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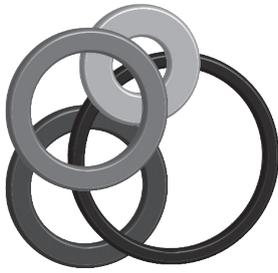


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# Abstracts from the 21th Annual Scientific Conference of Montenegrin Sports Academy and “Sport, Physical Activity and Health: Contemporary perspectives”: Dubrovnik, Croatia. 18-21 April 2024

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MEETING ABSTRACTS FROM MSA DUBROVNIK 2024 CONFERENCE

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## Invited speakers

### S1

#### Minimizing Sport Organization Politics to Maximize Sport Organization Benefits

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

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Primarily based on self-interest, organizational politics is defined by individuals whose actions do not consider others or the good of the organization (Kacamar & Baron, 1999). The effects of organizational politics on sport organizations are mixed. Counterproductive work behavior, greater job stress, and decreased job satisfaction were found to result from organizational politics (Wiltshire et al., 2014). Destructive, manipulative, a necessary evil, a useful strategy that helps get things done, and central to organizational functioning and decision making describe organizational politics (Landells & Albrecht, 2017). The direct relationship between perceived injustice and deviant behaviors was found to be stronger when the perception of politics existed in the workplace (Khattak et al., 2021). Turnover intentions, job satisfaction, and organizational commitment were found to be negatively related to organizational politics whereas employee motivation was positively related to it (Rughoobur-Seetah, 2022). Low to moder-

ate levels of organizational politics may represent a demand associated with higher job satisfaction and performance (Ellen et al., 2022). Politics within the sport organization can support the organizational mission if minimized through proper management. Minimizing organizational politics can be accomplished by creating and adhering to policies that do not reinforce politically based actions grounded in self-interest (Harris et al., (2007).

### S2

#### Masks, goggles and snorkels. Should we use these aids in learn-to-swim programs for non-swimmers or not?

Jernej KAPUS, Fatmir MISIMI

University of Ljubljana, Faculty of Sport, Ljubljana, Slovenia

The use of masks, goggles, and snorkels has become popular in some swimming schools, because these swim aids may provide important benefits for non-swimmers, such as unobstructed vision, normal breathing, and thus, easier face immersion. Submerging the face during floating assists buoyancy and can help to increase a beginners' confidence, allowing them to break physical contact with the bottom or the edge of a pool. Face immersion also helps to place swimmers in the correct horizontal body position, simplifying the complex coordination of arms, legs and breathing needed for other swimming activities. On the other hand, there is a risk that the use of

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mask, goggles and snorkel may increase swimmers' dependency on those aids, which, in turn, would hinder their acquisition of correct swimming techniques and might later increase fear of swimming when the ergogenic aids are not available. Unfortunately, there are only a few studies that deal with swimming didactics. Therefore, until recently, there were no clear conclusions as to whether or not the use of these swimming aids was suitable for programs for non-swimmers. The aim of this presentation is to discuss this topic and answer the question posed with the results of our latest research. We investigated the effects of using goggles and snorkel during the learn-to-swim program on the aquatic skills of young non-swimmers.

### S3

#### **Social capital and physical activity of high school students**

Hrvoje Ajman

Faculty of kinesiology Osijek, Josip Juraj Strossmayer University in Osijek, Osijek, Croatia

Scientists believe that physical inactivity is a major public health problem of the 21st century (Blair, 2009). In the world, prevalence of physically inactive children is growing every day, and Europe is not exception to this trend (Currie et al., 2012). Data from the report Health Behavior in School-aged Children from 2016 indicate the fact that in the countries of the world the percentage of girls aged 15 who are insufficiently physically active is from 78 to 95%, and from 71 to 90% for boys, while this value for EU member states ranges from 82 to 95% for girls, and from 72 to 89% for boys (Inchley, Currie, 2016). In explaining this problem scientists come to the conclusion that the bond between society and the individual, significantly affect on health and health habits of young people (Ellen, Mijanovich, Dillman, 2001; Davison, Lawson, 2006; McNeill, Kreuter, Subramanian 2006; Pickett, Pearl, 2001). In the past ten years, the number of scientific studies who explored the association between social environment and the health of children and young people, increased significantly (Kawachi, Subramanian, Kim, 2008; Kawachi, Takao, Subramanian, 2013). Social capital is defined as a set of links among individuals, who make up social networks and norms of mutual trust among people (Putnam, 2000). Today, research on social capital usually analyze relationship between physical activity or other predictors of health and family environment, local infrastructure or social relationships with friends or colleagues and interventions that have been implemented to increase daily physical activity of children and youth (Ziersch et al. 2009; Kahn et al. 2002). Social capital is context-bound by necessity. Thus, from a global perspective, it cannot be used as a 'cookbook' on how to achieve supportive environments and community action smoothly. However, social capital can provide new ideas on the processes that influence human interactions, cooperation, and community action for health promotion in various contexts.

