESSMENT IN RHYTHMIC GYMNASTICS**

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Rhythmic gymnastics is a combination of sport and art in which flexibility is one of most important ability and very high positioned in the performance specification equation. However, systematic research on specific tests of flexibility in rhythmic gymnastics is limited in the selection of the children potential as well in tracking of training process. The primary purpose of this research is construct a measurement instrument for evaluation of flexibility to be applied specifically to rhythmic gymnastics. The sample consisted of 41 rhythmic gymnasts aged 10 to 12. We used four tests and one of these four was newly constructed. SPSS Statistics 14.0 was used for statistical analysis, Shapiro-Wilks test was used to determine distribution normality, Kruskal-Wallis test with Bonferroni correction to determine the validation and Fleiss Kappa to determine the reliability, which is further determined Spearman's Rank by correlation. The results of the conducted statistical analyzes showed that the newly constructed test measure the flexibility which is required for success in rhythmic gymnastics. It would be good to implement newly constructed test when selecting children for rhythmic gymnastics as well as during transitive measurements in the training process.

**O30****RESEARCH ON GREEN TECHNOLOGY INNOVATION AND ECOLOGICAL CIVILIZATION LEGACY OF BEIJING WINTER OLYMPIC GAMES**

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Promoting the concept of the green Olympic Games and inheriting the green legacies of the Beijing Winter Olympic Games are key issues worthy of attention. The goal of this study is to summarize the green experience and green legacies of the Beijing Winter Olympics, promote the sustainable development of the Olympic Winter Games. Keywords "green science and technology innovation" and "winter Olympic legacy" are used to search relevant electronic databases, such as CNKI and Web of Science. The study based on the Olympic legacy measurement framework. Using green technologies and implementing the concept of ecological civilization, the Beijing Winter Olympics brought rich economic, social and ecological values to social development and human development, generating an ecological civilization legacy unique to the Beijing Winter Olympics. The ecological civilization legacy of the Beijing Winter Olympics, is the positive impact brought by the structural changes acting in different fields under the guidance of the ecological civilization ideology. It is necessary to inherit the ecological civilization legacy of the Beijing Winter Olympics, promote the construction of ecological sports venues,

promote the development of ecological sports, enhance people's ecological lifestyles and promote the idea of ecological civilization, to achieve the sustainable development of the Olympic Winter Games.

**O31****RELATION BETWEEN SOME MOTOR SKILLS AND FAST RUNNING AT 60 M LOW START IN FIFTH GRADERS**

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Pupils' motor skills and motor knowledge are of great importance for quality programming and reprogramming, as well as monitoring and evaluation in the teaching of Physical Education. The research was conducted with the aim to obtain information on the connection between a set of motor skills and motor knowledge in the 60m sprint from a low start in fifth-grade elementary school pupils. 21 motor tests were applied to a sample of 152-fifth grade elementary school pupils from Split, Republic of Croatia, aged 11 years ( $\pm 6$  months) that assessed their motor skills and one test of motor knowledge – the 60m sprint from a low start. The correlation between the set of predictor motor variables and the criterion variable of motor knowledge was determined by applying regression analysis. The results of the regression analysis indicate a statistically significant correlation between the predictor set of motor variables and the criterion variable 60m sprint from a low start. The value of the multiple correlation coefficient ( $R = 0.61$ ) indicates that the variability of the criterion variable is significantly influenced by the predictor set of variables. The analysis of the partial influence of individual motor variables in defining the significance of the regression model showed a statistically significant contribution to two variables of the predictor set of motor variables, namely the variables Tapping feet against the wall ( $\beta = 0.30$ ) and Polygon backwards ( $\beta = -0.28$ ). The results of this research will contribute to a better understanding of kinesiological education, especially in the domain of planning and programming as well as implementation and control of the physical exercise process.

**O32****PRE-PROTECTION MEASURES OF ATHLETE HEAT STRESS UNDER HIGH TEMPERATURE ENVIRONMENT**

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Athletes in outdoor sports events such as the Olympic Games often face the test of high temperature environment, how to reduce the negative effects of heat stress in high temperature environment has become a concern of researchers. The study analyzes the damage mechanism and pre-protection measures of athlete heat stress in high temperature environment. Specific key words "heat stress", "heat acclimatization", "pre-cooling", "exercise hydrating", "drug intervention" were used to search relevant electronic databases, such as PubMed, Web of Science and Scopus. The research was conducted according to PRISMA guidelines. Hot exercises should last for more than 7 days and no less than 100min per day; sports team can be combined with the actual conditions to choose the ice pulp internal pre-cooling, cold water soaked external pre-cooling and combined pre-cooling, pre-cooling intervention was available before 30min-1h, during the exercise, ac-

cording to the project, duration and water replenishment point, a small number of times supplemented with sugar-light saline; oral uradil can reduce the central temperature of the human body in a high temperature environment, menthol is able to improve mobility by improving thermal comfort. Pre-protection measures can reduce the negative impact of heat stress on athletes in high temperature environment, heat acclimatization, pre-cooling, exercise hydrating, and drug intervention are effective measures for the pre-protection of athletes.

**O33****RESEARCH ON THE CAPITALIZATION DILEMMA AND THE SOLUTION OF CHINESE FOOTBALL REFORM**Liu Zeyong<sup>1</sup>, Bu Te<sup>1</sup><sup>1</sup>Hunan Normal University, College of Physical Education, Changsha, Hunan, China**Correspondence:** Liu Zeyong (1002679102@qq.com)

For many years, China's professional soccer league has been undergoing market-oriented reform, and numerous challenges and hidden hazards associated with excessive financing have emerged thus far. The goal of this perspective is to identify the reasons of capital chaos during the process of market-oriented processional soccer reform, to analyze the league's possible risks of capitalization, and to examine governance option. Specific key words "Professional soccer league", "market-oriented reform", "market-oriented reform", were used to search relevant electronic databases. This paper demonstrates that the primary causes of over capitalization in professional soccer reform are profit-driven real estate capital, chaotic rivalry among clubs, a lack of governance in the public sectors, and a misalignment of government and soccer league aims. Pursuing various efforts to overcome conceptual and institutional barriers impeding the development of professional sports, maximizing the vitality of market capital, and thoroughly implementing the concept of professional sports goals in China are all necessary components of China's development in order to build a strong sports nation.

**O34****POWER VALUES DERIVED BY HIP-THRUST EXERCISE IN RELATION TO JUMPING AND SPRINTING PERFORMANCE IN YOUTH SOCCER PLAYERS: A PRELIMINARY INVESTIGATION**Luka Cikojevic<sup>1</sup>, Barbara Gilic<sup>1,2</sup>, Damir Lastre<sup>1</sup><sup>1</sup>University of Split, Faculty of Kinesiology, Split, Croatia, <sup>2</sup>University of Zagreb, Faculty of Kinesiology, Zagreb, Croatia**Correspondence:** Luka Cikojevic (cikaa3@gmail.com)

The hip-thrust is a horizontally directed resistance exercise and is observed as one of the most efficient exercises for developing horizontally directed power moments such as sprints and jumps. The aim of this study was to preliminary investigate the relationship between power values derived from hip-thrust exercise and jumping and sprinting performances in youth soccer players. Soccer players ( $n = 6$ , 15-20 years) were tested on sprinting 10 and 20 meters, standing broad jump, and hip-thrust exercise performing loads from 30-100% of 1 repetition maximal (1RM). Power values during hip-thrust were recorded using the PUSH Band. Mean power at 30%1RM and 70%1RM was correlated with sprinting 10 meters (Spearman's R=-0.89, -0.94, respectively), mean and peak power at 70%1RM with sprinting 20 meters (-0.84, -0.81 respectively), and mean and peak power at 70%1RM with broad jump (0.89, 0.89, respectively). Power values at moderate loads are associated with sprinting and jumping performance, implying that training at moderate loads could provoke optimal development

of horizontally directed power exercises which are crucial for soccer performance.

**O35****HOW YOUTH SOCCER TRAINING AFFECTS THE INDICATORS OF PERIPHERAL AND CENTRAL FATIGUE?**Marcin Andrzejewski<sup>1</sup>, Marek Konefal<sup>2</sup>, Tomasz Podgórski<sup>1</sup>, Beata Pluta<sup>1</sup>, Paweł Chmura<sup>2</sup>, Jan Chmura<sup>2</sup>, Jakub Marynowicz<sup>1</sup>, Kamil Melka<sup>3</sup>, Marius Brazaits<sup>4</sup>, Jakub Kryściak<sup>1</sup><sup>1</sup>Poznań University of Physical Education, Poznań, Poland; <sup>2</sup>Wrocław University of Health and Sport Science, Wrocław, Poland; <sup>3</sup>University of Wrocław, Wrocław, Poland; <sup>4</sup>Lithuanian Sports University, Kaunas, Lithuania**Correspondence:** Marcin Andrzejewski (andrzejewski@awf.poznan.pl)

Physical fitness optimization and injury risk-reducing require extensive monitoring of training loads and athletes' fatigue status. This study aimed to investigate the effect of a 6-month training program on the indicators characterizing the level of peripheral (creatinine kinase – CK; cortisol – COR) and central (serotonin – SER; brain-derived neurotrophic factor – BDNF) fatigue in youth soccer players. Eighteen soccer players were blood-tested four times: at the beginning of the preparation period (T0), immediately after the preparation period (T1), in the middle of the competitive period (T2), and at the end of the competitive period (T3). CK activity as well as concentrations of serum COR, SER and BDNF were determined. Training loads were recorded using a session rating of perceived exertion (sRPE). Statistical analyzes revealed significant effects for all biochemical parameters in relation to their time measurements. The statistical analyzes of sRPE and differences of biochemical parameters in relation to their subsequent measurements (T0-T1, T1-T2, T2-T3) also revealed significant effects observed for all variables. The results of the study showed that a combination of subjective and objective markers, including training loads, should be used in monitoring both physiological and psychological aspects of fatigue.

**O36****THE INFLUENCE OF MID-SEASON COACH TURNOVER ON THE PHYSICAL MATCH PERFORMANCE AND MATCH OUTCOME IN PROFESSIONAL SOCCER PLAYERS**Marek Konefal<sup>1</sup>, Alexis Padrón-Cabo<sup>2</sup>, Toni Modric<sup>3</sup>, Sime Versic<sup>3</sup>, Marcin Andrzejewski<sup>4</sup>, Paweł Chmura<sup>1</sup>, Damir Sekulic<sup>3</sup>, Jan Chmura<sup>1</sup>, Łukasz Radzimiński<sup>5</sup><sup>1</sup>Wrocław University of Health and Sport Sciences, Faculty of Physical Education and Sport, Wrocław, Poland; <sup>2</sup>University of Vigo, Faculty of Education and Sports Sciences, Pontevedra, Spain, <sup>3</sup>University of Split, Faculty of Kinesiology, Split, Croatia; <sup>4</sup>University School of Physical Education, Department of Recreation, Poznań, Poland; <sup>5</sup>Gdansk University of Physical Education and Sport, Department of Physiology, Gdansk, Poland**Correspondence:** Marek Konefal (marek.konefal@awf.wroc.pl)

The main purpose of this research was to compare the physical match activity and match performance before and after the coach turnover in professional soccer teams. A total of 1118 Polish Ekstraklasa team performances were analysed in the study. This number included the data of teams leaded by coaches who were about to leave the club, and new coaches, and the same coaches for all analysed period. Analysed: total distance covered (TD), number of high-intensity actions (NHIR). Changing the coach during the soccer season may result in short-term improvement in teams; results and physical match performance. However, after a period of about 5 games this effect disappear. The highest number of collected points per game are obtained by coaches who lead their teams for several

seasons. The selection and hiring of appropriate coach, suitable for the specific team and allowing him for longitudinal work could positively affect the match performance in professional soccer.

**O37**

### **INFLUENCE OF TACTICAL EQUIPMENT ON THE ERGOSPIROMETRIC ASSESSMENT OF MILITARY PARACHUTISTS.**

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The military parachutists are responsible of special air operations who require certain capabilities in their physical condition, due to their intense professional career. The analysis of oxygen consumption (VO<sub>2</sub>) and heart rate (HR) allows the determination of aerobic (VT1) and anaerobic (VT2) thresholds. Used to study the adequacy of the organism to exercise and in the analysis of sporting performance. Analysing the influence of tactical equipment on the stress test performance of elite parachutists. 10 parachutists, with an average of 29-41 years old. Anthropometric values were determined of: weight 76.45 kg ( $\pm$  9.68), height 173.69 cm ( $\pm$  5.42) and body mass index (BMI) 25.23 ( $\pm$  5.24). Each one, performed 2 maximal treadmill exercise testing: one a conventional stress test (A) and another with the tactical equipment (weight 20 kg) (B). We obtained maximum oxygen consumption (Metalyzer 3B) and monitored the electrocardiogram continuously. The test started at a speed of 6km/h and a slope of 1%. The results of the two test were compared. The average value and standard deviation (SD) of different variables with equipment (B) and without it (A) and p-value were obtained: velocity (A: 14.80  $\pm$  3.29; B: 11.50  $\pm$  1.42 Km/h; p=0.073), HR (A: 182.7  $\pm$  58.62; B: 177.75  $\pm$  9.71 b/m; p=0.038), VO<sub>2</sub> (A: 51.75  $\pm$  13.60; B: 54.00  $\pm$  30.82 ml/Kg/min; p=0.891). Also, the values of ventilatory thresholds: VT1 and VT2 of both tests were obtained, with significant differences. Tactical equipment causes a decrease in stress test performance with changes in VT1 and VT2.

**O38**

### **THE EFFECT OF FATIGUE ON THE PERCEPTUAL-COGNITIVE PERFORMANCE OF BASKETBALL PLAYERS**

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It is well documented that fatigue due to being highly competitive leads to injuries that decrease the ability to detect perceptual cues and dynamically process the information during the performance. This study aims to indicate to what extent fatigue caused by playing a competitive basketball game affects perceptual-cognitive performance (PCP) in university division basketball men (n= 10, age 22  $\pm$  2 years) and women (n= 10, age 20  $\pm$  2 years) players. The PCP was assessed using the Reaction Time, Reactive; Mode A and Mode B Tests provided by the D2; Dynavision. Data included reaction times and the number of correct visuomotor responses for a one-minute test. Mixed method ANOVA was applied for data analysis. The mean score of the Reactive Mode A and B significantly differ in both women and men players after playing an entire basketball game. The mean RT time for men players significantly increased post-game while women showed no significant differences. The reported results could indicate an integral role of fatigue on the injury risks by referring to the

perceptual-cognitive athletic performance differences and might spotlight the need for further training perceptual cues and dynamically processing the information to reduce the risk of injuries with fatigue. Further researching, using these normative data is integral to determine more specific parameters for addressing the effect of fatigue on perceptual-cognitive athletic performance and return-to-play conditions.

**O39**

### **RELIABILITY AND VALIDITY OF THE CROATIAN VERSION OF THE EUROPEAN HEALTH LITERACY SURVEY QUESTIONNAIRE**

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Health-literacy (HL; skills and knowledges related to decisions about health/healthcare) is an important issue in public health, which is poorly examined in southeastern Europe. The investigation aimed to: (i) evaluate the reliability of the general European-Health-Literacy-Survey-Questionnaire (HLSEU), and (ii) assess its validity with respect to another important determinant of overall health status – physical literacy (PL). Participants were university students from Croatia (n = 134, 19-21 years old, 39% females) who were tested on HLSEU and PL throughout the test-retest procedure. Reliability analyses included calculations of Kappa coefficient, percentage of equally responded answers, and t-test differences between test and retest. Validity of the HLSEU was established by correlations between HLSEU and PL. The reliability of the HLSEU questionnaire was high (Kappa: 0.79, with 91% equally responded answers), while the significant t-test differences between test and retest (t-test: 3.48, p < 0.05) can be explained by characteristics of the tested participants, who naturally tended to improve their HL between test and retest. HLSEU was significantly correlated with PL (<40% of the common variance), indicating relative independence of the HL and PL. Knowing the importance of HL, proper reliability of the evaluated version, and similarity of languages spoken in southeastern Europe, the usage of Croatian version of the HLSEU is encouraged in other countries in the region.

**O40**

### **EFFECTS OF FOAM ROLLING ON STRENGTH AND FLEXIBILITY OF HAMSTRING MUSCLES.**

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Foam rolling is frequently implemented in warm-up prior to an exercise session. The purpose of this study was to evaluate the acute effects of a short bout of foam rolling on maximal knee flexion strength along with active and passive hamstring flexibility. Fourteen healthy young participants were included in this within-subject randomized controlled trial. After warm-up a short bout (two sets of 60 s) of foam rolling was performed on the intervention leg (counterbalanced leg dominance) while the contralateral leg was used as a control. Measurement of peak knee flexion torque and hamstring passive and active range of motion were performed on both sides in counterbalanced order. An analysis of variance was conducted to evaluate differences between the two groups. Our results did not show significant differences between the intervention and control leg for any of the assessed parameters. The main findings are that a short bout of foam rolling does not affect maximal knee flexion strength and although hamstring passive flexibility increased following a warm-up adding the foam rolling intervention did not further affect flexibility. Based on our results we conclude

that short bouts of foam rolling can be used prior to exercise, as it has no deleterious effect on muscle performance. Foam rolling before exercise should be recommended solely based on individual preference.

#### O41

#### **VALIDITY OF A 2D KINEMATIC METHOD FOR MEASURING THE FORCE-VELOCITY-POWER PROFILE THROUGH THE VERTICAL JUMP**

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Over the last decade, many studies have evaluated the force-velocity profile (FVP) of vertical jumps using a simple calculation method (SCM). Those using the multi-point method reported excellent validity, while the others using the two-point method found a possible bias in the parameters of the FVP profile. The aim of this study was to evaluate the intra-session reliability and validity of the 2D kinematic method (KIN) and SAM for calculating the FVP profile of the squat jump (SJ) and countermovement jump (CMJ). KIN and SCM were compared with the standard force plate method (FP). Twenty and fourteen participants, respectively, were video recorded performing CMJ and SJ under two different loading conditions (20% and 80% of body mass) on a force plate. The primary variables, jump height and vertical displacement, were obtained from the video (KIN), flight time, and pre-measurement (SCM). The secondary variables, force and velocity, were calculated from the primary variables (KIN and SCM) or obtained from the FP. The tertiary variables, FVP profiles, were calculated from the secondary variables using a two-point method. Excellent intra-session reliability of all primary and secondary variables was observed for SJ (range: ICCs = 0.90-0.99; CV = 0.71-7.43%) and CMJ (range: ICCs = 0.83-0.99; CV = 1.50-11.09%). The validity of SCM and KIN for the SJ FVP profile was high for all primary and secondary variables, but decreased at the tertiary level, where only F0 showed high validity (SCM vs. FP: p = 0.43, ICCs = 0.73, CV = 7.56%; KIN vs. FP: p = 0.06, ICC = 0.58, CV = 9.51%). Similar results were observed for the CMJ, except that the SCM overestimated F0 (ICCs = 0.54; CV = 7.89; p = 0.02; ES = 0.49) and KIN showed trivial agreement and adjacent within-individual error (ICCs = 0.40; CV = 11.47%; p = 0.027; ES = -0.28). Both methods are highly valid for assessing SJ F0. Although KIN did not show higher validity than SCM, new tools such as mobile apps allowing 2D kinematic analysis could be developed in the future to assess jump height and vertical displacement and optimise the FVP measurement protocol.

#### O42

#### **EXPLORING POTENTIAL EATING DISORDER AMONG JUNIOR ARTISTIC SWIMMERS**

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Eating disorders are common issues in aesthetic sports. The demands of the sport and expected appearance result in different problems with nutrition behavior and body perception. Artistic swimming, is also exposed to influence of desired body. Although the official FINA rules do not determine how the artistic-swimmers should look like, it is clear that there is a kind of body appearance

that athletes aspire. The aim of the study was to investigate potential eating disorder (ED) among high level junior artistic swimmers. Previously validated BEDA-Q questionnaire was tested among 67 athletes, aged  $16 \pm 0.87$  (BH =  $167 \pm 5.44$  cm, BW =  $53.92 \pm 5.40$  kg). The results show that the 65% of tested swimmers, by the age of 16, have tried to lose weight. Furthermore 37% of them have tried that between 3-5times. 32% are often preoccupied with the desire to be thinner, but at the same time 54% are very often satisfied with the shape of their body. Knowing the potential danger of eating disorders and inverted perception of desired body appearance, coaches, nutritionists and MDS should pay more attention to participants in artistic swimming.

#### O43

#### **EFFECTS OF LEARNING ALPINE SKIING TECHNIQUES ON POSTURAL STABILITY**

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Alpine skiing is a sport and recreational physical activity which requires fine postural control to maintain balance in challenging conditions. Theoretically, balance dominates in alpine skiing, but coordinated action of the whole body of the skiers is equally important. The aim of this research was to determine the effects of experimental short-term program of intensive training of alpine skiing techniques to postural stability (on Biomed Balance System) of students. The sample is divided into an experimental group beginners who were on skis for the first time and control group. The results of ANCOVA within variables for the evaluation of postural stability show statistically significant effects of the applying experimental program in all applied variables at the level of significance  $p=.000$ . From the mean value results ( $M$ ) it is obvious that the experimental group achieved better results compared to the identical tests applied to the control group. The results of this research tell us that learning to ski can improve the ability to maintain balance, especially if it is conducted under the expert supervision of a ski instructor, which can have the effect of reducing the risk of injury.

#### O44

#### **REASONS FOR REGULAR AND EXCUSES FOR IRREGULAR PHYSICAL ACTIVITY OF MEDICAL STUDENTS FROM THE WESTERN BALKANS**

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Aim of this study was to determine reasons for regular and excuses for irregular physical activity (PA) of medical students. A cross-sectional study was conducted during three months of 2019/2020 on a sample of 2452 students from 14 medical faculties in Western Balkans (Slovenia, Croatia, Bosnia and Herzegovina, North Macedonia and Serbia) using online survey. The largest percentage of students had PA (62.3%). Reasons for regular PA of students were desire to feel better (52.7%), look better (52.7%), reduce stress (38.6%), lose weight (18.6%) and control chronic disease (5.5%). Male students in significantly higher percentage desire to feel better (60%), look better (46.9%) and lose weight (46.7%) compared to female students.

Overweight students more often desired to lose weight (35.3%), while normal weight students desired to reduce stress (39.6%), feel better (55.5%) and look better (40.1%) in relation to other students' nutritional status. Faculty obligations were the most common excuse for irregular PA (59.3%), followed by other reasons (14.2%), financial situation (8.6%), current life situation (8.4%) and current health condition (2.8%). Female students in higher percentage stated faculty obligations (60.7%) than male students. Overweight students significantly more often stated current life situation (13.6%) while obese students stated other reasons (26.3%). The results indicate that it is necessary to educate students about importance of regular PA for achieving and maintaining good health.

**O45****ASSOCIATIONS BETWEEN ENJOYMENT IN ONLINE PHYSICAL EDUCATION CLASSES AND PHYSICAL ACTIVITY LEVELS IN ADOLESCENTS**Mirela Sunda<sup>1</sup>, Barbara Gilic<sup>1,2</sup>, Alen Bascevan<sup>1</sup><sup>1</sup>University of Zagreb, Faculty of Kinesiology, Zagreb, Croatia; <sup>2</sup>University of Split, Faculty of Kinesiology, Split, Croatia**Correspondence:** Mirela Sunda (mirela.sunda@kif.hr)

The COVID-19 pandemic forced Physical education (PE) teachers to switch to online classes, increasing the problem of keeping students physically active. This study aimed to determine the associations between enjoyment in online PE classes and physical activity levels (PAL) during the COVID-19 lockdown. 198 high-school students aged 14-19 years participated in this study. Variables included interest and enjoyment in PE classes assessed by the Intrinsic Motivation Inventory questionnaire and PAL assessed by Physical Activity Questionnaire for Adolescents. Pearson's correlation coefficient was calculated to evaluate the associations between variables. Independent samples T-test and Chi<sup>2</sup> test were used for determining the gender differences in study variables. Significant correlation between PAL and interest-enjoyment in online PE classes was recorded ( $R=0.23$ ,  $p<0.05$ ). There were no significant differences between girls and boys in the total subset interest-enjoyment. However, the difference was observed in the subset enjoyment ( $\chi^2(1, N=198)=9.53$ ), with boys showing more enjoyment. Because of the evidenced positive association between interest-enjoyment in PE classes and PAL, it is crucial to provide students fun and interesting PE online classes to maintain PAL during the pandemic and similar situations. The special emphasis should be placed on girls.

**O46****RELATIONSHIPS OF MOTIVATION AND PERSONALITY TRAITS WITH THE MOOD STATE IN SITUATIONS OF MAXIMUM LOAD IN FEMALE ROWERS**Mladen Marinovic<sup>1,2</sup>, Ana Kokan<sup>2</sup><sup>1</sup>University of Split, Faculty of Kinesiology, Split, Croatia; <sup>2</sup>Institut of Kinesiology, Split, Croatia**Correspondence:** Mladen Marinovic (marin@kifst.hr)

This paper compares the relatively stable psychological characteristics of female rowers with the emotional state in situations of maximum load. 40 female rowers, who have competed in international regattas as part of the Croatian national team for the past 20 years, have completed the following tests: Motives of general and sport achievement of Havelka and Lazarevic as well as Eysenck's personality questionnaire. Just before the start of testing, rowers completed the Profile of mood state. The SPSS program was used for statistical data processing. The intercorrelation matrix indicates that: a) motivation of general achievement, as well as its facet of positive emotional reactions, significantly and negatively correlates

with all "negative" emotions except tension, b) motivation for sport achievement correlates significantly and positively with vigor while correlation is negative with anger, fatigue, and confusion, c) psychotism correlates with all "negative" emotions and has a negative correlation with vigor, d) neuroticism has significant and positive correlations with all "negative" emotions from POMS but fatigue, e) Extraversion has a significantly negative correlation with depression and confusion, The findings indicate the existence of a significant correlation between motivation, personality traits and mood in young female rowers in situations before maximum load. This information can be beneficial to coaches to improve the self-confidence of female rowers.

**O47****PHYSICAL ACTIVITY LEVEL AND DIETARY INTAKE AMONG MILITARY CADETS**Mohd Syrinaz Azli<sup>1</sup>, Mohar Kassim<sup>1</sup>, Jorrye Jakiba<sup>1</sup>, Siti Azilah Atan<sup>1</sup>, Faizal Abdul Manaf<sup>1</sup>, Emmy Hainida Khairul Ikram<sup>2</sup><sup>1</sup>National Defence University of Malaysia, Defence Fitness Academy, Kuala Lumpur, Malaysia; <sup>2</sup>Universiti Teknologi Mara, Faculty of Health Sciences, Selangor, Malaysia**Correspondence:** Mohd Syrinaz Azli (mohdsyrinaz@upnm.edu.my)

Nutritional status is important for all individuals especially in the military unit where intense energy and physical strength is required in maintaining energy balance and operational performance. Unfortunately, there is lack of research regarding category of military in training and diet quality and its association with physical activity. The purpose of this study was to determine the relationship between energy expenditure and nutritional status among military cadet's army. A sample of male (n=47) and female (n=36) cadet trainees completed a validated demographic questionnaire, food frequency questionnaire (FFQ) and international physical activity questionnaire (IPAQ). The average difference in the number of fruits is significantly different, with Post-Hoc assessment indicating cadets consume higher than the other two groups ( $p=0.010$ ). Next, it is revealed that all activities between female cadet trainees are significantly different ( $p=0.010$ ,  $p=0.092$ ,  $p=0.008$  and  $p=0.04$  respectively) with female cadet trainees having the highest average vigorous activities. The present study showed that further improvements and attention on dietary intake of cadet trainees particularly vegetable, fruits, calories, sugar and fat intake are necessary. Educational campaign on healthier food selection should be initiated at the university or training level.

**O48**  
**EFFECTS OF WEIGHT REDUCTION THERAPIES ON LEAN BODY MASS IN OVERWEIGHT AND OBESE PEOPLE: A META-REGRESSION ANALYSIS**Neli Yankova<sup>1</sup>, Ioni Petrovska<sup>1</sup>, Valentin Panayotov<sup>1</sup><sup>1</sup>National Sports Academy "Vassil Levski", Faculty of Sport, Department of Weightlifting, Boxing, Fencing and Sport for All, Sofia, Bulgaria**Correspondence:** Neli Yankova (v\_panajotov@abv.bg)

Presently, obesity is endemic in many countries. Many obese patients also suffer from diseases of high social impact, such as type 2 diabetes and cardiovascular disease. Generally, therapies combining energy-deficient diets and physical activity protocols are used for treating obesity. This analysis attempts to assess the impact of different combined diet-and-exercise weight reduction protocols on changes in lean body mass in overweight and obese people. 3142 publications in total were retrieved by filtering the database of the National Library of Medicine, National Institutes of Health USA by keywords ("weight loss", "diet" and "exercise") for the period be-

tween 01.01.2008 and 01.01.2018. After a selection procedure was applied, 92 of them were included in this meta-regression analysis. Results showed that therapies that combine resistance or interval training protocols and low-fat diets are the most efficient for preserving/increasing the amount of lean body mass during weight reduction interventions in overweight and obese individuals. In our opinion, weight reduction therapies should include physical activity protocols in addition to energy-deficient regimens. This strategy may successfully maintain or even increase patients' lean body mass. Higher amounts of muscle mass enhance physical and psychological wellbeing, as a tool for the prevention of relapses and "yo-yo" effects.

#### O49

#### **ALARMING WEIGHT CUTTING BEHAVIORS IN YOUNG COMBAT ATHLETES: A SYSTEMATIC REVIEW**

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Rapid weight loss (RWL) has been traditionally applied in combat sports ever since weight divisions have been conceived. While RWL patterns of adult combat have been extensively described in the existing literature, less is known about weight cutting strategies in young combat athletes. To systematically review available data on methods, frequency, prevalence and magnitude of RWL in minor-age combat athletes (<18 yrs). PubMed, Web of Science, Sport-Discuss and EBSCO were searched using predetermined keywords. To be eligible, studies had to be published in English in peer-reviewed journals and had to examine RWL patterns in competitive setting in combat athletes aged 18 or younger. Five studies met the inclusion criteria and were analyzed in-depth. To prompt RWL (about 3% on average), young combat athletes used food and fluid restriction, increased levels of exercise (mainly aerobic), training in impermeable clothing, frequent sauna use, while more radical methods such as taking diuretics and laxatives were rare. Frequency of RWL was not reported, but is likely dependent on the number of competitions per year. Weight cutting behavior must be strictly regulated and ideally banned in young combat athletes.

#### O50

#### **DIFFERENCES IN MOTOR, FUNCTIONAL AND SPORT-SPECIFIC ABILITIES IN TALENTED WRESTLERS OF DIFFERENT ACCELERATION OF BIOLOGICAL DEVELOPMENT**

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In selection of talented children aged 13 and 14, the assumption of dominance of children with accelerated biological development is assumed. Good results at that age can be consequence of technical-tactical excellence but also of earlier biological maturation. The aim of this study was to determine differences in: motor, functional, and sport-specific abilities between children of different biological accelerations. Study was conducted on a sample of 26 wrestlers aged  $13.8 \pm 0.74$ . Subjects were divided into three biological groups (accelerators n=9, normal n=10, decelerants n=7) and were tested with battery of 10 tests (6 motor, 1 functional and 3 sport-specific tests).

Groups differ as expected in all body characteristics (Kruskal-Wallis ANOVA: age H=9.85, p=0.01; body mass H=17.80, p<0.01; body height (H=19.20, p<0.01); sitting body height H=18.92, p<0.01; body mass index H=7.50, p=0.02). Groups differed significantly in two sport-specific and one motor test (Kruskal-Wallis ANOVA: wrestling bridge flexibility H=07.50 p=0.02; flip over H=065, p=0.04; medicine ball throwing H=17.80, p<0.01). We can assume that decelerators have technical-tactical advantage to compensate for weaker explosive power compared to accelerators. Accelerators have greater explosive power and decelerants are better in sport-specific flexibility as expected.

#### O51

#### **ASSOCIATIONS BETWEEN CROSSFIT BASELINE TEST AND SPECIFIC INDICATORS OF PHYSICAL FITNESS; PRELIMINARY STUDY**

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CrossFit is a branded fitness regimen which incorporates elements from high-intensity interval training, Olympic weightlifting, plyometrics, powerlifting, gymnastics, kettlebell lifting, calisthenics, strongman, and other exercises. CrossFit "benchmarks" are standardized workouts including a variety of exercises in order develop multiple components of fitness and simultaneously monitor the progress. In "CrossFit-Baseline- Test" (CBT), the goal is to complete a 500-meter rowing followed by a series of bodyweight exercise repetitions for time. The aim of this study was to determine relations between CBT results, and various measures of physical fitness in trained subjects. 29 highly physically active individuals (16 females all 20-23 years of age) were tested on CBT that consists of 500 meters rowing on ergometer, 40 squats, 30 crunches, 20 push-ups and 10 pull-ups. CBT was later correlated to Beep test, 300-yards, 1-minute side jumps, 1-minute push-ups, 30-sec abdominal curls, broad jump and 3 kg medicine ball throw. Significant Pearson's correlations were noticed between CBT test and almost all variables in female group, but only 300-yard ( $r=0.75$ ) and side jump tests ( $r=0.79$ ) were correlated to CBT in males. Results of the study showed that CBT test in trained female subjects can be observed as good measure of general physical fitness. On the other side, in males the CBT mostly represents anaerobic capacities.

#### O52

#### **MOST COMMON INJURIES IN SENIOR WATER POLO PLAYERS**

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Water polo is characterized by a combination of many skills like swimming, hitting, wrestling, passing, throwing, and catching the ball. It's known that sports bring many benefits and also many injury risks. This research aimed to determine the most common water polo injuries among two Croatian senior teams. The data were collected on a sample of 31 players conducting a validated questionnaire about the injuries in sport. The research confirmed previous findings on the most commonly injured region, which is the shoulder region. Besides, data on the time of onset of pain were detected, and the results showed that pain most often occurs after gym training (29.03%) and in a combination of training in the gym and several games in one week (19.35%) as well after 2-3 games a week apart (19.35%). In this paper, we also bear in mind supplementation and eating habits data of athletes and it was found that 90.32% of water polo players use supplements, mostly isotonic 74.19%. Know-

ing how much and when do water polo players get most injuries, coaches should certainly pay more attention to prevention and rehabilitation.

**O53**

### **DIFFERENCES IN SITUATIONAL POWER-PERFORMANCES AMONG PLAYING POSITIONS IN TOP LEVEL FEMALE HANDBALL**

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Since all activities in handball should be performed as fast and as powerful as possible, power is involved in almost all players' movements. There is an evident lack of studies that monitored this ability during matches. The study aimed to determine the situational differences in power among playing positions in top-level female handball. Variables included: body height, average game time, fastest shot, fastest sprint, and highest jump. Subjects were 227 female handball players that participated in the European handball championship 2020. Analysis of variance with the post-hoc Scheffe test was calculated. Results showed significant differences among playing positions in body height, fastest sprint and highest jump performed in real game situations. The largest differences were noticed in anthropometrics, with significant differences between back- and pivot-players on one side, and wing-players on the other. The fastest sprinting was recorded for wingers ( $26.5 \pm 1.12$  km/h), who were significantly faster than other players. Jumping performance was most diverse among playing positions, with back-players being superior in this performance ( $47.24 \pm 17.61$  cm,  $48.44 \pm 20.71$  cm, and  $50.35 \pm 16.76$  cm for centre-backs, left-backs, and right-backs, respectively). Evidenced differences are explainable knowing the specific positions' roles and typical game situations which players encounter during the match.

**O54**

### **MORPHOLOGICAL CHARACTERISTICS AND NUTRITIONAL STATUS OF SIXTH-GRADE GIRLS ACCORDING TO DIFFERENT CLIMATE ZONES**

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There are many factors that have an influence on obesity therefore, early regular monitoring of morphological characteristics and nutritional status of children are the best preventing method. For better understanding there is a new approach and guidelines which are recommended analysis of climate influence on obesity. This study aimed to examine the influence of two different Koppen-Geiger climate zones in Montenegro on morphological differences and nutritional status of school girls. The study sample of respondents were targeted from several different primary schools. We were divided 97 sixth-grade female respondents by two Koppen-Geiger climate zones from data of their permanent living residence. Girls belong to the Humid continental climate (Dfb, n=55,  $10.21 \pm .72$  years), and Mediterranean climate region (Csa, n=42,  $10.33 \pm .59$  years). Morphological characteristics were assessed using a battery of four variables: body height (BH), body weight (BW), waist circumference (WC), and hip circumference (HC). BMI and

Waist to hip ratio (WHR) values were calculated. We used WHO cutoff points for the assessment of the children's nutrition status. For determining differences between children living in different regions we used a T-test for independent samples. 27.27% of girls from the Continental climate region are obese compared to 23.81% of obese in the Mediterranean climate region. When comparing groups by climate regions, it is noticeable that there is no significant difference in morphological characteristics and body mass index. Although there is no difference in the morphological characteristics between girls of the Mediterranean and Humid continental climate regions, for more detailed conclusions, a larger number of morphological parameters should be monitored on a larger sample of respondents.

**O55**

### **PREDICTORS OF PERFORMANCE-LEVELS IN YOUTH WATER POLO; POSITION-SPECIFIC ANALYSIS**

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Studies rarely examined predictors of performance levels in youth water polo while taking into account playing positions. The aim of this study was to determine anthropometric and strengths and conditioning (S&C) determinants of performance levels in top-level youth water polo players. The study included 104 male junior water polo players from Croatia and Montenegro who competed in the Adriatic League (17-19 years of age). They were divided into three groups depending on the playing positions (35 Centers, 50 Outside players (Guards and Wingers) and 19 Goalkeepers). The variables consisted of 9 predictors (4 anthropometric and 5 S&C variables), and binarized criterion (performance-level: national- team- vs. team-level-players). Logistic regression was used to define the associations between predictors and criterion separately for each playing position. Anthropometric- and S&C-variables significantly determined performance-levels among Centers and Outside players. National-team players had: (i) lower body fat and larger body circumferences, (ii) better results in tests of water polo leg-power and -strength, and (iii) better performance in water polo sprint swimming (evidenced only for Outside players). No significant associations between predictors and criterion were evidenced for Goalkeepers. Considering the quality of the studied players and tradition of water polo in countries where the sample was drawn from, the significant predictors should be particularly observed and developed in Centers and Outside players to achieve better water polo performance.

**O56**

### **SOCIAL MARKETING IN RAISING AWARENESS ABOUT PHYSICAL ACTIVITIES AND HEALTHY LIFESTYLE ON HEALTH**

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Social marketing strategies could improve and raise awareness about physical activities and healthy lifestyle on health. Strategies of social marketing are base on motivation, inspiration, opportunities, communications and values. In the theoretical part of the paper will be present approach of social marketing in raising awareness about physical activities and healthy lifestyle on health. In the research's part of the paper will be present case studies about physical activities and healthy lifestyle. In this part of the paper will be present in-depth interviews with professors of sports, with physicians, in the cardiology, orthopedic, and others specializations. Specific in-depth

interviews will be with people that follow healthy lifestyle. The goal of this paper is to research theoretical approach of social marketing impact in raising awareness about physical activities on health. After theoretical review, the paper will present case studies about impact of physical activities on health. Using in-depth interviews with professors of sports and physicians, the paper will give opinion about social marketing strategies in raising awareness about healthy lifestyle and health. Results indicate that social marketing strategies impact on healthy lifestyle and health. With in-depth interviews with professors of sports and physicians, results indicate that social marketing strategies give motivation for physical activities and call for healthy lifestyle. The case studies in the paper show importance of healthy lifestyle on health. The findings prove that social marketing strategies have impact in raising awareness about physical activities and healthy lifestyle on health.

**O57****IS RECREATIONAL HANDBALL EFFECTIVE IN PROMOTING HEALTH PARAMETERS IN UNTRAINED MALE**

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Objective of present study was to examine effect of small sided handball games on aerobic capacity, body fat percent, resting heart rate and blood pressure in untrained males. Another objective was to investigate relationship between VO<sub>2max</sub> and body fat percentage. METHODS: We randomized 26 untrained males into two groups; experimental (n=16) and control (n=10). Experimental group was offered small sided recreational handball for 12 weeks. Single-stage treadmill test was used to measure aerobic capacity. Body fat was measured with Omron Body Fat Analyzer. Independent T-test was used to find significant difference in two groups post intervention. Pearson Product Moment Correlation was used to examine relationship in aerobic capacity and body fat. RESULTS: T test analysis revealed significant difference in body percent ( $t_{22} = 2.031, P = 0.054$ ). No significant difference in aerobic capacity ( $t_{22} = 1.578, P = 0.129$ ), systolic blood pressure ( $t_{22} = -1.637, P = 0.116$ ), diastolic blood pressure ( $t_{22} = -1.562, P = 0.133$ ) and resting heart rate ( $t_{22} = 1.620, P = 0.120$ ). Significant relationship seen between body fat and aerobic capacity ( $r = -0.523, n=14, p = 0.055$ ). CONCLUSIONS: Findings suggest that small sided handball was effective in reducing body fat percent in untrained males. However, no significant effect was seen on improvement of blood pressure, resting heart and aerobic capacity.

**O58****A COMPARISON STUDY ON DIFFERENCES FOR 4 CIRCUMFERENCE CITES IN BODYBUILDERS AND FITNESS CATEGORY DURING ALBANIA CHAMPIONSHIP**

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Performance and body parameters play a very important role in competition for the category of bodybuilders and fitness. The aim of this study was to find out differences for 4 circumference cites in bodybuilders and fitness category during Albania championship. Data measurement were done in Tirana during the championship for bodybuilders category N= 17 and fitness category N= 32. Measurement for neck circumference, shoulder, chest circumference and waist circumference were done in Tirana using usual

tape measurement. Mean data for neck circumference (bodybuilding- mean= 39.3cm; fitness- mean= 38cm), shoulder circumference (bodybuilding- mean= 123.6 cm; fitness- mean= 119.9cm), chest circumference (bodybuilding- mean= 109.3cm; fitness- mean= 104 cm) and waist circumference (bodybuilding- mean= 80.9 cm; fitness- mean= 77 cm). Data obtain for 4 circumference cites between the category of bodybuilding and fitness show significant differences in favor of bodybuilder category such as neck circumference ( $p= 0.05$ ; mean diff= 1.31 cm), shoulder ( $p= 0.05$ ; mean diff= 3.71 cm), chest circumference ( $p= 0.005$ ; mean diff= 5.43 cm) and waist circumference ( $p= 0.006$ ; mean diff= 3.7 cm).

**O59****EFFECTS OF ECCENTRIC TRAINING AND FOAM ROLLING ON BICEPS FEMORIS LONG HEAD STIFFNESS**

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Foam rolling is increasingly utilized for prevention and regeneration purposes although its effects are not well explained. The aim of our study was to evaluate the effects of eccentric training and a short bout of foam rolling (two sets of 60 s) on biceps femoris passive stiffness. Fourteen healthy participants were exposed to a single bout of intensive eccentric training. Foam rolling was applied to one leg and the contralateral leg served as a control. To account for possible effects of limb dominance and order of measurement a counterbalanced randomization was introduced. Passive stiffness was measured using shear-wave elastography on four time-points during the first visit (at baseline, after warm-up with or without foam rolling, immediately after and 60 minutes after eccentric overload) and on two follow-up visits (after 24 and 48 hours). Both follow-up measurements were preceded by warm-up including a bout of foam rolling (intervention leg). A repeated measures ANOVA was used. A significant effect of eccentric training was observed ( $p<0.001$ ), however our results did not reveal a significant interaction effect ( $p=0.56$ ). The present study's findings indicate that passive stiffness increases after (immediately and 60 minutes) an intense bout of eccentric exercise, which could reflect changes in the muscle's mechanical properties. Furthermore, a short bout of foam rolling apparently does not alleviate these changes.

**O60****PHYSIOLOGICAL EFFECTS OF LOCAL APPLICATION OF THERAGUN™:AN OBSERVATIONAL STUDY IN HEALTHY FEMALE PARTICIPANTS**

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Studies investigating the physiological responses after local percusion therapy are lacking. The aim of this study was to investigate the local-perfusion and temperature changes after a local TheragunTM application on the vastus medialis M. quadriceps femoris. 26 healthy female volunteers from a university population participated in the study. After assessing baseline measurements, a 4-min standardized TheragunTM application was performed on a randomly assigned leg. Skin temperature, deep tissue blood flow (flux), muscle oxygen saturation (SmO<sub>2</sub>), and flow velocity of erythrocytes (speed) were

assessed up to 50 min (5-min intervals) following the application application. After the TheragunTM treatment, significantly increased values were found for SmO<sub>2</sub> ( $\Delta$ mean  $4.29 \pm 0.40\%$ ,  $p < 0.05$ ), speed ( $\Delta$ mean  $12.60 \pm 4.82$  AU,  $p < 0.001$ ), flux ( $\Delta$ mean  $63.10 \pm 21.28$  AU,  $p < 0.001$ ), and skin temperature ( $\Delta$ mean  $3.05 \pm 0.02^\circ\text{C}$ ,  $p < 0.001$ ) up to 50 min compared to baseline. This study demonstrated that a local TheragunTM treatment for 4 min induces higher SmO<sub>2</sub>, speed, perfusion and skin temperature values compared to baseline. These findings could be of interest for trainers and athletes.

**O61****PRACTICES OF HUMAN RESOURCE DEVELOPMENT FOR VOLUNTEERS IN SPORTS ORGANIZATIONS IN ALBANIA**Rovena Elmazi<sup>1</sup><sup>1</sup>Sport University of Tirana, Faculty of Physical Activity and Recreation, Tirana, Albania**Correspondence:** Rovena Elmazi (rd.elmazi@gmail.com)

Voluntary activities in sport are considered as an important tool for quality enhancement in EU member states which should ensure that sports volunteers are provided with the necessary training and promote voluntary activities in sport. The main purpose of this study is to determine the models that will enable, interpret the information and determine the performance and success on the importance of voluntary activities in sports in promoting active citizenship, and that non-profit structures based on voluntary activities are a basic condition for sports development. The volunteer questionnaire was compiled from 11 open-ended questions, addressed to 43 volunteer subjects of the Albanian sports system. Excel and SPSS statistical programs were used for data processing. The results showed a satisfactory result for the training programs, also showed that the cooperation with other structures is stable. There is room for improvement as it allows the Accreditation category and orientation towards the labor market by orienting uncertain and inexperienced or a better coordination in cases of accreditation from external structures. Also for the assessment category it is noted that 22% of respondents said they have no experience in this area. The findings suggest that the development of human resources for volunteers in sports organizations is an additional task, to increase, raise awareness and exchange knowledge and experience for the promotion of sports in the future.

**O62****INTERNATIONAL LEGAL DOCUMENTS REGARDING SPORTS LABORS CONTRACT**Saimir Shatku<sup>1</sup>, Lumtor Shkreli<sup>1</sup><sup>1</sup>Sport University of Tirana, Faculty of Physical Activity and Recreation, Tirana, Albania**Correspondence:** Saimir Shatku (s\_shatku@yahoo.com)

Contracts and labour are amongst the most ancient and important institutions of labours and sport law. The purpose of this study was to make a general comparative analysis to the role of sports contractual, labour sports relations, sports contracts in athletes' transfers by gender in U18 and U21 in sports category. In total there are 250 type of sports contracts in International and European labour Legislation (2000-2021). Different databases were used: JSTOR, Pubmed, SPORDiscuss, EBSCO Databases Europeaid, CFCU. Results that sports and labour brought peace without the existence of contract. There are undoubtedly several question marks related to the efficacy, jurisdiction and potentials of signing, continuation and termination of the sports labour individual contract. At the other hand, the sports associations are public entities, with public or private legal character, which aim to support the sportsmen through subsidizing

and financial or promotional treatment. In conclusion of this review we have to say that every athlete has the right under the European Sports Charter and the rules of the Council of Europe to be protected by law and assignments. Finally sports contracts of employment should be based only document to enable the process of movement and transfer of athletes from one club to another, and from one country to another according to European legal requirements, to avoid abuse and corruption in the work and process sports.

**O63****RELIABILITY AND VALIDITY OF MOBILE APPLICATION FOR HAMSTRING MUSCLE POWER AMONG MILITARY CADET**Shahrulfadly Rustam<sup>1</sup>, Mohar Kassim<sup>1</sup>, Jorrye Jakiwa<sup>1</sup>, Norhafizah Hamzah<sup>1</sup>, Mohd Syrinaz Azli<sup>1</sup>, Siti Azilah Atan<sup>1</sup><sup>1</sup>Defense Fitness Academy, National Defence University of Malaysia, Sungai Besi Camp, Kuala Lumpur, Malaysia**Correspondence:** Shahrulfadly Rustam (shahrulfadly@upnm.edu.my)

Mobile learning using information technology elements is facilitating, helping the learning outcomes of a learning process more quickly, and effectively especially in physical fitness. The aim of this study is to develop and measure the reliability of mobile application for standing broad jump test physical fitness among Army Cadet Officers of National Defense University of Malaysia (NDUM). This is quantitative research using the test-retest method to obtain the reliability value of the test of mobile application used as a research instrument. The standing broad jump physical fitness test battery is used to develop mobile application and to measure the reliability of mobile application on the subject fitness. The findings showed the correlation coefficient between the first test score of the use of mobile application for standing broad jump and the second test score of the use of mobile application for standing broad jump is significant ( $r = 0.92$ ,  $n = 30$ ,  $p < 0.001$ ). The results of the study found that the value of Pearson correlation coefficient for both tests was  $r = 0.92$ . This shows the reliability of the use of mobile applications for standing broad jump test is high and acceptable. The implication at this study, the mobile application used is easy to obtain results on the level of physical fitness of muscle power for NDUM cadet officers. Not only that, this mobile application only requires a mobile phone that is owned by all community and is easy to implement anywhere.

**O64****FACTORS ASSOCIATED WITH POTENTIAL DOPING BEHAVIOUR IN WINDSURFING**Sime Versic<sup>1</sup>, Ognjen Uljevic<sup>1</sup>, Katarina Pelivan<sup>1</sup><sup>1</sup>University of Split, Faculty of Kinesiology, Split, Croatia**Correspondence:** Sime Versic (simeversic@gmail.com)

Windsurfing is dynamic water Olympic sport in which surfer is using wind force to generate forward motion on the water while maintaining balance on the board. Although is fast-raising and popular sport, studies have not addressed the issue of doping behavior. The main aim of this study was to identify potential doping behavior (PDB), and predictors of PDB in competitive windsurfing. The sample of participants included 48 senior windsurfers (40 males, 8 females, average age 31.1), participants of European Championship in slalom class. The participants responded to previously validated questionnaires that included socio-demographics and doping-related factors. Binary logistic regression was used to determine association between predictors and criterion – PDB. Only 60% participants showed negative-, while the rest of them reported positive- (XY%) or neutral-PDB. Logistic regression identified opinion about penalties for doping offenders as a

predictor of potential doping behavior in windsurfers (OR:2.99, 95%CI:1.44-6.2). The results of this study showed relatively high PDB, and higher doping likelihood in those athletes who advocate less rigid penalties toward doping offenders. The lack of association of other variables with the criterion can probably be attributed to the heterogeneous sample of participants. In future studies windsurfers for other disciplines and additional predictors should be included.

## O65

### RELATIONSHIP BETWEEN MATCH RUNNING PERFORMANCE AND PHYSICAL CAPACITY IN MALAYSIA YOUNG SOCCER PLAYERS

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Monitoring players during match play has become a fundamental approach to gain understanding on soccer demands. Considering there has been growing interest in performances of young players, it is important to understand on young players training requirement. Therefore, the aim of this study was to examine the relationship between match running performance and physical capacities in U15 young soccer players. Twenty outfield players from sports school and academy ( $n = 20$ ,  $1.63 \pm 0.8$  m, and  $56.1 \pm 9.5$  kg) volunteered to participate in the study. Match running performance was analysed during two matches for each player using 5 Hz global positioning system. The participants performed the Yo-Yo Intermittent Recovery Level 1 (YYIR1), Counter movement Jump (CMJ) and 20 m sprints to determine the physical capacities. The results showed there were no significant relationship between; total distance covered and YYIR1, sprint distance and leg power, maximum sprint speed during matches (km.h<sup>-1</sup>) with 20 m sprint ( $P > 0.05$ ). These results suggest that physical capacity test should not be used as a single factor in recognizing a young players potential to excel and to predict soccer performance. Young players may not need extraordinary capacity; however they must possess a reasonably high level within all areas to be a good player.

## O66

### IMPACT OF PHYSICAL ACTIVITY ON MICROBIOTA

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Effectiveness of physical activity as a preventive and treatment modality to tackle sedentary lifestyle related health problems (e.g. cardiovascular disease, diabetes, and obesity) has been well established. Biological mechanisms by which physical activity impact homeostasis and organic adaptations have been well studied. Sedentary lifestyle has negative impact on the indigenous microbiota and intestinal homeodynamics. Despite increasing evidence, to date this observed association is rarely considered in the sports science setting. This study aims to provide an overview of the effects of physical activity on the composition of the gut microbiome and discuss potential mechanisms by which exercise may exert a direct or indirect influence on gut microbiota. Two independent reviewers performed a systematic search in Embase, PubMed and Web of Science. Characteristics describing changes in the microbiome of the gastrointestinal tract and parameter of training load were extracted. Fourteen articles were included. Endurance train-

ing induced significant changes ( $p < .05$ ) in the target parameters  $\alpha$  diversity after 5 to 6 weeks,  $\beta$  diversity after week 1 to 8 weeks, and F/B ratio after 2 - 3 weeks. Training standards for  $\alpha$  diversity: 6- 7x/ week (total max.12hrs), 70-85% HR max; for  $\beta$  diversity: 3x/week à 60min, 60-90% HRmax; for F/B ratio: sprint interval training 3x/ week à 18-27min, 30s/session, 4 min rest. Endurance activity has a positive effect on diversity,  $\beta$  diversity and the F/B ratio of the gut microbiota.

## O67

### DIFFERENCE BETWEEN WINNERS AND LOSERS IN THE FINAL TEN MINUTES IN BALANCED MATCHES IN ICELANDIC HANDBALL TOP LEAGUE

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A big number of matches are still balanced at minute 50 with three or less goal difference. The objectives of the present study were: (i) to compare handball game-related statistics by match result (winning and losing teams) for the men's and women's teams in the final 10 minutes of balanced matches (goal difference 0-2 goals at minute 50). The game-related statistics of 52 balanced matches (75 male team performances, 39 female performances) played in the 2018/19 Icelandic League were analysed. Differences in the game statistics between match outcomes (winning or losing teams) for both genders were determined using Wilcoxon signed-rank test. For male teams, winners were more efficient in six variables; wing shots, 7m shots, total shots, and goalkeeper save efficiency from wing position, outside 9m and in total saves. For females, we found six variables; total shot efficiency, shots from outside 9m, total goalkeeper save efficiency, goalkeeper efficiency from outside 9m and more steals and blocks made by the defense. Results from both genders emphasise the role of goalkeepers, e.g. from outside 9m during the last 10 minutes in balanced matches. In male league, efficiency from close range positions (7m and wing) is important in offense. For female play, winners steal and block the ball more defensively and are more successful shooting from outside 9m offensively. Organization of set plays under pressure in the final minutes should be carefully prepared to optimize the efficiency of chances created.

## O68

### HEALTH-RELATED QUALITY OF LIFE OF YOUNG ATHLETES

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Sport, as a human activity, is a significant factor in promoting life and work of an individual, but also in the development of the society as a whole. As a result, an athlete's health status will also be at a higher level and their Health-related quality of life (HRQOL) will change. HRQOL measures an individual's perceptions of their own well-being and health within a single cultural environment. In the survey, we were researching if there is a difference in the

results of the HRQOL dimensions of lower-grade (mean age: 7.12 ± 0.54) athletes and non-athletes. In the cross-sectional study, 89 parents responded to questions in the Kidscreen-27 / proxy questionnaire, which asked about their child's subjective quality of life and the relationship between sports. Based on the statistically processed data, it can be shown that young athletes have higher HRQOL values compared to their non-athlete counterparts in all dimensions. Considerable attention must be paid to the mass involvement of children and young people in the sports system, but a key precondition for this is the training of the teacher / physical education teacher / coach, who can keep the child interested in sports on the daily basis.

**069****RELATIONSHIP BETWEEN BODY COMPOSITION AND REPEATED JUMP PERFORMANCE IN CROSSFIT ATHLETES**

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Association between body composition and athletes' performance has been frequently studied and used as a method of athlete selection, monitoring and performance prediction. To correlate body composition and repeated jump performance in CrossFit (CF) athletes and develop multiple regression models. Nineteen male CF athletes participated in this study (Age 28.63±6.62 years; Height 176.18±5.34 cm; Bodyweight 81.67±6.43 kg; BMI 26.29±1.34). Fat mass (FMkg), Lean Body Mass (LBMkg) and Muscle Mass (MMkg) expressed in kg were estimated by bioelectrical impedance analysis. Repeated jump performance was tested by the 30 seconds repeated jump test (RJT). Peak (RJTPP), mean (RJTXP) and minimal (RJTMP) power values were determined. Pearson correlation coefficient was used to define the association between variables and stepwise multiple regression analysis to determine their relationship. LBMkg showed significant correlation with RJTPP ( $r=0.78$ ,  $p<0.001$ ), RJTXP ( $r=0.80$ ,  $p<0.001$ ) and RJTMP ( $r=0.65$ ,  $p=0.003$ ). MMkg also showed significant correlation with RJTPP ( $r=0.87$ ,  $p<0.001$ ), RJTXP ( $r=0.88$ ,  $p<0.001$ ) and RJTMP ( $r=0.75$ ,  $p<0.001$ ). Two regression equations, explained by MMkg, for peak and mean power were developed: RJTPP =  $330.438 + 22.602 \times \text{MMkg}$ ,  $R^2=0.74$ , SEE = 3.1678W,  $p<0.001$  and RJTXP =  $237.1671 + 22.830 \times \text{MMkg}$ ,  $R^2=0.75$ , SEE = 3.0434W,  $p<0.001$ . Results showed moderate-high correlation between some variables of body composition and power values. Furthermore, we can conclude that MMkg is a strong predictor of repeated jump performance in CF athletes, explaining over 70% of some of the power values.

**070****MATCH RUNNING PERFORMANCE IN UEFA CHAMPIONS LEAGUE: DO MORE SUCCESSFUL TEAMS REALLY RUN LESS?**

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It is often hypothesized that more successful teams from elite football competitions achieve lower match running performance (RP) than less successful teams. However, the results of previous studies which investigated the associations between RP and different success indicators (i.e., final ranking in competition, match outcome) are not consistent. The aim of this study was to identify the associations between the RP and the UEFA club coefficient as an in-

dicator of the teams' success in highest-level football. We jointly evaluated the individual RP into the team RP and used them as cases in this study. Teams RP ( $n=40$ ) were collected from matches ( $n=20$ ) of the UEFA Champions' League group stage (UCL) in the 2020/2021 season, and included: total distance covered, distance covered in different speed zones: walking (<7.1 km/h), jogging (7.2–14.3 km/h), running (14.4–19.7 km/h), high-speed running (19.8–25.1 km/h), and sprinting (> 25.2 km/h). All RP data were collected by the semi-automatic video system InStat Fitness. Pearson's correlation coefficient was used to identify the association between the teams RP and the UEFA club coefficient. UEFA club coefficient was positively and negatively associated with sprinting ( $r=0.39$ ,  $p=0.01$ ) and jogging ( $r=-0.36$ ,  $p=0.02$ ) distance covered, respectively. These findings show that teams with a higher UEFA club coefficient achieved lower amount of low-intensity running and covered greater sprinting distance, indicating that in highest-level football more successful teams play at a higher game pace than less successful teams.

**071****THE IMPORTANCE OF DIGITAL COMPETENCIES IN MODERN MANAGEMENT OF SPORT ORGANIZATIONS**

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The digital competence of employees working in the sports industry is becoming increasingly important every day. The digital tool management competences that sports organizations have at their disposal are increasingly becoming a decisive factor not only in terms of business but also in those of sports and competition. The digital transformation of society also results in the digital transformation of sport at all its levels, from management to competition. The aim of this paper is to determine different levels of digital transformation of sports organizations in the Republic of Croatia through an analytical approach to the use of digital tools in sports organizations. By processing data using different analytical methods based on a survey of 145 sports organizations in 18 largest cities and 30 different sports, different levels of digital transformation of sports organizations in the Republic of Croatia were defined. The research detected five levels of digital transformation, starting from the infrastructural level, followed by the communicational, applicative, analytical and finally the integrated level of digital transformation. The research showed certain links between sports organizations in the context of digital competences when comparing the membership, budgetary self-sufficiency as well as sports results. The results of the research imply that digital competencies are of great importance in sports organizations, and the necessity of the digital transformation of sports organizations must be an increasing priority of their management structures in order to be successful in sports.

**072****INFLUENCE OF WEIGHTLIFTING ON MOTOR ACTIVITY IN CHILDREN**

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One of the main tasks of the training process in Olympic weightlifting is to provide a healthy motor training regime. Participants

seek to achieve a tangible positive impact on the body, as adequate conditions for physical development are provided. Good training practices in sports clubs guarantee high-class performance. The goal of the present study is to identify the changes in the physical performance of children (boys) due to the influence of specialized Olympic weightlifting training methodology. 16 weightlifters aged 12 years were studied. The study was divided into two stages: the baseline measurements were taken in June 2018 and the final ones – in June 2019. The studied Olympic weightlifting methodology imposed positive effects on the strength and speed abilities of subjects. Based on the study results, we can conclude that due to the specialized training work we have applied, the participants improved all the studied parameters of muscle strength. The highest effects were found in the development of explosive force of the lower limbs and the improvement of speed and flexibility.

### O73

#### ATTITUDES TOWARDS RECOVERY METHODS IN TENNIS PLAYERS

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Optimal recovery is very important for tennis players. The aim was to examine attitudes towards recovery methods in tennis players from different categories. A cross-sectional survey using anonymous questionnaire was performed on 80 tennis players regarding recovery methods they use and their attitudes towards them. The sample included ATP, WTA, ITF, Davis Cup and Fed Cup players, and recreational players. The questionnaire included sociodemographic data, data regarding participants' status in tennis, and hours of play per week. Most of the sample consisted of professional tennis players (58%), male players represented 55% of the sample, and 11% of the sample were ranked amongst Top 20 tennis players in the world in 2020. Most of the participants used more than one recovery method. Regarding their attitudes, highest agreement was with the statement that recovery methods they use help them to relax and decrease their risk of injury. Professional players had higher agreement with the statement that recovery methods help with muscle soreness ( $p=0,042$ ) in comparison to amateurs. There were no significant differences in attitudes regarding the gender of the participants. Tennis players, regardless of their status and gender, mostly use more than one recovery method with the main purpose to achieve relaxation and to decrease the risk of injury

### O74

#### THE INFLUENCE OF SWIMMING ON THE DEVELOPMENT OF BASIC MOTOR SKILLS OF YOUNGER PRIMARY SCHOOL CHILDREN

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In this paper, a comparison of the development of basic motor skills of trained swimmers and untrained elementary school students is performed. The sample of respondents included swimmers from the Belgrade swimming club Mornar and students of the elementary school Branko Radičević in Pancevo. In addition to basic anthropometry, basic motor tests (strength, speed, endurance, flexibility, agility, balance, precision and coordination)

were measured. Using standard statistical procedures, the difference between the groups was determined using 6 variables for assessing motor skills, and the trained swimmers showed better results. The results of the research tell us that swimming, as one of the most complete basic activities, has a positive effect on the development of children of younger school age. This research is innovative because it shows the different impact of swimming on basic motor skills.

### O75

#### DIFFERENTIAL INFLUENCE OF GENERAL ANTHROPOMETRIC AND MOTOR PREDICTORS ON PRE-PLANNED AGILITY IN PUBESCENT BOYS AND GIRLS; MULTIPLE REGRESSION STUDY

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The aim was to investigate the influence of balance, jumping power, speed, and morphological variables on three different agility performances in early pubescent boys (N = 73) and girls (N=63). The predictors included body height and mass, body fat, high jump, overall stability index, ankle mobility, and 10 and 15 m sprint. Statistical analysis orderly included calculation of correlations, regressions models for correlated variables, and validation of regression models. Calculated regression models for male group explained 38% of the variance in the Zig zag test, 12% in 20 yards test and 81% in T-test. The significant regression model for Zig zag test included body mass, high jump and ten-meter sprint, while 20 yards test had no predictors in male group. For T-test predictor was just ten-meter sprint. Calculated regression models for female group explained 57% of the variance in the Zig zag test, 32% in 20Y test and 42% in T-test. The significant regression model in female group included only ten-meter sprint for all three agility criteria. Regression models were cross-validated using the second half of the sample (36 boys, 31 girls). Correlation between predicted and achieved scores provided statistically significant validation statistics for all agility tests.

### O76

#### RESEARCH ON THE PROTECTION AND INHERITANCE OF JIUHE ZHUOWU FROM THE ANTHROPOLOGICAL PERSPECTIVE

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Jiuhe Zhuowu of Tibet was listed in the national Intangible Cultural Heritage list in 2014, and has a history of more than 1,300 years. It is a dance praying for good luck and deterring evil spirits, and it is also one of the oldest traditional dances of various ethnic groups in the world. However, the inheritance and development of Jiuhe Zhuowu is not optimistic. To explore the status quo and inheritance dilemma of its development, in order to put forward the corresponding conservation path. Literature, field investigation and interview were used to study the inheritance dilemma and protection path of Jiuhe Zhuowu. Inheritance dilemmas include: 1. Ecological environment restriction; 2. Low level of industrial development; 3. There are faults in inheritors. The proposed protection paths are as follows: 1. Increase the mode of communication and break through the space barrier; 2. Increase interactive performances to stimulate industrial development; 3. Make full use of local elites and inherit folk sports culture. The traditional Tibetan sports culture is profound and diversified, which bears witness to the development of Tibetan history and contains the

spirit and culture of The Tibetan people. It can awaken the cultural consciousness of the Tibetan people and protect it is the protection of different cultural forms and values as well as the protection of cultural diversity.

## Poster presentations

P1

### EFFECTIVENESS OF THE DISTANCE LEARNING METHOD DURING LEARNING DANCES

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This investigation has arisen during COVID-19 pandemic and lockdown period as cause of closure schools and higher education institutions. Learning dances, where physical contacts dominate, become extremely demanding and challenging. The basic aim of this investigation is to analyze some metric characteristics during learning samba dance in conditions of distance learning. The sample of subjects consisted of 24 females and 15 male kinesiology student's (21-24 aged). Three experts were evaluated the performance of samba dance according previously and in detail determined criteria, after the period of two-month learning dances in distant learning conditions. Of the learning methods commonly used in dance learning (visual, audio, analytic and kinesthetic), kinesthetic method was completely annulled during distance learning. Common kinesiological methods for analyzing metric characteristic were applied in new learning circumstances. According to K-S results, evaluation of three experts do not deviate significantly from the Gaussian curve at the level of error of 0.05. Satisfactory values of Cronbach alpha coefficient were determined (.95) and total variability of experts according factorial analysis were explained 90%. High correlation (.81) was established between evaluating samba dances learned on line on the scale from 0 to 10 and samba classical evaluation on Likert scale. Newly constructed test for assessing the level of samba dancing skills in distance learning conditions has a satisfactory metric characteristics of sensitivity, objectivity, validity and pragmatic validity.

P2

### RETENTION PROCESS OF GYMNASTICS SKILLS IN YOUNG-SCHOOL-AGED CHILDREN

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The assessment of the level of motor skills in the retention phase is done in order to determine the impact of the process of motor learning on the process of memorization, and thus on the automation of motor skills. The aim of this study was to determine differences in the levels of some gymnastics skills in retention points after different retention intervals. The sample of respondents consisted of a total of 56 first grade pupils (7 years old). The sample of variables consisted of 13 simpler gymnastics skills assessed on a Likert scale. After an experimental gymnastics treatment lasting 9 months, the subjects were tested after two months and four years after the end of the treatment. Trends in the quality of skills retention can be grouped into several groups. The first group of skills did not show differences between different measurement points, while in the second group a significant deterioration in performance between measurement points was noted. The third group of skills, structurally the most complex,

showed differences only after 4 years of retention period. It can be concluded that no link between skills has been established that would precisely define the causes of different trends of decreasing the level of skills. Namely, for some skills a retention period of two months was sufficient to determine the actual level of acquisition, while some skills required a significantly longer time, in our case a period of 4 years, to determine the actual level of its acquisition.

P3

### PHYSICAL ACTIVITY AND BODY IMAGE AMONG ADOLESCENTS; ANALYSIS OF THE ASSOCIATION DURING THE PERIOD OF COVID-19 PANDEMIC LOCKDOWN

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Studies showed alarming decrease of the physical activity levels (PAL) as a result of COVID-19 pandemic lockdown, while body image (BI) is considered as hypothetically correlated with PAL. This study aimed to evaluate the association between BI and PAL in adolescents from Croatia, during the lockdown which occurred in 2020. The sample comprised high school students ( $n = 129$ , 41% females, 15-20 years of age) from Split-Dalmatia region, who were observed during the period of COVID-19 lockdown. Stunkardfigure rating scale was used for the evaluation of the BI, while Physical Activity Questionnaire for Adolescents was used to determine PAL. T-test did not evidence significant difference between genders in PAL ( $t$ -test = 0.49,  $p = 0.59$ ). Mann Whitney showed better BI among boys ( $MW = 2.67$ ,  $p < 0.01$ ). Spearman's correlation did not show significant correlation between BI and PAL (Spearman's correlation: 0.04, 0.03, and 0.03 for total sample, boys and girls, respectively). BI is a complex construct influenced by numerous factors and not exclusively by PAL (and vice-versa), which is herein evidenced even in the period of COVID-19 pandemic. In evidencing factors of influence on PAL during lockdown, other correlates should be evaluated.

P4

### THE ACUTE EFFECTS OF SMALL-SIDED GAMES ON STRENGTH AND LOWER LIMBS ASYMMETRY IN YOUNG RUGBY PLAYERS

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The Small Sided Games (SSG), are sport-specific exercises spread and used in all team sports for technical-tactical and conditional skills. The literature aims to understand the acute effects of SSG on the young athlete motor skills. The aim of this study is the assessment of SSG's acute effects on strength and lower limb asymmetry (AS) in Under 18 championship young rugby players ( $17.2 \pm 0.8$  years). The SSG was performed using modified rugby touch rules, 3vs3 in 20x40m field with 3 periods of 10 min (2 min rest). The test executed pre and post SSGtouc were the cross-over hop test for distance (CH) for the explosive strength of the single limbs and the calculation of the relative AS%. The values pre-post SSG showed a decrement of -3.9% for left limb's strength (not statistically significant) and an increment for AS of 238% ( $p < 0.05$ ,  $p=0.002$ ). A significant variation emerged for the functional AS. This result is mostly due for the nature of the SSG where lot of

changes of direction are performed. For this, rugby coaches and strength and conditioning coaches have to work synergically to optimize training load and injury prevention when SSGs are integrated with traditional training. Further studies should be done in the future with a greater number of samples and more experienced in the SSG organization.

**P5**

### **SOMATOTYPE CHARACTERISTICS OF ELITE YOUNG ATHLETES FROM THE REPUBLIC OF KOSOVO**

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A large number of published studies have established the somatotype characteristics of athletes from different sports. The research goal is to establish and compare the anthropometric characteristics, body composition and somatotype components of Kosovo young elite athletes. The research was conducted on 255 young athletes aged 18, divided as: 92 footballers, 83 basketballers and 80 handballers. Aiming to determine the effects of each kind of sport and the differences between the athletes, ANOVA and Tukey Post Hoc tests were applied. The obtained results show numerous relations and differences between the tested young athletes. The research results suggest that footballers are shorter and lighter than basketballers and handballers; have lower BMI than handballers. Handballers are shorter than basketballers, have greater BMI than basketballers and footballers. Footballers, compared to handballers, have a greater bone-component and less fat-component percentage. Basketballers possess greater bone-component percentage values than handballers. Footballers have a dominant mesomorph-component. Their somatotype-category is balanced mesomorph. Handballers are established to have a common mesomorph athletic-type with a characteristic skeleton's longitudinal dimension. The ectomorph is dominant in basketballers – a mesomorph-type with a characteristic skeleton's longitudinal dimension and balanced correlation between the bone and muscle tissue.

**P6**

### **THE DIFFERENCES BETWEEN INITIAL AND FINAL MEASUREMENTS OF MORPHOLOGICAL CHARACTERISTICS OF FEMALE VOLLEYBALL PLAYERS**

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This research aims at finding out the differences between the initial and final measurements of the morphological characteristics of (female) volleyball players from the Kosovo Super League and First League between the experimental group and the control group. The participants in this study was 123 players from eight volleyball clubs from the Kosovo Super League and one volleyball club from the Kosovo First League, who are divided into three groups: experimental group 1 ( $n = 42$ ), experimental group 2 ( $n = 39$ ), and control group 3 ( $n = 42$ ). Ten variables of anthropometric space, thirteen variables of basic motoric abilities, and six variables of specific motoric abilities were used to compare morphological characteristics between the experimental and control groups. The results were processed using the SPSS program for Windows version 26, while the evaluation and discussion were done using multivariate analysis of variance (MANOVA) and univariate analysis

of variance (ANOVA), in which case the morphological differences between the groups of volleyball players at the initial and final measurements in experimental group 1 and the control group were confirmed at the statistical level ( $p = 0.000$ ). Thus, it is found that the structured training process was beneficial and influenced the development of morphological characteristics in senior volleyball players, while it is believed that future research should focus on younger volleyball players.

**P7**

### **ANTHROPOMETRIC PARAMETERS AS INDICATORS OF OBESITY AMONG YOUNGER SCHOOL CHILDREN FROM PRIMARY SCHOOLS ON THE TERRITORY OF BUDVA MUNICIPALITY**

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Overweight and obesity is one of the biggest world health issues in the past period. Analyses of the BMI trend on children and adolescents worldwide (31.5 million, 5-19 years old) conducted from 1975 to 2016 have shown there was some significant increase of overweight and obese children. The main aim of this investigation was analyses overweight and obesity in children from the municipality of Budva. The sample has contained 254 students, 123 males and 131 females from the first four grades from the primary school. Body mass index (BMI) was employed to estimate general WHO referral values of overweight and obesity among gender and ages. Body height and (WtHR) was employed to estimate the risk of abdominal obesity of children according to general WHO referral values. The results have shown high percent of overweight and obese children (26.8%). It is also confirmed the statistical significant difference in overweight and obesity among males and females, while the males had much stronger percent's than females. On the other hand, the abdominal obesity was estimated in the same level as overweight and obesity, while the higher percent was recognized within males too. The results reached in this investigation recommended some activities that is the must to be conducted as prevalence to decrease the obesity of children. It is necessary to increase physical activity, controlled nutrition and decrease the sedentary activities.

**P8**

### **MONTENEGRIN REPORT ON GENDER-BASED EQUALITY IN SPORT**

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In the field of competitive sports, the successes of women in Montenegro are visible, but it is unclear their presence in decision-making structures and in leadership roles. The main purpose of this report is to describe the current state of gender-based equality in Montenegrin sport, i.e. to determine whether the presence of women in decision-making structures and leadership roles is proportional with their participation in sport as his consumers, all with a goal to offer ideas for planning, directing and leading future development. The research was conducted drawing on a pre-established methodology related to the assessment of the gender-based equality level based on six defined indicators. Grades were attributed on data found from multiple sources collected until December 2021. To evaluate each of these indicators,

a five-point grading scale was employed (5 = excellent; 4 = very good; 3 = good; 2 = fair; 1 = poor). All indicators averaged 2.5 (good). Women's participation in competitions (31.6%) and their presence in the Olympic team (53%) were rated 4 (very good) and 5 (excellent). Furthermore, the presence of women in the role of coach (5%) and in National Olympic sport federations management structures (13%) were rated 1 (poor) and 2 (fair). Finally, the presence of women in the National Olympic (10%) and Paralympic committee (9%) management structures were rated 2 (fair) and 1 (poor). There is ample evidence that Montenegrin women in decision-making structures and in leadership roles are not present in accordance with their number in competitions or with the results they achieve. Thus, effective intervention in politics are needed. This study has been done within a ERASMUS + Sport project under the title SWOST - Sport Without Stereotypes that was approved by the EACEA (No. 622774-EPP-1-2020-1-IT-SPO-SCP from 1 January 2021).

**P9**

### **EFFECTS OF SWIMMING TRAINING ON BONE MINERAL DENSITY COMPARED TO HIGH-IMPACT SPORTS: A SYSTEMATIC REVIEW**

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Previous studies have shown that certain exercises have a positive effect on bone mass, but it is not clear how exercise can be used for the purpose of prevention and bone health. This review paper aims to analyze the effects of swimming training on bone mineral density compared to other high-impact sports (gymnastics, power-lifting, combat sports). The search was performed using a platform for searching (Pubmed, Google Scholar, Web of Science) and using the keywords: bone mineral density, swimming, physical activity, aquatic, bone mass. The selection of papers included criteria that the papers have been published in the last 20 years, that the original scientific paper is available in full text, that the structure or mass and composition of the bones are analyzed using DXA technology. After a detailed analysis of 8 scientific papers, results show that the values of BMD swimmers and sedentary groups are similar, which are lower than other athletes with high-impact strength. Differences in BMD in the spine and lumbar spine, femur, upper arm, between swimmers and sedentary groups, as well as between swimmers and athletes engaged in high-intensity contact with the ground, increased with age and favored non-swimmers. High-impact sports training shows a significant improvement in bone health at all ages and is especially recommended as a prevention of osteopenia and osteoporosis. This study suggests that swimming has no osteogenic benefits, and for overall health, swimming training should be supplemented with strength training and resistance exercises to preserve bone strength and prevent bone mineral density as we age.

**P10**

### **A NEW METHODOLOGICAL APPROACH FOR REPORTING SPORT INNOVATION IN MONTENEGRO**

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There is currently no established system for assessing innovations in the field of sports in Montenegro and wider, so it is unclear what the current level of innovation in the field of sports. This research aimed to focus on a review of the literature on innovation in the field of sport in Montenegro in order to provide better basis for the establishment of a monitoring system. The research was conducted drawing on a pre-established methodology related to the assessment of the level of sports innovation based on sixteen defined indicators. Grades were attributed on data found in available scientific articles that were published till 2021, as well as in the grey literature. To evaluate each of these indicators, a six-point grading scale was employed (5 = excellent; 4 = very good; 3 = good; 2 = fair; 1 = poor; 0 = without reliable information). All indicators averaged 2.25 (fair) on a six-point scale, while only one indicator was rated as excellent, five indicators were rated as good, four indicators were rated as fair, and lastly, five indicators were rated as poor. Based on the obtained results, a low level of innovation in the field of sports in Montenegro was determined, and this also applies to innovative indicators individually. These results can be used as an initial step in planning an appropriate strategy development at the national level which will lead to the improvement of innovations and their implementation in the field of sports in Montenegro. This research was completed within a national project under the title "Montenegrin Platform for Innovation in Sport" that was approved by the Ministry of Science in Montenegro (No.03/1-062/20-263/2 from 28 April 2020), as well as in line with the SHIINE COST Action's objectives (CA18236).

**P11**

### **AGGRESSION AND INTERPERSONAL VIOLENCE IN SPORTS CLUBS: PREVALENCE AND TYPES BASED ON THREE FACTORS**

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Recognition of aggression and violence against children has a growing tendency in contemporary society as well as in the field of sport, where destructive behaviors can de-emphasize the well-known positive benefits of playing sports. The aim of the study was to examine how factors such as age (younger/older), years of training (0-1/over 5y) and type of sport (individual/collective; contact/non-contact) may affect the prevalence and manifestation of aggression and interpersonal violence (IV) in the sport. A total of 2237 athletes aged 11-18 years from Serbia (Autonomous Province of Vojvodina) were included in this cross-sectional study. Data were collected using an ad-hoc questionnaire designed by the authors and analyzed with the SPSS program. The results indicate that age and type of sport can increase the aggression and IV manifestation. Namely, being older, playing collective or contact sports have a higher tendency for aggressive behaviors. Furthermore, physical aggression is more prevalent in older children and in team collective or contact sports. However, the psychological type is more dominant in older children with five or more years of training and playing a collective or non-contact sport. The results highlight some factors that may contribute to the occurrence of these destructive behaviors in athletes.

**P12**

### **THE DECISIVE ROLE OF PSYCHOLOGY IN JUDO: A SYSTEMATIC REVIEW**

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Based on the reviewed literature we have tried to understand the role psychology can play in the practice and performance of combat sports, specifically Judo. The goal of this systematic review was to explore and understand whether stress, emotions and motivation can play an important role in sport performance. Three electronic and scientific data bases, PubMed, Web of Science and Science Direct were used for finding eligible articles using the following keywords: "judo" AND "psychology"; "Judo" AND "psychological preparation"; "Judo" AND "anxiety"; "Judo" AND "mental toughness"; "Judo" AND "motivation". The research was conducted using the PRISMA guidelines. The included studies reviewed the relationship between an athlete's psychology and sports performance. The results demonstrated the importance of the psychological impact on judo athletes. In particular it has been noted how some factors such as depression, anxiety, nervousness, anger, fatigue, tension and confusion tend to increase, especially during weight loss. On the other hand, parameters such as stamina tend to decrease. We have also noticed that according to the management of emotions and according to the level of the competition, the influence that psychological factors have on the performance of the judoka may vary. A review of the literature did not reveal any major differences in terms of gender. We can affirm that the psychological parameters play a fundamental role in practice and competition, and therefore, must be kept under control for an optimal performance.

### P13

#### DEVELOPMENT PROGRAM OF THE MEN'S U16 BASKETBALL SELECTION

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Due to the characteristics of the basketball game, there is a need for a high level of development of motor skills, motor and functional abilities. For this reason, it is important to evaluate the player's movement technique and to measure their result in start acceleration tests (20m sprint), agility tests (Side\_steps; 20\_yards) and 300m test (anaerobic endurance). By continuous and targeted work on the mentioned components it is possible to directly influence the player's situational efficiency and performance on the court. The aim of this paper is to determine the impact of the planned and programmed 8-month training process on the development of abilities in men's U16 basketball team. The sample consisted of 12 players (age  $14.83 \pm 0.72$  years, height  $189.88 \pm 5.81$  cm and weight  $81.61 \pm 17.69$  kg) of the men's U16 basketball team. All players underwent initial and final testing that included the level of performance in motor tests and in the anaerobic endurance test. To gain insight into the significance of the change in results between repeated tests, ANOVA for repeated measurements was used. Results in all tests improved with a statistically significant difference in the 20m sprint test ( $p = 0.04$ ) and agility tests ( $p = 0.00$ ); 300m test did not show a significant difference. The availability of modern diagnostic equipment combined with professional coaches in controlled conditions has enabled significant progress of young basketball players.

### P14

#### LEVELS OF DISTRESS AND PHYSICAL ACTIVITY OF ADOLESCENTS DURING THE COVID-19 PANDEMIC

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To explore the levels of physical activity, negative affectivity, and coping and preoccupation with the pandemic in an adolescent sample. The study involved 2409 adolescents of elementary and high schools aged 10 to 19. The Depression, Anxiety and Stress Scale (DASS-21) was applied, and information about levels of physical activity, coping and preoccupation with pandemic and isolation measures were collected. Research has been conducted anonymously and online via web form. Male and female adolescents are highly involved in physical activities – three or four times a week. Findings of this research show that on average male adolescents are more likely to engage in physical activities than females and exercise more frequently (five and more times a week, and females who exercise just once or twice a week). Also, a relation of physical inactivity distress and preoccupation was obtained for adolescent girls. No similar finding was found for males. However, very high physical activity (five or more times a week) was a protective factor for coping and preoccupation with coronavirus infection. Levels of physical activity have a different effect on the distress of male and female adolescents during the COVID-19 pandemic. It can be concluded that female adolescents that are less physically active are more at risk of depression, anxiety and stress.

### P15

#### THE ROLE OF PARENTS IN ENCOURAGING CHILDREN TO EXTRACURRICULAR KINESIOLOGICAL ACTIVITIES

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Extracurricular kinesiological activities, in addition to providing the opportunity for actively spending leisure time, significantly contribute to the improvement of children's health and the development of their abilities, knowledge and achievements, so it is desirable to encourage and direct them. To assess parents' attitudes about physical activity and about encouraging children to extracurricular kinesiological activities in their leisure time. The secondary goal is to determine the differences in parental attitudes about encouraging activities with respect to the child's involvement in organized extracurricular kinesiological activities. The research was conducted on a sample of 191 parents of third and fourth grade primary school students. An anonymous questionnaire assessed parents' attitudes about physical activity and about encouraging children to extracurricular kinesiological activities. Frequencies of answers were calculated, and the significance of the differences was determined by Man-Whitney U test. 79,58% of children were involved in organized extracurricular kinesiological activities, while 20,42% weren't. Man-Whitney U test indicates the existence of statistically significant differences in parental attitudes related to activity encouragement. Parents whose children attend organized extracurricular kinesiology activities are more likely to encourage children to engage in physical activity. In directing children to extracurricular kinesiological activity and encouraging an active lifestyle, the role of parents will be significant only if parents have positive attitudes about physical activity.

### P16

#### DIFFERENCES IN SERVE RECEPTION PARAMETERS BETWEEN ELITE VOLLEYBALL CLUBS ACCORDING TO THE TEAM STANDINGS

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The game analysis tends to be used in order to detect regularities in the game actions, the quality of the execution, and efficiency—the results of the execution. The purpose of this study was to show differences in the statistical parameters of serve reception in relation to the current standings for men's and women's teams. Twenty volleyball clubs (M=10 and F=10) in 180 matches were analyzed, that are competing in the Serbian Super League, after the end of the first half 2021/2022. Data were collected using the statistics program Data Volley 2007. Additional statistical analysis was performed using the SPSS Statistics. ANOVA showed that higher placed clubs have better results in number of serve receptions ( $F=11.527$ ;  $p=0.000$ ), faults of serve reception ( $F=5.955$ ;  $p=0.003$ ), negative reception ( $F=7.157$ ;  $p=0.001$ ), and reception the serve efficiency ( $F=3.495$ ;  $p=0.032$ ). Additional, MANOVA indicate differences in volleyball receive parameters on general level between clubs according to their league position ( $F=3.525$ ;  $p=0.000$ ). As results indicate, differences in parameters of receiving serve show that better placed teams in the table have a lower total number of reception, less reception faults, less negative reception and higher reception efficiency.

**P17****ITALIAN VALIDATION OF "PARTICIPATION AND NON-PARTICIPATION OF PEOPLE WITH DISABILITY IN SPORT AND ACTIVE RECREATION" QUESTIONNAIRE"**

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Participation in sport and active recreation is a fundamental right guaranteed by the Convention on the Rights of Persons with Disabilities (CRPD) of United Nations, 2006. Literature has confirmed, over the last decades, the benefits of sport and active recreation for the people with disabilities. Nevertheless, participation in sport and active recreation for people with disabilities is lower than the general population. The aim of the study is to validate the Italian version of "Participation and non-participation of people with disability in sport and active recreation" questionnaire ("Partecipazione e non partecipazione delle persone con disabilità nello sport e nelle attività ricreative"), a 2017 University of Technology of Sydney research project, in collaboration with the Australian Sports Commission. Due to the sample size of the population, an electronic snowball technique was used, as in the original study. A process of back-translation was used to validate the questionnaire in the Italian language. The questionnaire items and the scale were reviewed by 5 experts in special education. An interview pre-test was conducted with a sample of 10 sportsmen and sportswomen with disabilities to check that the contents were interpreted correctly. A Confirmatory Factor Analysis was carried out with SPSS to validate the items. Cronbach's Alpha and McDonald's Omega were used to confirm scale reliability. 139 participants answered the questionnaire. CFA showed similar results with original questionnaire and, overall, the analysis of data shows that "Partecipazione e non partecipazione delle persone con disabilità nello sport e nelle attività ricreative" is a useful and valid tool for asses' participation and its impact on quality of life for people with disabilities. This Italian validation could help the international and cross-cultural studies to promote social inclusion for people with disabilities through sport and active recreation. However, it needs to be further tested on a larger sample.

This questionnaire underlines the importance of barriers in the perspective of social inclusion and can be administered to assess the constraints in the social context for people with disabilities.

**P18****QUALITY AND CONSUMER PREFERENCES OF DURUM WHEAT PASTA ENRICHED WITH CARROT WASTE ENCAPSULATES**

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The food industry is focused on creating novel food or functional food products which, in addition to the basic nutritional values, contain ingredients that improve the general conditions of the body and decrease the risk of diseases. A smart approach for designing such a new product is by enriching traditional foods with natural additives and flavors. Carrot waste has attracted considerable attention because of the potential health benefits of its lipophilic bioactive compounds, mainly carotenoids and tocopherols. The aim of the present study was the characterization of innovative pasta with increased nutritional value. To this end, durum wheat semolina was used to prepare five types of pasta, i.e. control pasta, and pasta enriched with either 10% or 20% encapsulated carrot waste extract obtained by either freeze drying or spray drying techniques. The different pastas were evaluated for their nutritional quality, physical and texture properties, as well as sensorial attributes. The results illustrated that the carrot waste encapsulates can be incorporated into pasta to enhance the product with high protein and other bioactive ingredients. The addition of encapsulates affected cooking, textural and color parameters. The fortification of pasta also improved the protein, fat, and ash contents. Overall, the sensory acceptability of 10% enriched pasta was satisfactory and comparable to those of the control durum pasta. Pasta fortified with carrot waste encapsulates has the potential to be a technological alternative for the food industry to provide nutritional enriched pasta.

**P19****SUPPLEMENT USE IN ADOLESCENTS CONCERNING THEIR ENGAGEMENT IN SPORT**

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The consumption of dietary supplements is widely spread among adolescents. They often research topics related to healthy eating and supplements. The focus of this study was to determine differences in the frequency and types of supplements used by adolescents and their dietary habits concerning their engagement in sport. Frequencies and percentages were calculated for all variables. Differences between groups were determined by t-test (significance level  $p<0.05$ ). The 74% of adolescents use supplements, most often using vitamins and minerals while much less often proteins and amino acids. As reasons for using supplements, non-athletes state the improvement of health status and disease prevention, while athletes state as reasons the improvement of sports performance and the increase or decrease of body weight. Adolescents who engage in sports have better dietary habits and are more often informed about nutrition than adolescents who do not engage in sports. They also use dietary supplements more often; consume more fruits and vegetables, and dairy products. Furthermore 51.26% of adolescents are aware of too little knowledge about supplements and 48.97% of them want to know more.

It can be concluded that adolescents show interest in supplements and their intake and want to get more information on this topic. Athletes should be aware of the fact that nutrient needs should be provided through food, rather than supplements. Adolescents should be educated about appropriate supplements use and proper food intake.

**P20**
**THE ASSOCIATION BETWEEN FUNCTIONAL MOVEMENT SCREEN AND STAR EXCURSION BALANCE TEST RESULTS AND THE OCCURRENCE OF INJURIES AND PAIN SYMPTOMS IN SOCCER PLAYERS**

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Soccer is very popular sport with high risk of injuries. The aim was to investigate whether Functional Movement Screen (FMS) and Star Excursion Balance Test (SEBT) results can predict occurrence of injury and painful symptoms amongst soccer players. The research was performed as cohort study and included 42 soccer players from Vukovarsko-Srijemska County, Croatia. Participants filled the questionnaire regarding their sociodemographic data, soccer playing, injuries and painful symptoms, and FMS and SEBT tests were performed. After 3.5 months they filled the second part of the questionnaire with the information regarding injuries and painful symptoms in that period. Participants with the FMS result  $\geq 15$  reported significantly less discomfort or general pain, low back pain and injuries in comparison to participants with the score  $\leq 14$  ( $p=0,035$ ;  $p<0,001$ ;  $p<0,001$ ). Lower scores of SEBT for both legs negatively correlated with discomfort or pain, lower back pain, and injuries. Likewise, positive correlations were found between FMS and SEBT results. FMS and SEBT results can predict injuries and painful symptoms amongst soccer players and their results are positively correlated. These tests can be used to identify players at risk of injury.

**P21**
**EVERYDAY LIFE TRANSFORMATION OF UNIVERSITY STUDENTS DURING THE FIRST AND FORTH WAVE OF COVID-19 PANDEMIC – CASE STUDY FROM SERBIA AND SLOVENIA**

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Previous research indicates numerous health, social, psychological, economic and other consequences caused by the COVID-19 pandemic. The aim of this research is an in-depth analysis of potential transformation of everyday life (EL) of university students, caused by restrictive measures in spring 2020, as well as an analysis of measures at the end of 2020 and the first half of 2021. Qualitative research was conducted using a semi-structured interview with university students from June 10th to July 27th, 2020, and the second phase from June the 1st to 28th, 2021. Results indicate a sudden change in EL of students in the spring of 2020, namely: the transition to online teaching, moving out of the dormitories, a sharp decline in physical activity, increased food intake, fear about themselves and family members. The results of repeated interviews indicate "habituation" to the new circumstances, but also a decrease in motivation to learn, "oversaturation" with online classes.

Findings suggest that the consequences of the long duration of the COVID-19 pandemic crisis brought a certain transformation in students' EL, but also some peculiarities of their strategies in adapting to these "new" conditions.

**P22**
**RELATIONSHIP BETWEEN EXCESSIVE EXERCISE ACTIVITY AND MOTIVATION FOR PHYSICAL EXERCISE**

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Numerous studies have proven the positive effects of regular physical activity that helps to cope with daily stress, reduce obesity, the emergence of risky diseases, improve mental and physical health. But despite the large number of positive effects of physical activity, there can be an overdose in physical activity that can lead to the emergence of exercise addiction. Exercise addiction is a condition in which individuals who exercise regularly lose control of their exercise behavior, leading to negative consequences for an individual's private and social life. The aim of this research was to investigate the relation between the main motives for exercise and excessive exercise activity. Data were collected on a sample of 233 young adults comprising of 124 kinesiology students (from the three faculties of kinesiology – Osijek, Zagreb and Split) (53.2%) and 109 recreational athletes (46.8%). There were 107 males (45.9%) and 126 females (54.1%). The socio-demographic data questionnaire and The Obligatory Exercise Questionnaire (OEQ) were used in the research. This study is to understand whether there are correlations between main motives for exercising such as health, physical appearance, challenge and enjoyment, hanging out with friends, competition and any of three dimensions of OEQ (Exercise frequency and commitment, Exercise preoccupation and intensity, Exercise emotionality). The correlations between observed variables were generally low ( $r = -.28 \text{ to } .30$ ), but some results show significance. Respondents who exercise more often and are more dedicated chose competition as the main motive for exercising ( $r = .30$ ), while other reasons such as help in overcoming stress, increasing strength, endurance ( $r = -.17$ ) are less important for them. In terms of gender relations, men exercise more often and are more dedicated ( $r = .24$ ), they are more focused and exercise more intensely ( $r = .15$ ). They generally scored higher values on the exercise dependence scale (overall score,  $r = -.18$ ). The findings suggest that male respondents who chosen competition as the main motive for exercising are more committed to exercise, exercise more often and more intensely.

**P23**
**INFLUENCE OF PHYSICAL ACTIVITY ON PREVENTION OF ALZHEIMER'S DISEASE**

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Alzheimer's is a progressive disease beginning with mild memory loss and possibly leading to loss of the ability to carry on a conversation and respond to the environment. It can be the consequence of several factors, both genetic and environmental. There is growing scientific evidence that healthy behaviors may reduce the risk for subjective cognitive decline. The study aims to overview the possible benefits of physical activity in preventing Alzheimer's disease. Research on available literature was conducted on PubMed

(Medline) database. All studies that include physical activity and prevention of Alzheimer's disease were considered for inclusion in the study. Following the literature review, we found 249 studies that included the keywords: "Alzheimer's disease" AND "Physical activity" or "Alzheimer's disease" AND "prevention". After reading the abstract or full text, seven studies were included in the review. The results implicate that physical activity could result in improvements in brain health, prevent cognitive decline, and diminish the incidence of Alzheimer's disease. These protective effects of physical activity could be influenced by reducing various cardiovascular risk and metabolic disorders. Evidence from review studies suggests that physical exercise has a protective effect on brain functioning among the older population. Finally, exercise may also decelerate the development of Alzheimer's disease.

**P24****EFFECTS OF LOW-LOAD RESISTANCE TRAINING ON PHYSICAL FORM IN OLDER WOMEN**

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The aging of the population is one of the greatest challenges facing modern society, which results in issues and growing interests of the world community related to the health and functionality of this population. This study aimed to determine the effects of twelve-week low-load strength training with elastic bands in chairs on the physical form in elderly women. In the experimental treatment, the sample consisted of 168 women from 6 gerontological centers, divided into 2 groups, experimental ( $n=86$ ) and control ( $n=82$ ). The treatment was conducted in 2018, where the respondents from the experimental group underwent a 12-week programmed strength training, while the respondents from the control group conducted their usual daily activities. The results of this study indicate that strength training with elastic bands in chairs (CBRT) leads to a significant increase in all parameters of physical form, which is contained in the battery of the Senior Fitness Test. The obtained results show that this type of strength training could be an effective means of improving and advancing the health status and raising the physical form of elderly women. This research has been done in line with the COST Action's objectives (CA20104).

**P25****WELL-SELECTED SKI EQUIPMENT HELPS SKI BEGINNERS IN ACQUISITION OF SKI KNOWLEDGE**

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The aim of this research was to determine the influence of the length of skis and ski boots on learning basics of alpine skiing. Included were 178 ski beginners (132 males and 46 females). Initially, subjects' body height and feet length were measured, and based on the measures, adequate ski equipment was chosen. Afterwards they were included in 10-days alpine ski school where they learned skiing according to precisely defined program. Upon completion of ski school, participants demonstrated snowplough, basic turn, parallel turn and short turn in front of

five independent judges. We found statistically significant negative correlation between ski length and average grade for element snowplough ( $r=-0,19$ ). Moreover, significant correlation was determined between feet length and average grade for parallel turn ( $r=-0,16$ ) and length of ski boots and element parallel turn ( $r=-0,20$ ). Results suggest how ski equipment (skies and ski boots of adequate length) influence the speed and level of learning basics of alpine skiing.

**P26****THE LEVEL OF PHYSICAL ACTIVITY IN DIFFERENT AGE GROUPS DURING THE COVID-19 PANDEMIC**

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Motion is besides oxygen and water one of the essential human needs that helps us stay alive. With the advent of the COVID-19 pandemic, the measures restricting movement have been introduced globally to prevent the virus's spread and minimise the harmful consequences. The aim of the study was to establish the level of physical activity in people of different age groups during the period of restricted movement during the COVID-19 pandemic. The research attempted to determine the differences in the level of physical activity between secondary school pupils, students and middle-aged people. Also, we considered the differences with regard to gender. The total number of the participants is 300. The level of physical activity was determined using a short version of the International physical activity questionnaire. The obtained results indicate that secondary school pupils achieved the highest values in all measured elements compared to two other groups of respondents. The university student group also had higher values than middle-aged respondents in all aspects of physical activity levels except in the low level of physical activity. The results also point to considerable gender differences in the groups' general level of physical activity. The male respondents in all three groups achieved higher average values in the general level of physical activity than female respondents. Appropriate physical activity is one of the critical factors of maintaining our physical abilities and health. Its value is based on physical exercise and training, which can positively impact people in all stages of life.

**P27****INTRA-POSITIONAL AND INTER-POSITIONAL DIFFERENCES AMONG YOUNG FEMALE VOLLEYBALL PLAYERS IN AGILITY TESTS**

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The aim of this study was to determine the differences between less successful and more successful youth female volleyball players, as well as their inter-positional and intra-positional differences in agility tests. The study was conducted on a sample of 204 youth Croatian female volleyball players (mean chronological age,  $14.11 \pm 0.84$  years). The players were divided into 5 subgroups according to their playing position (setters, opposite players, passer-hitters, middle blockers, and libero players). The variable sample used to assess agility consisted of 3 tests: Side steps, 9-3-6-3-9 test, and Step-hop test. Methods of data analysis included the determination of metric characteristics for all three agility tests. The inter-positional and intra-positional differences were determined by applying the analysis of covariance (ANCOVA) with a post hoc test of differences (Tukey Unequal N HSD test). The

analysis of covariance revealed a significant impact of biological age indicators on all agility tests. Furthermore, discriminant analysis of differences showed that more successful volleyball players achieved better results in all three agility tests. High reliability of the test was determined by Cronbach's Alpha coefficient (0.87-0.96). The results of this study showed a positive effect of agility tests in differentiating less successful and more successful players regardless of their position. Greater biological maturity and training experience represent great competitive advantage in this age group.

**P28****PARENTAL INVOLVEMNT IN SUPPORTING SPORTS ACTIVITIES OF YOUNG SWIMMERS**Katarina Krijan<sup>1</sup>, Dario Vrdoljak<sup>1</sup>, Mirjana Milic<sup>1</sup><sup>1</sup>University of Split, Faculty of Kinesiology, Split, Croatia**Correspondence:** Katarina Krijan (katarinakrijan24@gmail.com)

The aim of the paper was to determine the form and the extent of parental involvement in supporting their children (of both sexes) who are participating in competitive swimming in younger age categories. The sample of participants included 64 parents (N1:40 mothers; N2:24 fathers) of young Croatian swimmers. By using a modified anonymous Parental Involvement in Sport Questionnaire – PISQ, which consists of 33 closed-ended questions, the level of four dimensions of parental involvement in children's sports activities was determined: directive behavior, praise and understanding, pressure, and active involvement. By using t-test and one-way analysis of variance, differences between parents in all four dimensions of involvement in swimming were tested according to sex, age, and parents' education level. The results showed no significant differences between mothers and fathers in any dimension of involvement in a child's sports activity. Most parents are interested in swimming as a sport and support their children in training and selection of the sport, but only partially attend their competitions, which indicates formalistic support and verbal incentive to train, without the active presence and consistent involvement in all processes of the sport. Parental support plays an arguably important role during a child's overall and long-term athletic development path, both for staying in swimming and for the success of achieving sports results.

**P29****FACTORS DETERMINING THE CHOICE OF HEALTHY DIETS FOR KAZAKH ATHLETES OF VARIOUS SPORTS**Kazys Milasius<sup>1,2</sup>, Yeldana Yerzhanova<sup>2</sup>, Zhanna Sabyrbek<sup>2</sup>, Galiya Madiyeva<sup>2</sup>, Saule Kasymbekova<sup>2</sup>, Madina Adilzhanova<sup>2</sup>, Zhanna Kalmatayeva<sup>2</sup><sup>1</sup>Vytautas Magnus University Education Academy, Vilnius, Lithuania;<sup>2</sup>Al-Farabi Kazakh National University, Faculty of Medicine and Health, Almaty, Kazakhstan**Correspondence:** Kazys Milasius (kazys.milasius@vdu.lt)

According to the World Health Organization (WHO), 40-60% of human health depends on a lifestyle in which 25-30% is devoted to a rational diet. Therefore, by meeting physiological needs in accordance with a rational diet, athletes can adapt more quickly to the applied physical load and achieve better sport results. The aim of the study was to describe and compare the factors that determine the healthy diet of athletes of various sports. The study, which aimed to assess the factors determining healthy diet, involved 157 students of physical education and sports studies at the University of Almaty. Respondents were divided into 3 groups - sports games (volleyball, football, basketball, tennis) (n = 85), endurance

sports (long distance running, skiing, road cycling, triathlon (n = 22) and combat sports (wrestling, Judo, karate, boxing) (n = 50). The questionnaire by Steptoe et al. (1995) was applied to establish the opinion of the investigated subjects on the factors that determine healthy and rational dietary choices of student athletes. Our research has shown that among the factors that determine the healthy diet of athletes of various sports, the main ones are health, the character of the chosen sport and athlete's body composition. Factors such as current trends, the popularity of the food consumed, and the influence of family and friends are less important. The athletes we studied noted their efforts to eat and live healthy, most of them were satisfied with their health, their body mass. A greater variety of respondents' responses was observed when assessing the composition of food supplements, the effect of discount promotions on product selection. The responses received on adherence to the diet indicate that the athletes studied do not always keep the correct diet.

**P30****INFLUENCE OF PHYSICAL ACTIVITY ON TOBACCO CONSUMPTION AND PULMONARY FUNCTION IN ADOLESCENTS**Lea Busac Kristo<sup>1,2</sup>, Andrea Krajacic<sup>2,3</sup><sup>1</sup>University of Applied Health Studies, Zagreb, Croatia, <sup>2</sup>University of Zagreb, Faculty of Kinesiology, Zagreb, Croatia, <sup>3</sup>SiLab, Sensory Integration Laboratory, Zagreb, Croatia**Correspondence:** Lea Busac Kristo (lea.busac@student.kif.hr)

The respiratory system and respiration are among the most important physiological mechanisms. Smoking and tobacco smoke consumption in general are one of the leading public health problems today, especially among the young population. This study aims to compare the habits of tobacco consumption and the results of spirometry measurements of male adolescent athletes and non-athlete adolescents. A total of 83 respondents participated in the study; Osijek Football Club footballers and adolescents of the same age from the Local Communities of the City of Osijek, who do not do sports. The first part of the study included a short questionnaire with general demographic indicators, and the second part a lung function test, spirometry. The respondents were mostly between 17 and 18 years old. Out of the total number of tested, only 29.1% of athletes consume tobacco products, while the non-athletes number rises to as many as 42.8%. The four parameters of pulmonary function test did not show statistically significant differences between groups, which confirms the initial hypothesis that at this age there is no significant difference because respondents do not consume tobacco products for a longer period. Doing sports leads to a negative attitude towards tobacco use. However, the number of young people consuming tobacco products who are not physically active is worrying.

**P31****OSMOTIC DEHYDRATION AS A METHOD FOR DELIVERING ENHANCED NUTRITION FOR THE ATHLETES**Lidija Jevric<sup>1</sup>, Vladimir Filipovic<sup>1</sup><sup>1</sup>University of Novi Sad, Faculty of Technology, Novi Sad, Serbia**Correspondence:** Lidija Jevric (lydija@uns.ac.rs)

Application of osmotic dehydration method is targeted on obtaining in economic and ecological manner, relatively high foods' dehydration levels, while enhancing and improving its' nutritive value, via proper choosing of applied osmotic solution. By application of sugar beet molasses, as an osmotic solution in osmotic dehydration of foods, excellent dehydration and nutrition results are obtained. Fresh peaches were washed, dried, peeled and cut into cubes of: 1×1×1 cm,

while molasses, with initial dry matter content of 85.04% was diluted to the concentrations 80% of dry matter. Osmodehydration process was conducted in laboratory jars, in temperature chamber with constant temperature of 50 °C for 5 hours. At the end of the process, samples were taken out from molasses, lightly washed with water and blotted to remove adhered water. Content of proteins, sugar, K, Ca and Mg were determined. Obtained results showed that by consuming 100 g of peach osmodehydrated in molasses, nutrition daily needs of athletes are met in following amounts: proteins: 6.88%; sugars: 98.37%; K: 33.60%; Ca: 15.28%; Mg: 56.42%. These results are direct consequence of peaches solid gain from molasses, where molasses' nutritional composition enriched peach samples, while dehydrating it. Consuming osmodehydrated peach in molasses, especially during activity, athletes can quickly replace metabolized sugar and supplement their body with minerals and in some extent with proteins.

**P32****SCHOOL ENVIRONMENT AND ENERGY BALANCE-RELATED BEHAVIOURS IN SERBIAN CHILDREN**

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School environment can influence children's energy balance-related behaviors (EBRBs), thereby the relevant data was collected in 2019 within the second round of the WHO European Childhood Obesity Surveillance Initiative (COSI) in Serbia. The study examined the relationship between school environmental factors and EBRBs in Serbian children. A nationally representative sample of children aged 7.0-8.9 comprised 2010 participants. Data was collected according to the COSI protocol. School variables were: physical environment, school organization, extracurricular PA, school health promotion, school nutrition score, unhealthy food marketing, school canteen availability. The dependent variables identified by factor analysis were: 1. Sedentary behavior and lack of healthy dietary habits; 2. Increased snack and sugary drink consumption, 3. Low PA level and lack of sleep. Significant correlations between school variables and all dependent variables were obtained ( $p \leq .05$ ). School health promotion, higher school nutrition score, and provision of school gym and playground, were related to more favorable EBRBs in children. Multicomponent school-based intervention might contribute to school children's health.

**P33****DIFFERENCES IN ALL-AROUND RESULTS BETWEEN REGIONS IN MEN AND WOMEN ARTISTIC GYMNASTICS**

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Expansion of artistic gymnastics brings new gyms, and number of children in the Compulsory program is increasing. For better progression of gymnastics, it is necessary to know in which regions of Croatia the results are weaker. The aim is to determine the differences in all-around score between four regions of Croatia in the Compulsory program, girls and boys. A sample consisted of 221 competitors, 170 girls and 41 boys, participating in the Croatian Championships. The sample of variables consisted of the all-around

score and regions north, east, west, and south, which are composed of the gymnastics clubs. Differences between all-around score and regions was calculated by ANOVA with Bonferroni correction at the level of statistical significance  $p < 0.05$ . Results have shown there is statistically significant difference in the younger age categories in girls. In younger categories in boys there is no statistically significant difference. Better results were achieved by the clubs in the region west and south, compared with the region north and east. In the older categories, both boys and girls, the best results are achieved in the region north, and the worst in the region east. It would be necessary to improve the quality of gymnastics in north and east region for younger age categories in girls and in the region east for older categories, boys and girls.

**P34****ACTIVE BREAK AND ACADEMIC SKILLS IN PRIMARY SCHOOL STUDENTS**

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Implement a program of "active break" (AB) in Primary Education to analyze its impact on school performance and concentration of students. Three-week quasi-experimental design with 156 participants. A 5-minute AB intervention program has been applied in the classroom, repeated twice during the morning school day (30 sessions throughout the intervention program). The instruments used in the pre and posttest were: Test Direct behavior rating scale, Test of attention D2, One minute test and CDI Test. A statistical analysis of repeated measures was applied using the Wilcoxon test or the t test for paired data, taking into account the distribution of the differences in the paired data. The results indicate that there are significant differences in the behavior variables (Test Direct behavior rating scale), concentration. (Attention test D2), Mathematical competence (One minute test) and emotional state / level of satisfaction (CDI). Implementing AB during the school session could be a very positive tool due to its double contribution to students, improving health and the possible benefit in academic performance.

**P35****RELATIONSHIP OF SEGMENTAL ASSESSMENT OF MUSCLE MASS BY BIOIMPEDANCE WITH HAND GRIP STRENGTH IN MIDDLE-AGED PEOPLE**

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The analysis of body composition by bioimpedance is useful to examine the effects of physical exercise on the body. An emerging activity that involves active upper body movement is Nordic walking. Analyze the relationship between the segmental muscle mass of the upper extremities and the hand grip strength in women practicing Nordic walking. 20 subjects participated with a mean age of  $50.6 \pm 5.1$  years. Using an impedance scale (In Body® 120), the percentages of fat and muscle were obtained. Manual grip strength was measured using a manual dynamometer (Takei-TKK5001®), performed three times on each hand and the best was recorded. Regarding the percentage of muscle mass, the participants presented a mean value of  $35.34 \pm 3.31\%$ . The mean right and left hand pressure

force was  $8.80 \pm 3.74$  (kg-f) and  $6.85 \pm 4.70$  (kg-f), respectively. Significant differences are found in lean mass, where it is greater on the dominant side ( $t = 3.26$ ;  $p = 0.003$ ). When analyzing the correlation between the strength values of each limb with those of its body composition, it is observed that, the greater the amount of lean mass, the greater the force in said limb ( $p = 0.000$ ). The results suggest that strength values can be obtained from segmental body composition.

### P36

#### **IDENTIFICATION OF THE MAIN FACTORS OF PHYSICAL DEVELOPMENT AND SPORTS PREPAREDNESS IN 12-, 14- AND 16-YEAR-OLD BULGARIAN GIRLS BASKETBALL PLAYERS**

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The regularities in the dynamics of the physical development of the female organism and the changes that occur in it led to problems in the manifestation of motor qualities at different ages. The study aims to optimize the training process of U12, U14, and U16 basketball players by revealing the factor structure and identifying the main factors of physical development and sports fitness in different age groups. Specialized literature was analyzed to carry out the research, and a test battery for sports-pedagogical testing was used, according to Borukova, 2021. 173 female basketball players were studied. The data was processed mathematically and statistically through variation, correlation, and factor analysis. The results showed a change in the factor models of the physical development and the specific performance with the age increasing. The factor components with the most significant weight for the U12 are the anthropometric characteristics, for the U14 are the technical basketball skills, while for the U16, the height is a prerequisite for more outstanding achievements in the maximum vertical jump. The rearrangement of the features in the integral factor structure of the sports preparedness enables the coaches to optimize the training process for the U12, U14, and U16 female basketball players.

### P37

#### **DIFFERENCES IN ATTACK SITUATIONAL ACTIVITY INDICATORS BETWEEN MEN'S AND WOMEN'S HANDBALL**

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The intention of this study is to attempt to scientifically detect the hypothetical differences in attack situational activity between men's and women's elite handball. The data were collected by analyzing handball matches played in Croatian Women's and Men's Premier Handball League. Matches played by 54 women's and 64 men's teams were analyzed. The analysis included 21 indicators of absolute and relative situational activity in attack. The data were collected through the official statistics protocol of the Croatian Handball Federation for competition seasons 2011/12, 2012/13, 2013/14, and 2014/15. The differences in the attack situational activity indicators between men's and women's handball were determined by univariate analysis of variance. The results reveal specific technical-tactical models of play that distinguish between men's and women's handball. Women's handball is characterized primarily by a greater tendency towards positional rather than transitional attack, and

consequently towards fewer, longer attacks in comparison to men. In the positional attack, the finish is directed towards line positions, especially wingers, and towards individual attempts of breaking through to the line and securing 7m shots. Men's handball is characterized by a tendency towards a greater number of attacks, especially quick transitional attacks, and in the positional attack phase, towards realization from back positions. The results generated by this type of study can provide useful guidelines for planning, programming, and differentiating the training process in men's and women's handball.

### P38

#### **RELATION OF MOTOR SKILLS LEVEL AND PHYSICAL ACTIVITY OF 4TH GRADE PUPILS IN CROATIA**

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The aim of this study was to explore the relationship between physical activity level and motor skills development among primary school pupils and gender differences in physical activity level and motor skills development. The sample of study subjects included 52 4th grade schoolchildren (28 boys and 24 girls) whose mean age was 10.6 years. Pupils' motor skills were assessed by Bruininks – Oseretsky test of motor proficiency-short form that includes 14 particles. Physical Activity Questionnaire for Older Children (PAQ-C) was used to assess physical activity. The test-retest method with seven days interval between the surveys was used to establish the reliability of the questionnaire. Results showed statistically significant differences among pupils' motor skills according to physical activity level in the following variables: total score (TS)  $H=6,097$ ,  $p = 0.047$ ; dribbling a ball-alternative hands (DB-AH)  $H = 10,556$ ,  $p = 0.005$ ; dropping and catching a ball – both hands (DCB-BH)  $H=7,315$ ,  $p=0.025$ . Likewise, there were no gender differences in the physical activity level, but statistically significant difference was found in three particles of motor skills test: fine motor precision (folding paper) and manual dexterity (transferring pennies) in favor of girls and in bilateral coordination (one legged – stationary hop) in favor of boys. The results indicated that the pupils with higher level of physical activity have achieved higher total score at the motor skills assessment test and gender differences in three particles of motor skills test.

### P39

#### **EXERCISE AND PHYSICAL ACTIVITY FOR ADOLESCENTS AND ADULTS WITH CEREBRAL PALSY**

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Cerebral palsy is a group of permanent, non-progressive disorders that cause significant limitations due to hypertonia, spasticity, and involuntary movements. This review aims to summarize and present the effects of exercise and physical activity on health-related quality of life for adolescents and adults with cerebral palsy. Similar to other chronic conditions, people with cerebral palsy are less active than the healthy population, which puts them at risk of developing secondary health issues such as cardiovascular diseases, obesity, and other conditions. Search was conducted on the PubMed domain using keywords: "cerebral palsy" AND "adults" AND "physical activity OR exercise", and out of thirty results, a

total of nine randomized controlled trials were chosen for analysis after following inclusion and exclusion criteria. Each of the studies examined the effects of exercise on general and specific aspects of health-related quality of life. Depending on the intervention, there was an increase in cardiorespiratory fitness, strength, flexibility, balance in both ambulatory and non-ambulatory patients with confirmed cerebral palsy diagnosis. Physical activity and exercise are crucial for people with cerebral palsy since the worsening of symptoms can cause even greater disability. On the other hand, physical inactivity poses a health risk on its own, especially for people with chronic conditions.

**P40****DOES INTEGRATED NEUROMUSCULAR EXERCISE IMPROVE HEALTH-RELATED FITNESS IN LOWER ELEMENTARY BOYS?**Marijana Sindjic<sup>1</sup>, Maja Batez<sup>1</sup><sup>1</sup>University of Novi Sad, Faculty of Sport and Physical Education, Novi Sad, Serbia**Correspondence:** Marijana Sindjic (marijanas15@gmail.com)

Integrated neuromuscular exercise showed benefits for improving health and skill-related physical fitness in the training process, but there is a lack of benefits of integrated neuromuscular exercise during physical education. The current study aimed to determine the effects of integrated neuromuscular exercise implemented during physical education in a primary school in the Republic of Serbia on health-related fitness in lower elementary boys. The sample consisted of 65 healthy boys who were divided into the intervention and control groups. The intervention group performed integrated neuromuscular exercise while the control group performed the traditional physical education activities. Both groups performed activities eight weeks, two times per week within the first 15 min of physical education class. After the initial 15 min, the intervention group performed the same activities as the control group in the main and final part of the class. Before and after the program the Fitnessgram battery tests assessed the health-related fitness. Intervention group significantly reduced all fat measures while the control group significantly reduced only triceps skinfold. Both groups significantly improved the performance of almost all muscular fitness tests and cardiorespiratory endurance, but the intervention group increased more than the control group. The obtained results show the potential value of including this approach of exercise during physical education, whose contribution was given by this research.

**P41****JOINT ASSOCIATIONS OF PHYSICAL INACTIVITY AND HIGH SCREEN TIME WITH ABDOMINAL OBESITY AND RAISED BLOOD PRESSURE IN ADOLESCENTS: THE CRO-PALS STUDY**Marjeta Misigoj-Durakovic<sup>1</sup>, Josip Karuc<sup>1</sup>, Maroje Soric<sup>1</sup><sup>1</sup>University of Zagreb, Faculty of Kinesiology, Zagreb, Croatia**Correspondence:** Marjeta Misigoj-Durakovic (marjeta.misigoj-durakovic@kif.hr)

Purpose of the study was to investigate associations of inactivity and high screen time (ST) with abdominal obesity (AO) and raised blood pressure (BP) in adolescents. This investigation includes 832 students (414 girls) aged 15 and 16 years. Duration of daily moderate-to-vigorous PA and recreational ST was self-reported via the SHAPES questionnaire. Participants were divided in four groups according to the adherence to the PA guidelines: insufficient PA+inadequate ST; sufficient PA+inadequate ST; insufficient PA+adequate ST; sufficient PA+adequate ST. AO was determined using Adolescent metabolic syndrome criteria, while

high BP was ascertained according to the ESH guidelines. Multiple logistic regression models were run to compare the odds of having AO or raised BP according to the type of healthy behaviors. While adhering to the PA guidelines was not associated with lower odds of AO or raised BP, adolescents with increased ST had 57% higher odds of raised BP compared to their peers who adhered to ST guidelines ( $OR=1.57$ ,  $95\%CI=0.97-2.55$ ). The odds of both AO and raised BP in all 3 groups of adolescents that adhered to one or both guidelines were not different than in their peers that did not adhere to either of the guidelines. Regardless of the level of PA, ST has a significant impact on elevated BP values in adolescents.

**P42****CONNECTION BETWEEN WORK MODEL AND AMOUNT OF TRAINING DURING LOCKDOWN WITH THE RESULTS IN KICKBOXING**Mate Skelin<sup>1</sup>, Hrvoje Karnincic<sup>1</sup>, Gordan Drasinac<sup>2</sup><sup>1</sup>University of Split, Faculty of Kinesiology, Split, Croatia; <sup>2</sup>University of Split, University Department of Professional Studies, Split, Croatia**Correspondence:** Mate Skelin (skela.mate@gmail.com)

During lockdown, some clubs had the usual approach to training while others did not because of the prescribed measures. Differences in training also occurred due to compliance or non-compliance with measures. Some sport's theorists argue that this should affect results at all levels of sport. The aim of this theses is to examine the models of work and the amount of individual aspects of training during lockdown in kickboxing. The second goal is to determine the relationship between the work model / amount of training in lockdown and kickboxing results. The validated questionnaire collected data from 40 active fighters from various Croatian clubs. Kickboxers mostly trained at home or at open, no special program was done, it was usually decided by the athlete himself, psychological support they received from the coach. Compared to previous sparring they did less than 50%, TE-TA training 60% endurance 70% and performance strength 80%. Fighters who had good results before the pandemic paid more attention to training during the pandemic. Fighters who worked harder on endurance did better in 2022. The difference between the results before and after the lockdown is significantly related to the amount of TE-TA training (Spearman). Club activities during the lockdown will affect the results. Clubs need to balance between adherence to measures and results, aware of the fact that some things their competition is not allowed to do work. Based on this research, training instructions in similar situations can be given.

**P43****LOCOMOTOR STABILITY AND MOBILITY OF FOOTBALL AND HANDBALL PLAYERS**Mila Vukadinovic Jurisic<sup>1</sup>, Uros Puzovic<sup>1</sup>, Bogdan Zivanovic<sup>1</sup>, Nikola Radulovic<sup>1</sup>, Ilona Mihajlovic<sup>1</sup>, Jelena Obradovic<sup>1</sup><sup>1</sup>University of Novi Sad, Faculty for Sport and Physical Education, Novi Sad, Serbia**Correspondence:** Mila Vukadinovic Jurisic (mila.vukadinovic88@gmail.com)

Functional Movement Screening (FMS) is used to assess the human movement patterns, with the greatest focus on the assessment of stability and mobility locomotor system. The aim of the study was to determine differences between football and handball players' in stability and mobility. Twenty-four athletes (aged  $20.5 \pm 3.7$  years), were divided into: the football group (FG, n = 12), and the handball group (HG, n=12). The FMS battery was

applied: Deep squat, Hurdle step, In-line lunge, Shoulder mobility, Active straight-leg raise, Trunk stability-up, and Rotary stability. A t-test for two-independent groups was used to determine the differences between the groups in the total score. The differences between the groups in the individual tests, chi-square test (?2) were applied. In total, there is no statistically significant difference ( $p=0.15$ ) between groups (FG, AS=16.33 point vs. HG, AS=15.50 points). The results of the chi-square test show that there is no statistically significant difference ( $p=0.05$ ) between FG and HG in any of the individual tests of FMS. There is no difference between football and handball players in locomotor stability and mobility. An adequate plan and program of the training process can be developed to prevent injuries and improve the functional mobility of athletes, according to the FMS scores in individual tests.

**P44****DISTRIBUTION COEFFICIENTS OF NOVEL STEROIDAL DERIVATIVES AND ITS CORRELATIONS**

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The present study describes the computational modeling of distribution coefficients of novel steroidal derivatives, as the compounds with remarkable anticancer activities. The goal was to identify the specific correlations between calculated distribution coefficients and experimentally obtained lipophilicity data. Reversed-phase ultra-high performance liquid chromatography with polar aprotic and protic solvents was applied in order to obtain experimental results. Computational method was used to calculate in silico distribution coefficients. The presented results cover the determination of pH versus distribution coefficients profiles, which specify the existing form of the molecules and molecules distribution between different phases. Experimentally obtained lipophilicity values were correlated with in silico distribution coefficients and gave statistically meaningful and justified correlations with high correlation coefficients and low prediction errors. The findings indicate that the novel steroidal derivatives have the values of the distribution coefficients in the range acceptable for the potential drug candidates.

**P45****THE STATUS OF THE SPINAL COLUMN IN THE SAGITTAL PLANE OF SWIMMERS AND WATER POLO PLAYERS**

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Children often spend their free time passively, with computers, mobile phones, or TV devices. Staying in a passive and irregular body position often leads to a violation of the postural status of children. One of the most common activities of parent's choice to improve their child's postural status is swimming. Swimming positively impacts children's mood, increases their safety in and around the water, and has a positive effect on the health status of children. The aim of this study compared the differences in the postural status of the spine in the sagittal plane in boys who practice swimming

and water polo. The sample comprised 122 males, assessment of the status of the spine was made by Contemplus-Templo capture system for assessing postural status in the 3D analysis of postural status. MANOVA indicated that there was a statistically significant difference in the overall system variables. Individually observing variables proved that groups of subjects differ statistically significantly in two of the three observed spinal segments, based on ANOVA; differences exist in cervical and lumbar lordosis between the tested groups of subjects. The obtained results indicate that the group of water polo players has increased values of cervical and lumbar lordosis about the control group and the group of swimmers.

**P46****MORPHOLOGICAL CHARACTERISTICS DIFFERENCES OF FOOTBALLERS OVER TWO PREPARATORY PERIODS**

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The morphological characteristics of athletes are one of the essential factors of sporting achievements in different sports. Football is one of the sports where monitoring changes in the morphological characteristics is a standard process for monitoring training effects. The purpose of the study is to show changes in the morphological characteristics of footballers over two preparatory periods during one year. Morphological characteristics of footballers were analyzed using a bioelectric impedance method on body analyzer Tanita MC 780, height was measured using SECA type 220. Statistical analysis was done with IBM SPSS Statistics 26, with statistical significance set at  $p \leq 0.05$ . During the first preparatory period, statistically significant changes were found for the following variables: TBW (MD= -0.86;  $p=0.02$ ), ECW (MD= -0.19;  $p=0.005$ ), ICW (MD= -0.70;  $p=0.03$ ), PMM (MD= -1.04;  $p=0.012$ ). During the second preparatory period, statistically significant changes were found for the following variables: PBF (MD= -1.40;  $p=0.02$ ), TBW (MD= 1.25;  $p=0.01$ ), ICW (MD= 0.10;  $p=0.004$ ), PMM (MD= 1.30;  $p=0.01$ ). Concerning the obtained results, we conclude that the training process is not the only factor influencing the morphological characteristics of athletes.

**P47****EFFICIENCY OF DIFFERENT WINDSURFING TEACHING MODELS**

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The aim of this study was to determine the most efficient windsurfing teaching program. This research was conducted on 159 students without windsurfing experience. During the lessons 3 different teaching methods were applied: 1. Buoy range method, 2. Reduced preliminary exercises 3. Division inside of the group. At the end of the program, every examinee was evaluated by 5 independent examiners. Windsurfing knowledge was rated through grades from 1 to 5 in the following elements: 180° turn in place, start, sail controlling, tack and jibe. All implemented programs showed better average results in every element of windsurfing technique. The biggest differences of average grade were manifested in jibing and start element in groups taught with reduced preliminary exercises. The smallest differences manifested in tacking, turn in place and jibing element in groups taught using buoys. Higher dispersion was present in jibing element in most of the groups, but mostly in groups taught using

the buoy range. Descriptive indicators are showing positive influence of buoy range and division inside of the group, but without statistically significant difference. The significance of the buoy range is increasing with learning progress of beginners. In reduced preliminary exercises program students achieve better average results in all elements, so this program has positive influence on the amount of acquired knowledge in motorically competent group.

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#### **THE INFLUENCE OF MOTOR ABILITIES ON THE SPRINTING SPEED OF BOYS OF YOUNGER SCHOOL AGE**

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This study aimed to determine the influence of motor abilities on sprinting speed in boys of younger school age. The sample consisted of 104 boys aged 10-11, who attended "12. December" elementary school in Sjenica. Seven motor tests were applied: Tapping with hand(s), Standing long jump(cm), Throwing the medicine ball from lying position(m), Leaning on the bench(cm), Back polygon(s), Lifting hull, and Endurance in hanging joint(s). A standardized 60m(s) running test was used to estimate the sprint running speed. The influence of the system of predictor variables on the criterion variable was calculated by Linear Regression Analysis. The results showed that the whole system of predictor variables had a statistically significant influence ( $p = 0.02$ ) on the criterion variable (Running at 60m). By individual observation of the variables, it can be noticed that the Jump away from the place, Lifting the hull and the Polygon backward have a statistically significant influence ( $p \leq 0.05$ ) on the variable Running at 60m. No statistically significant effects ( $p \geq 0.05$ ) on the criterion variable (Running at 60m) could be observed in other predictor variables (Bench Lean, Hand Tapping, Back Throwing, and Bending Endurance). It can be concluded that the manifestation of motor abilities (explosive leg strength, repetitive torso strength, and coordination) significantly affect the running speed at 60m in boys of younger school age.

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#### **EFFECTS OF ACUTE B-ALANINE SUPPLEMENTATION ON COUNTERMOVEMENT JUMP PERFORMANCE**

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Beta-alanine is a nonessential amino acid produced in the liver, and when combined with L-histidine forms, a dipeptide called carnosine. Intramuscular carnosine yields the most substantial effect on regulating acidity produced during high-intensity anaerobic activities. The goal of this study is to evaluate the effect of Beta-alanine on jumping performance after strenuous exercise. Twelve healthy, physically active men volunteered for the study and signed written informed consent. A single-blind, randomized, controlled study was applied. Participants were allocated either to a placebo (inulin) or beta-alanine group (0.08gr per kg). For fatigue protocol, we implanted 4x400 meter running with 3 min pause between the repetitions. Before and after the fatigue protocol, participants performed the Bosco jump protocol. One-way repeated-measures ANOVA was applied for determining the differences within group subjects. Acute Beta-alanine supplementation revealed no statistically significant difference within subject in experimental group for

CMJ1-time ( $p = 0.215$ ,  $\eta^2 = 0.29$ ) and CMJ1 height ( $p = 0.232$ ,  $\eta^2 = 0.27$ ), while in control group statistical significance remained present for both CMJ1-time ( $p = 0.017$ ,  $\eta^2 = 0.71$ ) and CMJ1-height ( $p = 0.031$ ,  $\eta^2 = 0.64$ ). Beta-alanine supplementation can enhance jumping performance after strenuous exercise. Future research should have applied longer supplemental duration and administration protocols further to identify the effect of beta-alanine on exercise performance.

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#### **CONSUMPTION EXPENDITURE ON SPORTING GOODS: EDUCATIONAL ATTAINMENT LEVEL APPROACH**

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The industry for the sports equipment production with the development of technology is growing rapidly in accordance with the preferences of consumers who are engaged in a certain type of sports activity which is non work-related in sports industry. Personalization and customization of products for performing sports activities by non-professional exercisers is becoming an imperative that must be viewed from multiple perspectives. The aim of this paper is to consider the impact of educational attainment level approach on choosing sports equipment as well as grouping European Union countries according to sporting indicators which include educational level. Accordingly, the methodological framework in this paper will be based on the application of hierarchical multiple regression as well as cluster analysis in order to group countries based on sports indicators that include educational level according to Eurostat. The expected results are based on determining the contribution of educational attainment level to the performance of sports activities and consumption expenditure on sporting goods which is non work-related. Also, the results should establish a group (cluster) of EU countries that has an optimal ratio of sports indicators based on educational level, which leads to greater physical activity as well as higher consumption in the sports industry. The findings suggest that higher educational attainment level contributes to greater interest in playing sports as well as greater opportunities to allocate income for purchasing sporting goods.

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#### **PHYSICAL ACTIVITY AND EMOTIONAL STATE DURING CONFINEMENT IN THE COVID-19 PANDEMIC**

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Social isolation and generalized confinement in many countries has caused a decrease in physical activity (PA) and an increase in levels of stress, anxiety and depression. The objective of this work has been to evaluate the incidence of PA on the emotional state during a period of mandatory confinement due to COVID-19. 360 university students from Málaga University participated divided into three groups, control (Sedentary, Sed), and experimental (group with low physical activity, BAct, and physically active, Act). The experimental groups were conducted on a PA intervention program for 11 weeks, from the beginning to the end of the mandatory confinement. A weekly online questionnaire was collected, recording the level of PA

(min / week) and the results of the PIL test (purpose in life). The level of PA decreased significantly at the beginning of the confinement and increased significantly in the flexibilization phases. PA has a positive effect on the sense of life and practicing some physical exercise on a regular basis could be a crucial tool to face a state of mandatory confinement.

**P52****SIMILARITIES AND DIFFERENCES IN EXERCISE MOTIVATION IN WOMEN OF DIFFERENT AGES**

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Physical activity has been proven to be beneficial at all stages of life. Currently, increasing the level of physical activity for the under-active adult population remains an important and open health issue. It is essential to be aware and recognize all the factors related with physical activity, including all motivational aspects. The main objective of this research study is to define the similarities and differences in motivation for physical activity with women of different age groups. Research and data was recorded on a data set of 97 examinees of age 18 years or older, of whom participate in group training at Guliver Fitness Center. All examinees were divided into three groups: younger, middle, and elderly. There are 14 factors from the questionnaire that define the sample of variables based on basic statistics. For data analysis, ANOVA and Kruskal-Wallis test were utilized. Out of the 14 isolated factors there was only one statistical outlier from the data set. The outlier corresponds with levels of motivation for physical activity to eliminate or avoid serious health conditions. The elderly subgroup shows a higher motivation level, in correspondence with the previously mentioned, compared with the two other subgroups. It is concluded, based on the data sets, that the elderly subgroup dedicates more attention to their health. In result, it is assumed that this subgroup is more aware of their health since there are more health problems as age increases. The results show that the awareness of the importance of physical activity would be beneficial regardless of age group, in essence creating a positively reinforced work ethic from an early age to benefit health long term.

**P53****FORCE-VELOCITY TEST ON A CYCLE ERGOMETER – SINGLE VS MULTIPLE TRIAL PROTOCOL**

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Force-velocity tests performed on stationary cycle ergometers are widely used to assess the force-velocity (F-V) capacities of the lower limbs. There are two main types of protocols used testing F-V capacities on a cycle ergometer - single-trial multi-trial protocol. The purpose of the present study was to understand the difference between the two protocols. Ten physically active participants performed 6-second sprints of cycle ergometers loaded with 5%, 7% and 11% of body weight. For the multi-trial protocol maximal speed and force at the moment of maximal pedaling speed obtained at all loading condition were used for calculating F-V relationship. For the single trial protocol only 5% of load were used for calculating F-V relationship. For that purpose, all data points (F and V), obtained during acceleration were used for calculating F-V relationship. Maximal theoretical force, velocity and power were determined from F-V relationship and compared between two methods. The observed F-V relationships were approximately linear and mainly strong ( $r > 0.94$ ), independently of test protocol. Maximal force, velocity and

power and maximal force showed strong correlations ( $r > 0.85$ ), but significant difference ( $p < 0.05$ ). Assessing maximal muscle capacities through linear F-V relationships could be easily performed using single and multi-trial protocols. Differences between protocols with increasing loading could be resultant of fatigue or technique, and more research is needed. This research provides a basis for simplified assessment F-V relationship on a cycle ergometer.

**P54****GENDER DIFFERENCES IN SOCIAL ENTREPRENEURIAL INTENTIONS OF SPORT SCIENCE STUDENTS: SAMPLE FROM VOJVODINA**

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Certain researches emphasized the gender gap in the context of the development of social entrepreneurial intentions. This research aims to examine differences in relations between dimensions of social entrepreneurial planned behavior and social entrepreneurial intentions of sports science students, through the gender aspect. The sample of respondents included sports science students from the final, fourth year of Bachelor studies at the University of Novi Sad, Serbia (N=127, 91 males and 36 females). The proposed theoretical model included five dimensions: Entrepreneurial Skills (ES), Attitude Toward Behavior (ATB), Subjective Norms (SN), Perceived Behavioral Control (PBC) as independent variables, and Social Entrepreneurial Intentions as dependent variable (SEI). Statistical analysis included SEM and multi-group moderation test analyses in SPSS, AMOS 24.0. Obtained results showed existing differences in the prediction of entrepreneurial intentions regarding gender ( $p < 0.05$ ). Also, ATB ( $\beta = 0.68$ ) and PBC ( $\beta = 0.41$ ) predict dominantly the SEI of male students, while PBC ( $\beta = 0.78$ ) only predicts the SEI of female students. Theoretical contribution of the study showed that gender factor differs the students in entrepreneurial intentions. From a practical point, more attention should be paid to strengthening the social entrepreneurial intentions of female students. This research has been done in line with the SHIINE COST Action's objectives (CA18236). The data used in this study were collected within the research project "The importance of the promotion of sports entrepreneurship: an analysis of the entrepreneurial intentions of sports science students" (register number: 142-451-2258/2021-01), which was conducted by the Faculty of Sport and Physical Education and financed by the Provincial Secretariat for Higher Education and Scientific research. For Milen Baltov it was additionally part of his research activities under the "Economic Education in Bulgaria 2030" grant at the Free University in Brussels.

**P55****SPORT-SPECIFIC TRAINING AFFECTS HEART RATE RECOVERY WHEN COMBINED WITH RAPID WEIGHT LOSS PROCEDURES**

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Wrestling is one of the sports branches where muscle strength critical. The implementation of different proportions of action, such as pulling, pushing and lifting, during wrestling activities causes different physiological requirements. Heart rate recovery (HRR) is the

difference in heart rate during exercise and a certain time interval after the onset of recovery. The goal of this study was to determine the difference in HRR between two different instances: Sport-specific high intensity training combined with rapid weight loss (RWL) and sport-specific training alone. Ten national level wrestlers (mean age  $22.44 \pm 4.53$  yrs; mean body weight  $73.36 \pm 4.42$  kg; mean body height  $174.43 \pm 3.78$  cm) were included in this study. All the participants underwent the sport-specific high-intensity training along with rapid weight loss (RWL) procedures, for the first measurement. For the second measurement identical training session was performed without RWL included. The high-intensity sport-specific training consisted of four sets of maximal number of shoulder throws with work to rest ratio: 15:45 s, and each set lasting 10 minutes with a break of 3 minutes in between. HRR was measured at three time points: first, second and third minute after each set of throws. We found statistically significant difference for the values obtained after first and second minute of recovery in second set for both instances ( $p=0.034$  and  $p=0.037$ , respectively) with higher values observed when RWL was included. We can conclude that there is a difference in HRR during training and RWL compared to sport-specific training alone. Additionally, sport-specific-training along with RWL could impair the aerobic component of recovery.

**P56****RELIABILITY AND VALIDITY OF FUTSAL SHOOTING SKILL TESTS**

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This research aims to develop a new futsal shooting test and check its validity and reliability. A total of 200 futsal players, consisting of 100 male and 100 female futsal players, were recruited in an attempt to evaluate the Dynamic Ball Futsal Shooting Test (DBFST) as an instrument for assessing shooting skills in futsal. DBFST requires players to pass, control, and shoot the ball on the target area in the size of a futsal goal and is divided into 9 segments. Each test subject completed 2 trials to test the reliability of the Dynamic Ball Futsal shooting Test (DBFST). Test results showed that the first and second validity test results for female players were 0.743 and 0.767 respectively, and the first and second reliability test results for the same subject were 0.809 and 0.801 respectively. Similarly, test results showed that the first and second validity test results for male players were 0.708 and 0.767 respectively, and the reliability test for the same subject were 0.822 and 0.808 respectively. The values of validity and reliability were found to be  $> 0.60$ , meaning that this test is applicable on male and female futsal players. Based on the results aforementioned, it is concluded that the test shooting instrument developed, namely DBFST, is a valid and reliable instrument for assessing futsal shooting skills.

**P57****THE IMPACT OF MORPHOLOGICAL CHARACTERISTICS AND MOTORIC SKILLS IN YOUNG FOOTBALL PLAYERS SELECTION**

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The purpose of this research is to prove the impact of morphological characteristics and motoric skills in differentiation between the first and second team of young football players U17. The research was conducted with 30 football players of cadets category (U17) of FC Prishtina

Academy. The football players were divided into group one (n=15) and group two (n=15). Division of the football players was done by the coaches before the start of the competition season. In the first group were selected more qualitative football players who have competed in the Superior League, whereas less qualitative football players were selected to represent the second team during Regional competitions. The testing of morphological characteristics and motoric skills of the football players was conducted during the competition period 2019/2020. Measurements of anthropometric characteristics were rated through three variables: speed (10m and 30m), agility (20m zig-zag with and without ball) and specific endurance (300m shuttle tempo test). The results of T-test analysis have shown statistically significant differences in motoric skills in favor of the first group, but no statistically significant differences in the morphological characteristics. According to this research we can confirm that the motoric skills (speed, specific endurance and agility with and without the ball) have had statistically significant impact in selection of qualitative football players (first team) and no statistically significant impact from the morphological characteristics (body height, body weight, BMI).

**P58****UNIVARIATE LINEAR MODELLING APPROACH IN LIPOPHILICITY ESTIMATION OF NOVEL STEROIDAL DERIVATIVES WITH ANTICANCER POTENTIAL**

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The present study is focused on linear modeling of lipophilicity of a series of 30 steroid derivatives with anticancer potential based on molecular descriptors and univariate linear regression approach. Reversed-phase ultra-high performance liquid chromatography (RP-UHPLC) method with methanol/acetonitrile/water mobile phase and C18 stationary phase was used for determination of experimental lipophilicity. The regression modeling was carried out based on univariate linear regression method. In silico descriptors of lipophilicity were calculated by ALOGPS2.1. program. Based on in silico logP parameters it can be concluded that the studied steroid derivatives have moderate lipophilicity. The obtained univariate linear regression model successfully correlates the average or consensus logP values of the studied series of steroids with log<sub>k</sub> retention parameter. The statistical quality of the model was confirmed by cross-validation method and external validation approach, as well as by comparison of the experimental and predicted data. The obtained model confirms that the obtained retention factor is an outstanding descriptor of lipophilicity of a studied series of steroid derivatives and can be utilized for the prediction of chromatographic behavior of structurally similar steroid derivatives.

**P59****EFFECTS OF HIGH-INTENSITY TRAINING ON STUDENT BODY COMPOSITION AND CARDIORESPIRATORY FUNCTION: A SYSTEMATIC REVIEW**

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Insufficient physical activity as well as inadequate nutrition of children increase the risk factors for various diseases in the future. We know

that regular exercise leads to increased levels of cardiorespiratory fitness (CRF), which acts as a protective or preventive mechanism of the organism. The aim is to review the available literature on high-intensity exercise and try to determine its impact on students' body composition and their health. We used terms: "body composition", "high-intensity interval training", "cardiorespiratory fitness", "students", "physical education" and "youth" to search relevant electronic databases - Web of Science and PubMed. The research is written and reported based on PRISMA guidelines. In order for the research to be included in the further analysis, they had to be published after 2015, and the exercise had to be conducted with high intensity at least twice a week. Also, we set the age limit for participants (8-18 years). In most of these researches, we noticed significant improvements in body mass index and maximum oxygen consumption. This type of training protocol caused positive effects on the body composition and aerobic abilities of students, which may indicate the need for further implementation in physical education classes. In addition to the benefits, these kind of training protocols are safe and fun for schoolchildren.

**P60****E-COUNTRY AND INCLUSION OF ITS NATIONAL SPORT TEAMS TO INTERNATIONAL SPORT COMPETITIONS**

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The purpose of this study was set in order to answer the question of what represents the e-country and explain the meaning of inclusion of its national sport teams to the international sport competitions. E-country should be a new form of social organization that would overcome the existing problems that occur in the traditional form. Namely, the e-country would not be territorially limited, it would have its own constitution and laws, and citizens who would obey them. It would contain all the elements implied by the traditional form but it would be a country in which everyone would be welcome and got citizenship easily. This would be a country in which there would be no struggle for territories, nationalism, chauvinism, or any other destructive social issues. This new form of the country would create an e-nation that would intent to unite the entire world to be as one. This e-country would have its own national sport teams that would equally participate in the international sport competitions to promote the idea that the world without traditional countries, as well as idea that all the people living life in the peace. Therefore, it is not difficult to conclude that national competitions will exist until the national teams of e-country defeat all other national teams and, thus, unite the citizens of entire planet into one compact social group that will never clash within itself again.

**P61****ESTIMATION OF ANISOTROPIC LIOPHILICITY OF NOVEL ANTICANCER STEROIDAL DERIVATIVES BY RP-UHPLC AND MULTIPLE LINEAR REGRESSION APPROACH**

Strahinja Kovacevic<sup>1</sup>, Milica Karadzic Banjac<sup>1</sup>, Jasmina Anojcic<sup>2</sup>, Sanja Podunavac-kuzmanovic<sup>1</sup>, Lidija Jevric<sup>1</sup>, Ivana Kuzminac<sup>2</sup>, Andrea Nikolic<sup>2</sup>, Marina Savic<sup>2</sup>, Marija Sakac<sup>2</sup>

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The aim of this study is to find the optimal molecular descriptors that can describe the retention behavior of novel anticancer steroid derivatives in reversed-phase ultra-high performance liquid chromatography. RP-UHPLC method with methanol/water mobile phase and C18 stationary phase was used for determination of log<sub>k</sub>. Multiple linear regression (MLR) method was applied for the regression modeling of log<sub>k</sub> parameter based on molecular descriptors. Suitable computer software was used for determination of in silico physicochemical molecular descriptors of the studied compounds. The obtained MLR model successfully correlates the log<sub>k</sub> parameter with polar surface area, molar refractivity and van der Waals surface area. Multicollinearity was not detected since there is no significant correlation between independent variables. The statistical quality of the obtained MLR model was confirmed by cross-validation approach and applying the external test set. Besides, the calculated statistical parameters depicted the MLR model as a reliable one. The findings suggest that the obtained MLR model can be successfully used in the prediction of the retention behavior and lipophilicity of the studied series of anticancer steroid derivatives.

**P62****DIFFERENCES BETWEEN MALE AND FEMALE ARTISTIC GYMNASTICS TOP FLOOR ROUTINES**

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Male and female artistic gymnasts exercise on the same apparatus - floor, but the composition of their routines differ. Depending on the gender, difficulty scores include the sum of 8 or 10 most difficult elements and a different number of compositional requirements. This paper analyzed the differences between top-level routine compositions and between different scores, all depending on gender. Participants represented 80 male and female gymnasts who participated in the floor finals at the Olympic Games in the period 1996-2016. In the routines of the top female gymnasts, single somersaults with longitudinal rotations were replaced by double somersaults with longitudinal rotations. Also, turns around the longitudinal axes were added to jumps with large amplitudes. In top male gymnasts, while trying to make floor routines as attractive as possible (characterized by somersaults with multiple transverse and longitudinal rotations), additional attention is paid to the safety of the gymnasts - sometimes even ignoring the attractiveness of the routine. By analyzing the different scores obtained in men's and women's final competitions, a significant difference in all scores (difficulty value, execution value and final value) was found only at the 2004 Olympics, while significant gender differences were found at all other Olympics but only in some scores. It was concluded that, although their routines are shorter and the elements are not classified in the same difficulty groups, the exercises of top male gymnasts are structurally more demanding than the routines of top female gymnasts.

**P63****DIFFERENCES IN PERFORMANCE OF SERVE RECEPTION BETWEEN MALE AND FEMALE ELITE SERBIAN VOLLEYBALL PLAYERS**

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Volleyball is a team sport in which the object of the game is to send the ball over the net in order to ground it on the opponent's court, and to prevent the same effort by the opponent. Performance Analysis is a

discipline involving systematic observations to enhance performance and improve decision making. The aim of this study was to examine differences in serve reception between male and female volleyball players. Volleyball players from twenty clubs ( $M=10$  and  $F=10$ ) and 180 matches were analyzed. Data are gathered from competition of Serbian Super League, after first half of the 2021/2022 season, based on the Data Volley 2007 software. Additional statistical analysis was performed using the SPSS. A multivariate analysis of variance showed differences between clubs of male and female players in serve reception parameters ( $F=2.714$ ;  $p=0.015$ ). Moreover, differences on univariate level were observed in faults of serve reception ( $f=8.349$   $p=0.004$ ) and efficiency ( $f=5.197$ ;  $p=0.024$ ) where male players have better results. Based on the results of this research, it can be concluded that there is an evident difference between the parameters of serve reception in men's and women's players at the general level, where male players made less faults in serve reception with greater efficiency in performance compared to female players.

**P64****SPORTS MOTIVATION OF VOLLEYBALL PLAYERS: A COMPARATIVE STUDY**Varghese C Antony<sup>1</sup>, Vivek Kumar Jaiswal<sup>2</sup><sup>1</sup>King Fahd University of Petroleum & Minerals, Physical Education Department, Dhahran, Saudi Arabia; <sup>2</sup>Government Arts College Bamhani Banjar, Mandla, Madhya Pradesh, India**Correspondence:** Varghese C Antony (vcantony@kfupm.edu.sa)

Motivation represents one of the most critical psychological factors that arouse and energize people to action that facilitates sports performance. The conceptual framework of self-determination theory was designed to describe the role of motivation in sport and PA. The objective of this study was to compare the sports motivational factors between male and female junior volleyball players. Participants were 86 male and 82 female junior volleyball players aged between 15-18 years ( $M\pm SD=16.70\pm 2.44$ ). Sports Motivation Scale (SMS- 28: Pelletier et al., 1995) was employed to measure players' motivational factors. T-test was applied to compare the means between the gender groups. Statistical significance was set at 0.05. Analysis showed a highly significant difference between male and female junior volleyball players on sports motivational factors: Intrinsic Motivation (IM:  $p=.001<.05$ ) female junior players scored ( $M\pm SD=73.61\pm 12.57$ ) higher than male players ( $M\pm SD=64.65\pm 8.07$ ). Self-Determined Extrinsic Motivation (SEM:  $p=.001<.005$ ) male players scored ( $M\pm SD=24.50\pm 3.62$ ) higher than female players ( $M\pm SD=19.48\pm 4.80$ ). Non-Determined Extrinsic Motivation (Non-SEM:  $p=.001<.05$ ) and Amotivation (AM:  $p=.001<.005$ ) male volleyball players had higher mean scores on these motivational factors than female players. Female junior volleyball players demonstrated more intrinsic motivation than male players. Male volleyball players showed more self-determined extrinsic motivation than female players. Further, male junior players were more attracted to non-self-determined extrinsic motivational factors than their counterparts.

**P65****METHOD OF APPLICATION MICROMECHANICS IN PLANNING AND PROGRAMMING OF TRAINING FOR FOOTBALL PLAYERS UNDER 17**Vladimir Sipka<sup>1</sup>, Stefan Maricic<sup>1</sup>, Filip Sadri<sup>1</sup>, Damjan Jakšić<sup>1</sup><sup>1</sup>University of Novi Sad, Faculty of Sport and Physical Education, Novi Sad, Serbia**Correspondence:** Vladimir Sipka (vsipka14@gmail.com)

Football is more uniform than ever, small details make the difference between victory and defeat, so the space for error is reduced to

a minimum. An error in the dosing and programming of training can directly affect the poor performance of a football player or the entire team. The aim of this research was to prove the advantages of planning and programming training with the help of microtechnology, as well as to determine the differences in the parameters of speed, explosive power and aerobic abilities after six months of training. On a sample of 22 football players under 17 ( $16.71\pm 0.63$ ) of the football club Vojvodina individual movement activities were monitored during training and matches for a period of six months. Tracking of movement activities was done with the Global Positioning System technology – Katapult device. Functional abilities were assessed by tests: running at 5 and 20 meters, vertical jumps (Squat Jump, Countermovement Jump) and Yo-Yo Intermittent recovery test level 2. After six months of monitoring and programming training using GPS devices, there is significant improvement in the parameters of speed, explosive power of the lower extremities as well as the aerobic capacity of football players. This finding confirms the existence of benefits when planning training with the help of GPS or Catapult technology.

**P66****A COMPARATIVE ANALYSIS OF THE FUNCTIONAL MOVEMENT SCREEN OF RACKET PLAYERS**Xiao Wensheng<sup>1</sup>, Soh Kim Geok<sup>1</sup>, Mohd. Rozilee Wazir Norjali Wazir<sup>1</sup>, Othman Talib<sup>2</sup>, Bai Xiaorong<sup>1</sup><sup>1</sup>University Putra Malaysia, Faculty of Educational Studies, Department of Sports Studies, Serdang, Selangor, Malaysia**Correspondence:** Xiao Wensheng (xiaowensheng33@gmail.com)

There is evidence that functional movement screen can predict general risk of musculoskeletal conditions and injuries. However, there is no comparative analysis of functional movement screen in racket players. This study aimed at investigating the functional movement screen of racket players, combine the characteristics of the events to find out their functional movement characteristics and physical weaknesses, and compare the differences in functional movements screen between different sports. The athletes were tested through seven fundamental movement patterns (deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg-raise, trunk stability push-up and rotary stability) to evaluate the movement pattern of the athletes, and confirm, grade and score the limitations. Tennis, badminton, and table tennis players have no significant differences in total functional movement screen scores, but rotary stability, trunk stability push-up, and deep squat have the highest frequency of motion compensation. The FMS total scores of tennis, badminton and table tennis players were not significantly different, and rotary stability, trunk stability push-up, and deep squat have the highest frequency of motion compensation. In addition, the total FMS score of racket sports is slightly higher than the standard 14 points, but there was a greater risk of injury. Therefore, In the future training should strengthen the training of compensatory function movements.

**P67****EFFECTS OF TAI CHI CHUAN ON HEALTH-RELATED PHYSICAL FITNESS AND BALANCE AMONG THE ELDERLY: A SYSTEMATIC REVIEW**Xiaorong Bai<sup>1</sup>, Kim Geok Soh<sup>1</sup>, Roxana Dev Omar Dev<sup>1</sup>, Othman Talib<sup>1</sup>, Wensheng Xiao<sup>1</sup><sup>1</sup>University Putra Malaysia, Faculty of Educational Studies, Selangor, Malaysia**Correspondence:** Xiaorong Bai (baixiaorong188@gmail.com)

Tai Chi Chuan as a way of general exercise has been recognized for its impact on physical fitness by the elderly. Nevertheless, the elder-

ly can't determine what their specific health effects are. This study aims to evaluate the effects of Tai Chi Chuan on health-related physical fitness and balance among the elderly. All search keywords are determined by Mesh of PubMed. Electronic databases of PubMed, Scopus, SPORT Discus, and CINAHL were applied to retrieve all articles published before August 2021. The research was conducted according to PRISMA guidelines and to assess the risk of bias by PEDro. Eight low-risk studies met all the criteria. There was strong scientific evidence to support that Tai Chi Chuan had a positive effect on muscle endurance, flexibility, and balance while limited evidence to support influence on cardiorespiratory fitness. However, Tai Chi Chuan was not influentially on body composition and unaccounted-for impact on muscular strength. Depending upon it, Tai Chi Chuan has a positive effect on physical health among the elderly such as muscle endurance, flexibility, and balance but no effect on body composition. Furthermore, insufficient evidence makes it hard to evaluate the effect of Tai Chi Chuan on cardiorespiratory fitness and muscle strength.

**P68****EFFECTS OF URBAN GARDENING ON PHYSICAL ACTIVITY AND HEALTH – A REVIEW OF REVIEWS**Zeljka Znidaric<sup>1</sup>, Karim Abu-Omar<sup>1</sup>, Damir Sekulic<sup>2</sup><sup>1</sup>Friedrich-Alexander-University Erlangen-Nuremberg, Department for Sport Science and Sport, Erlangen, Germany, <sup>2</sup>University of Split, Faculty of Kinesiology, Split, Croatia**Correspondence:** Zeljka Znidaric (zezaa55@hotmail.com)

Community gardens can improve the health and well-being of their users through the promotion of healthy behaviors such as light physical activity (PA) and social contacts, which effect physical, psychological, mental and health domains. To review the current available evidence on urban gardening and provide an overview of its key health outcomes: PA, body weight/body composition, mental health/psychological impact, well-being and quality of life (QOL), social contacts, and general social impact. Only articles published in English in peer-reviewed journals that dealt with adult populations were considered for in the study inclusion. Predetermined keywords were used to search for relevant articles in PubMed from the earliest date possible to December 2021. Additional papers were gathered by searching the reference lists of the papers searched. Studies met the inclusion criteria. Across the different health outcomes, the beneficial effects of gardening on increased PA, improved body composition, mental health, well-being, QOL, and social impacts could be identified in most reviews. Results demonstrate beneficial effects of gardening on health outcomes mentioned in purpose, hinting at the potential to of interventions to promote urban gardening to achieve a public health impact. The findings show a positive relationship between community garden engagement and physical and mental health and well-being, with higher QOL and better social support and cohesion.

**P69****AIKIDO ELEMENTS AS A MEANS OF DEVELOPING THE COORDINATION ABILITIES OF CHILDREN 10-11 YEARS OLD WITH VISUAL IMPAIRMENT**Zoya Varfolomeeva<sup>1</sup>, Maria Telyatnikova<sup>2</sup><sup>1</sup>Cherepovets State University, Department of Theory and Methods of Physical Education, Cherepovets, Russia; <sup>2</sup>Education Center No.44, Cherepovets, Russia**Correspondence:** Zoya Varfolomeeva (varf.zoya@gmail.com)

The high prevalence of various pathologies of the child population's visual function makes the search for new approaches and the means

of adaptive physical education of children of the nosological group under consideration relevant. The aim of this study is to test the effectiveness of the methodology for developing the coordination abilities of 10-11 year old children with visual impairment using aikido elements. Analysis of medical documents, pedagogical experiment, testing, calculation of the reliability of differences according to the Wilcoxon criterion were used. The study showed that as a result of the dosed use of Aikido elements and the adaptation of the technique to the features of dynamic equilibrium of children with visual impairment, a positive shift in the level of motor coordination occurs. A reliable positive influence of the experimental technique on the level of static equilibrium, dynamic equilibrium and visual orientation in space has been established. However, the changes in the level of spatial orientation based on sound localization and kinesthetic differentiation have not been statistically confirmed. The findings suggest that Aikido can be used as an effective means of physical education for people with visual impairment.

**P70****DIETARY HABITS AND PHYSICAL ACTIVITY LEVEL OF 4TH GRADE PUPILS IN CROATIA**Zvonimir Tomac<sup>1</sup>, Marin Marinovic<sup>1</sup><sup>1</sup>University Josip Juraj Strossmayer of Osijek, Faculty of Kinesiology, Osijek, Croatia**Correspondence:** Zvonimir Tomac (ztomac@kifos.hr)

The aim of this study was to determine the awareness of dietary habits and level of physical activity among primary school pupils, investigate their correctness in eating behaviors, level of physical activity, and examine whether there are any gender differences in physical activity level. The sample of study subjects included 65 4th grade schoolchildren (37 boys and 28 girls) from an urban area. Pupil's habits were tested by a questionnaire that was compound of 13 questions, 7 questions were connected to diet and the other 5 questions were about physical activity which is part of the Physical Activity Questionnaire for Older Children (PAQ-C). Results showed that most children have positive dietary habits. The Analysis showed statistically significant differences between genders in the 4 types of activity: roller skating ( $\chi^2 = 23.07$ ;  $p=0.00$ ), dancing ( $\chi^2 = 19.73$ ;  $p=0.00$ ), soccer ( $\chi^2 = 20.93$ ;  $p=0.00$ ) and volleyball ( $\chi^2 = 14.97$ ;  $p=0.00$ ). The results show that 50% of students are very active, 20-30% have an appropriate level of physical activity, while a small number of students are physically active in sports clubs.

**Workshop Presentations****W1****HOW DOES HYPOXIC TRAINING IMPROVE ATHLETIC PERFORMANCE?**Ron Clijsen<sup>1,2</sup>, Erich Hohenauer<sup>1,2,3</sup><sup>1</sup>University of Applied Sciences and Arts of Southern Switzerland, RES lab, Landquart, Switzerland; <sup>2</sup>International University of Applied Sciences THIM, Landquart, Switzerland**Correspondence:** Ron Clijsen (ron.clijsen@supsi.ch)

In elite sports, winning or losing is determined by minimal differences in athletic performance. Physiological adaptations in response to altitude and hypoxic training can improve endurance athletic performance. Therefore, altitude and hypoxic training are frequently used methods to enhance the aerobic capacity of endurance athletes. This workshop aims to provide insights and knowledge of the physiological adaptations of altitude and hypoxic training. We

will first provide the theoretical physiological background of altitude and hypoxic training, followed by a practical session where the participants experience the physiological impact of exercise under hypoxic conditions in real-time. The participants become familiar with the use of state-of-the-art equipment measuring SpO<sub>2</sub>, SmO<sub>2</sub>, and heart rate (variability) in different environmental conditions. After this workshop, the participants can measure relevant parameters for athletic performance and understand the physiological adaptations to hypoxic training.

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## W2

### DISSEMINATION OF WESTERN BALKAN SPORT INNOVATION LAB AND CA 18236 MULTI-DISCIPLINARY INNOVATION FOR SOCIAL CHANGE

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Contemporary society is paying more and more attention to innovations. Innovations in the sports industry occur in many ways, including sports organizations, sports teams, and players. Nowadays, innovation is often measured and can be viewed from several as-

pects: companies, economy, a branch of activity, and regional and world aspects. Indicators are obtained based on which steps can be created for a more successful business of the company, i.e., the region, the state. This workshop aims to dual goals: 1) to meet participants with a lab environment for responding to social problems in the sports ecosystem (e.g., in the established Western Balkan Sport Innovation Lab), 2) to present and promote to students their roles in employment by integrating education programs into lab's operations and promote Cost Action CA18236. In the beginning, it will be provided the theoretical background of sports innovations and multi-disciplinary innovations for social change. After that, participants should meet a new methodology for assessing innovation in sports. The methodology has been developed according to the leading methodologies for assessing general innovations in the countries of Europe and the world. This workshop doesn't insist on previous experience in this field. So, after realizing this workshop, the participants can be introduced to a new methodology for assessing the innovations in sports.

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Revised Maj 2021

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- A structured abstract of less than 250 words;
- Maximum number of references is 30;
- Maximum combined total of 6 Tables/Figures.

Meeting Abstracts contain conference abstracts of the sports science papers presented at the MSA annual conference and MSA-sponsored meetings. This publication offers a first look into the current research in the field of Sports Science.

Open Submissions

Indexed

Peer Reviewed

Meeting Abstracts should be:

- Restricted to 250 words (including title, authors and institutions) and must include the following separate sections: [1] purpose; [2] methods; [3] results; [4] conclusion;
- Without references;
- Without Tables/Figures.

### 1.3. Submission

MJSSM only accepts electronic submission to the e-mail of the Journal Office: [office@mjssm.me](mailto:office@mjssm.me).

Submitted material includes:

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Name the files according to the family name of the first author. Authors submitting revised versions of the manuscript can use the identification number of their manuscript as provided by the Journal Office. See example:

- ✓ FAMILY NAME-manuscript.doc – (main manuscript file)
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### 1.4. Peer Review Process

An original manuscript submitted for publication will be submitted to the review process as long as it fits the following criteria:

- The study was not previously published, nor has been submitted simultaneously for consideration of publication elsewhere;
- All persons listed as authors approved its submission to MJSSM;
- Any person cited as a source of personal communication has approved the quote;
- The opinions expressed by the authors are their exclusive responsibility;
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The editors-in-chief, executive editor and associate editors will make a preliminary analysis regarding the appropriateness, quality, originality and written style/grammar of the submitted manuscript. The editors reserve the right to request additional information, corrections, and guideline compliance before they submit the manuscript to the ad-hoc review process.

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## 1.6. After Acceptance

After the manuscript has been accepted, authors will receive a PDF version of the manuscripts for authorization, as it should look in printed version of MJSSM. Authors should carefully check for omissions. Reporting errors after this point will not be possible and the Editorial Board will not be eligible for them.

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## 2. MANUSCRIPT STRUCTURE

### 2.1. Title Page

The first page of the manuscripts should be the title page, containing: title, type of publication, running head, authors, affiliations, corresponding author, and manuscript information. See example:

Transfer of Learning on a Spatial Memory Task between the Blind and Sighted People Spatial Memory among Blind and Sighted

Original Scientific Paper

Transfer of learning on a spatial memory task

Selcuk Akpinar<sup>1</sup>, Stevo Popovic<sup>2,1,2</sup>, Sadettin Kirazci<sup>1</sup>

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*E-mail: stevop@ac.me*

Word count: 2,980

Abstract word count: 236

Number of Tables: 3

Number of Figures: 3

#### 2.1.1. Title

Title should be short and informative and the recommended length is no more than 20 words. The title should be in Title Case, written in uppercase and lowercase letters (initial uppercase for all words except articles, conjunctions, short prepositions no longer than four letters etc.) so that first letters of the words in the title are capitalized. Exceptions are words like: "and", "or", "between" etc. The word following a colon (:) or a hyphen (-) in the title is always capitalized.

#### 2.1.2. Type of publication

Authors should suggest the type of their submission.

#### 2.1.3. Running head

Short running title should not exceed 50 characters including spaces.

#### 2.1.4. Authors

The form of an author's name is first name, middle initial(s), and last name. In one line list all authors with full names separated by a comma (and space). Avoid any abbreviations of academic or professional titles. If authors belong to different institutions, following a family name of the author there should be a number in superscript designating affiliation.

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Affiliation consists of the name of an institution, department, city, country/territory(in this order) to which the author(s) belong and to which the presented / submitted work should be attributed. List all affiliations (each in a separate line) in the order corresponding to the list of

authors. Affiliations must be written in English, so carefully check the official English translation of the names of institutions and departments.

Only if there is more than one affiliation, should a number be given to each affiliation in order of appearance. This number should be written in superscript at the beginning of the line, separated from corresponding affiliation with a space. This number should also be put after corresponding name of the author, in superscript with no space in between.

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Whenever possible expand your authors' affiliations with departments, or some other, specific and lower levels of organization.

#### **2.1.6. Corresponding author**

Corresponding author's name with full postal address in English and e-mail address should appear, after the affiliations. It is preferred that submitted address is institutional and not private. Corresponding author's name should include only initials of the first and middle names separated by a full stop (and a space) and the last name. Postal address should be written in the following line in sentence case. Parts of the address should be separated by a comma instead of a line break. E-mail (if possible) should be placed in the line following the postal address. Author should clearly state whether or not the e-mail should be published.

#### **2.1.7. Manuscript information**

All authors are required to provide word count (excluding title page, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References), the Abstract word count, the number of Tables, and the number of Figures.

### **2.2. Abstract**

The second page of the manuscripts should be the abstract and key words. It should be placed on second page of the manuscripts after the standard title written in upper and lower case letters, bold.

Since abstract is independent part of your paper, all abbreviations used in the abstract should also be explained in it. If an abbreviation is used, the term should always be first written in full with the abbreviation in parentheses immediately after it. Abstract should not have any special headings (e.g., Aim, Results...).

Authors should provide up to six key words that capture the main topics of the article. Terms from the Medical Subject Headings (MeSH) list of Index Medicus are recommended to be used.

Key words should be placed on the second page of the manuscript right below the abstract, written in italic. Separate each key word by a comma (and a space). Do not put a full stop after the last key word. *See example:*

#### **Abstract**

Results of the analysis of...

*Key words:* spatial memory, blind, transfer of learning, feedback

### **2.3. Main Chapters**

Starting from the third page of the manuscripts, it should be the main chapters. Depending on the type of publication main manuscript chapters may vary. The general outline is: Introduction, Methods, Results, Discussion, Acknowledgements (optional), Conflict of Interest (optional), and Title and Abstract in Montenegrin (only for the authors from former Yugoslavia, excluding Macedonians and Slovenes). However, this scheme may not be suitable for reviews or publications from some areas and authors should then adjust their chapters accordingly but use the general outline as much as possible.

#### **2.3.1. Headings**

Main chapter headings: written in bold and in Title Case. *See example:*

✓ **Methods**

Sub-headings: written in italic and in normal sentence case. Do not put a full stop or any other sign at the end of the title. Do not create more than one level of sub-heading. See example:

- ✓ *Table position of the research football team*

### **2.3.2 Ethics**

When reporting experiments on human subjects, there must be a declaration of Ethics compliance. Inclusion of a statement such as follow in Methods section will be understood by the Editor as authors' affirmation of compliance: "This study was approved in advance by [name of committee and/or its institutional sponsor]. Each participant voluntarily provided written informed consent before participating." Authors that fail to submit an Ethics statement will be asked to resubmit the manuscripts, which may delay publication.

### **2.3.3 Statistics reporting**

MJSSM encourages authors to report precise p-values. When possible, quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Use normal text (i.e., non-capitalized, non-italic) for statistical term "p".

### **2.3.4. 'Acknowledgements' and 'Conflict of Interest' (optional)**

All contributors who do not meet the criteria for authorship should be listed in the 'Acknowledgements' section. If applicable, in 'Conflict of Interest' section, authors must clearly disclose any grants, financial or material supports, or any sort of technical assistances from an institution, organization, group or an individual that might be perceived as leading to a conflict of interest.

## **2.4. References**

References should be placed on a new page after the standard title written in upper and lower case letters, bold.

All information needed for each type of must be present as specified in guidelines. Authors are solely responsible for accuracy of each reference. Use authoritative source for information such as Web of Science, Medline, or PubMed to check the validity of citations.

### **2.4.1. References style**

MJSSM adheres to the American Psychological Association 7th Edition reference style. Check the Publication Manual of the American Psychological Association (2019), Seventh Edition that is the official source for APA Style, to ensure the manuscripts conform to this reference style. Authors using EndNote® to organize the references must convert the citations and bibliography to plain text before submission.

### **2.4.2. Examples for Reference citations**

One work by one author

- ✓ In one study (Reilly, 1997), soccer players...
- ✓ In the study by Reilly (1997), soccer players...
- ✓ In 1997, Reilly's study of soccer players...

Works by two authors

- ✓ Duffield and Marino (2007) studied...
- ✓ In one study (Duffield & Marino, 2007), soccer players...
- ✓ In 2007, Duffield and Marino's study of soccer players...

Works by three or more authors: cite only the name of the first author followed by et al. and the year

- ✓ Bangsbo et al. (2008) stated that...
- ✓ In one study (Bangsbo et al., 2008), soccer players...

Works by organization as an author: cite the source, just as you would an individual person

- ✓ According to the American Psychological Association (2000)...
- ✓ In the APA Manual (American Psychological Association, 2003), it is explained...

Two or more works in the same parenthetical citation: citation of two or more works in the same parentheses should be listed in the order they appear in the reference list (i.e., alphabetically); separated by a semi-colon

- ✓ Several studies (Bangsbo et al., 2008; Duffield & Marino, 2007; Reilly, 1997) suggest that...

### 2.4.3. Examples for Reference list

Works by one author

Borg, G. (1998). *Borg's perceived exertion and pain scales*: Human Kinetics.

Works by two authors

Duffield, R., & Marino, F. E. (2007). Effects of pre-cooling procedures on intermittent-sprint exercise performance in warm conditions. *European Journal of Applied Physiology*, 100(6), 727–735. <https://doi.org/10.1007/s00421-007-0468-x>

Works by three to twenty authors

Nepocatych, S., Balilionis, G., & O'Neal, E. K. (2017). Analysis of dietary intake and body composition of female athletes over a competitive season. *Montenegrin Journal of Sports Science and Medicine*, 6(2), 57–65. <https://doi.org/10.26773/mjssm.2017.09.008>

Works by more than twenty authors

Krustrup, P., Mohr, M., Amstrup, T., Rysgaard, T., Johansen, J., Steensberg, A.,..., Bangsbo, J. (2003). The yo-yo intermittent recovery test: physiological response, reliability, and validity. *Medicine & Science in Sports & Exercise*, 35(4), 697–705. <https://doi.org/10.1249/01.mss.0000058441.94520.32>

Works by group of authors

NCD-RisC. (2017). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *Lancet*, 390(10113), 2627–2642. [https://doi.org/10.1016/s0140-6736\(17\)32129-3](https://doi.org/10.1016/s0140-6736(17)32129-3)

Works by unknown authors

*Merriam-Webster's collegiate dictionary* (11th ed.). (2003). Merriam-Webster.

Journal article (print)

Scruton, R. (1996). The eclipse of listening. *The New Criterion*, 15(3), 5–13.

Journal article (electronic)

Aarnivala, H., Pokka, T., Soininen, R., Mottonen, M., Harila-Saari, A., & Niinimaki, R. (2020). Trends in age- and sex-adjusted body mass index and the prevalence of malnutrition in children with cancer over 42 months after diagnosis: a single-center cohort study. *European Journal of Pediatrics*, 179(1), 91–98. <https://doi.org/10.1007/s00431-019-03482-w>

Thesis and dissertation

Pyun, D. Y. (2006). *The proposed model of attitude toward advertising through sport*. [Unpublished Doctoral Dissertation]. The Florida State University.

Book

Borg, G. (1998). *Borg's perceived exertion and pain scales*: Human Kinetics.

Chapter of a book

Armstrong, D. (2019). Malory and character. In M. G. Leitch & C. J. Rushton (Eds.), *A new companion to Malory* (pp. 144–163). D. S. Brewer.

Reference to a Facebook profile

Little River Canyon National Preserve (n.d.). *Home* [Facebook page]. Facebook. Retrieved January 12, 2020 from <https://www.facebook.com/lirinps/>

## 2.5. Tables

All tables should be included in the main manuscript file, each on a separate page right after the Reference section.

Tables should be presented as standard MS Word tables.

Number (Arabic) tables consecutively in the order of their first citation in the text.

Tables and table headings should be completely intelligible without reference to the text. Give each column a short or abbreviated

heading. Authors should place explanatory matter in footnotes, not in the heading. All abbreviations appearing in a table and not considered standard must be explained in a footnote of that table. Avoid any shading or coloring in your tables and be sure that each table is cited in the text.

If you use data from another published or unpublished source, it is the authors' responsibility to obtain permission and acknowledge them fully.

### **2.5.1. Table heading**

Table heading should be written above the table, in Title Case, and without a full stop at the end of the heading. Do not use suffix letters (e.g., Table 1a, 1b, 1c); instead, combine the related tables. See example:

- ✓ **Table 1.** Repeated Sprint Time Following Ingestion of Carbohydrate-Electrolyte Beverage

### **2.5.2. Table sub-heading**

All text appearing in tables should be written beginning only with first letter of the first word in all capitals, i.e., all words for variable names, column headings etc. in tables should start with the first letter in all capitals. Avoid any formatting (e.g., bold, italic, underline) in tables.

### **2.5.3. Table footnotes**

Table footnotes should be written below the table.

General notes explain, qualify or provide information about the table as a whole. Put explanations of abbreviations, symbols, etc. here. General notes are designated by the word Note (italicized) followed by a period.

- ✓ *Note.* CI: confidence interval; Con: control group; CE: carbohydrate-electrolyte group.

Specific notes explain, qualify or provide information about a particular column, row, or individual entry. To indicate specific notes, use superscript lowercase letters (e.g. <sup>a,b,c</sup>), and order the superscripts from left to right, top to bottom. Each table's first footnote must be the superscript <sup>a</sup>.

- ✓ <sup>a</sup>One participant was diagnosed with heat illness and n = 19. <sup>b</sup>n = 20.

Probability notes provide the reader with the results of the texts for statistical significance. Probability notes must be indicated with consecutive use of the following symbols: \* † ‡ § ¶ || etc.

- ✓ \*P<0.05, †p<0.01.

### **2.5.4. Table citation**

In the text, tables should be cited as full words. See example:

- ✓ Table 1 (first letter in all capitals and no full stop)
- ✓ ...as shown in Tables 1 and 3. (citing more tables at once)
- ✓ ...result has shown (Tables 1-3) that... (citing more tables at once)
- ✓ ....in our results (Tables 1, 2 and 5)... (citing more tables at once)

## **2.6. Figures**

On the last separate page of the main manuscript file, authors should place the legends of all the figures submitted separately.

All graphic materials should be of sufficient quality for print with a minimum resolution of 600 dpi. MJSSM prefers TIFF, EPS and PNG formats.

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Figures and figure legends should be completely intelligible without reference to the text.

The price of printing in color is 50 EUR per page as printed in an issue of MJSSM.

### 2.6.1. Figure legends

Figures should not contain footnotes. All information, including explanations of abbreviations must be present in figure legends. Figure legends should be written below the figure, in sentence case. See example:

- ✓ **Figure 1.** Changes in accuracy of instep football kick measured before and after fatigued. SR – resting state, SF – state of fatigue, \* $p>0.01$ , † $p>0.05$ .

### 2.6.2. Figure citation

All graphic materials should be referred to as Figures in the text. Figures are cited in the text as full words. See example:

- ✓ Figure 1
- ✗ figure 1
- ✗ Figure 1.
- ✓ ....exhibit greater variance than the year before (Figure 2). Therefore...
- ✓ ....as shown in Figures 1 and 3. (citing more figures at once)
- ✓ ....result has shown (Figures 1-3) that... (citing more figures at once)
- ✓ ....in our results (Figures 1, 2 and 5)... (citing more figures at once)

### 2.6.3. Sub-figures

If there is a figure divided in several sub-figures, each sub-figure should be marked with a small letter, starting with a, b, c etc. The letter should be marked for each subfigure in a logical and consistent way. See example:

- ✓ Figure 1a
- ✓ ...in Figures 1a and b we can...
- ✓ ...data represent (Figures 1a-d)...

## 2.7. Scientific Terminology

All units of measures should conform to the International System of Units (SI).

Measurements of length, height, weight, and volume should be reported in metric units (meter, kilogram, or liter) or their decimal multiples.

Decimal places in English language are separated with a full stop and not with a comma. Thousands are separated with a comma.

Percentage	Degrees	All other units of measure	Ratios	Decimal numbers
✓ 10%	✓ 10°	✓ 10 kg	✓ 12:2	✓ 0.056
✗ 10 %	✗ 10 °	✗ 10kg	✗ 12 : 2	✗ .056

Signs should be placed immediately preceding the relevant number.

- |            |            |                           |
|------------|------------|---------------------------|
| ✓ 45±3.4   | ✓ p<0.01   | ✓ males >30 years of age  |
| ✗ 45 ± 3.4 | ✗ p < 0.01 | ✗ males > 30 years of age |

## 2.8. Latin Names

Latin names of species, families etc. should be written in italics (even in titles). If you mention Latin names in your abstract they should be written in non-italic since the rest of the text in abstract is in italic. The first time the name of a species appears in the text both genus and species must be present; later on in the text it is possible to use genus abbreviations. See example:

- ✓ First time appearing: *musculus biceps brachii*
- ✓ Abbreviated: *m. biceps brachii*



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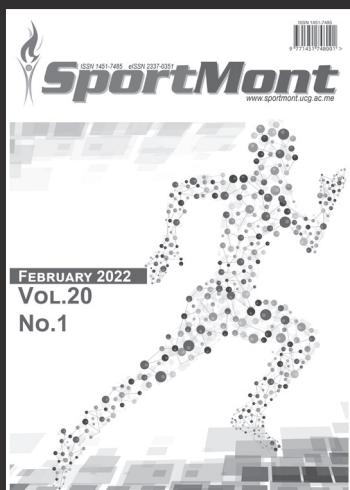
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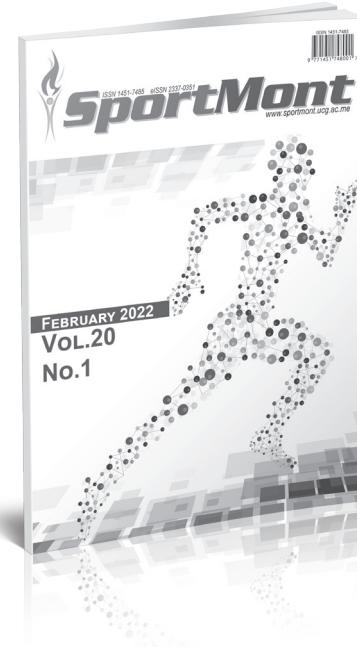
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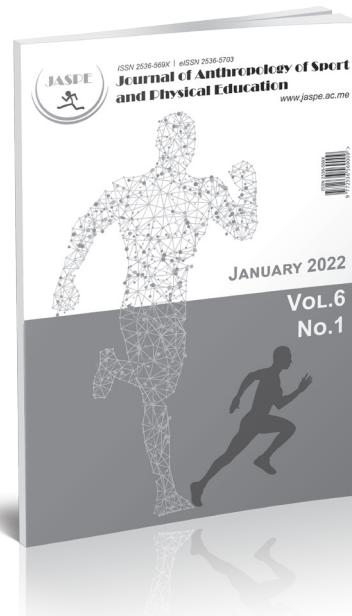
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