### S4

#### **Physical activity-related injuries prevention in adolescents – results of the PARIPRE project**

Peter Bakalár<sup>1</sup> – on behalf of the PARIPRE project partners

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Background. In adolescence, regular physical activity is associated with numerous physiological, psychological and social benefits and therefore it is promoted as a health promotion tool. Nonetheless, this tool is not one without adverse effects with literature providing many examples of physical activity-related injuries (PARI) burden on individuals' health and society. Therefore, active PARI prevention and recognition of their risk factors must be integral component of physical activity promotion.

Objectives. PARIPRE (Physical activity-related injuries prevention in adolescents) project aimed to address all six domains proposed by Centres for Disease Control and Prevention for PARI prevention: Data and Surveillance, Research, Communication, Education and training, Health systems and health care, and Policy. Implementation. To cover first two domains, PARIPRE used Health Behaviour in School-aged Children (HBSC) study to gather epidemiological data on PARI in 5 European Union (EU) member states and intervention studies in two of them to determine effect of PARI intervention programme in adolescents. Other four domains were covered by preparation of scientific papers, evidence-based recommendations, creation of promotion materials shared via web page and social media and workshops for various stakeholders. Results. At least one PARI in previous 12 months was reported by 50% of 11-, 13- and 15-years old adolescents in 5 EU member states in sports clubs' activities, 39% in leisure-time physical activity (not in sports clubs), and by 26% of adolescents in physical education at school or in supervised academic sports. The neuromuscular training-based intervention programmes were effective in reducing the risk of PARI in adolescent basketball and football male players.

### S5

#### **Enhancing Physical Literacy through Innovative Physical Education Strategies**

Hrvoje PODNAR<sup>1</sup>

<sup>1</sup>University of Zagreb Faculty of Kinesiology, Croatia

The enhancement of physical literacy within the educational landscape signifies a pivotal shift towards integrating academic knowledge with physical well-being. Physical education has the crucial role in fostering physical literacy among students, which is fundamental for a balanced and active lifestyle. Physical literacy, which combines physical ability, confidence, motivation, and an understanding of the health benefits of physical activity, is the foundation of holistic development. Understanding the role of physical fitness and its impact on health is crucial in developing physically literate students who prioritize their fitness for health benefits rather than peer competition. Central to this discussion are innovative strategies aimed at equipping physical education teachers with the necessary competencies to enhance students' physical literacy. Given the complex nature of physical literacy, which encompasses physical, affective, cognitive, and social domains, a comprehensive approach is advocated. This involves the use of evidence-based tools and assessment methods tailored to meet the diverse needs and capabilities of students. By embedding these tools within an inclusive educational framework, educators can devise personalized interventions that not only improve physical competencies but also elevate confidence, motivation, and an appreciation for an active lifestyle. Collaborative efforts are needed to create an educational environment that prioritizes physical literacy in curricula, instilling lifelong values of health and physical activity. The goal is to encourage a unified approach among educators, policymakers, and stakeholders to promote physical literacy as a fundamental element for improving societal health and well-being.

### S6

#### **Planning the training for elite football players using match running performance – an evidence-based approach**

Toni Modric<sup>1</sup>

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Football is a complex sport characterized by high physical demands. Analysis of physical demands in football is usually conducted by quantification of the match running performance such as: total distance,

distance covered in different speed zones, and number of accelerations. Longitudinal analysis of match running performance in football indicates that the intensity level of matches has increased tremendously over the last decade. To ensure successful coping with such high match loads, well-planned (physical conditioning) training is crucial. Historically, the selection of training methods has been guided primarily by personal experience rather than by empirical evidence on effectiveness. Despite the recent revolution in analytics, coaches still seldom use empirical evidence to guide their training decisions. As evidence-based decisions are transparent, defensible, objective, and scientific, they should be considered more widely. The purpose of this communication is to discuss the crucial scientific evidences in the context of planning of the training in elite football players. The reviewed reports can assist coaches at football clubs in optimizing performance and mitigating injuries, while at the same time raising awareness for using empirical evidence as guidelines for planning of the training.

## S7

### Training Load Management in Soccer: A Practical Approach

Predrag BOZIC<sup>1</sup>

<sup>1</sup>Serbian Institute of Sport and Sports Medicine, Belgrade, Serbia

The training load (TL), a pivotal variable manipulated to induce specific training adaptations, plays a critical role in the development and maintenance of physical fitness, as well as in sustaining consistent match performances over time. Beyond its direct impact on physical performance, effective TL management holds the potential to reduce injury risks and enhance player availability throughout the season. Navigating the dynamic and challenging sports environment, characterized by varying factors such as injury occurrences, player statuses, illnesses, and overall well-being, presents a complex task for sport scientists and technical staff. Bridging the gap between scientific knowledge and coaches' on-field expertise is essential, yet existing literature lacks a comprehensive approach that integrates these elements. This study addresses this gap by presenting a practical approach tailored for soccer coaches in managing training load at both team and individual levels. Diverging from studies that narrowly focus on specific TL aspects like external load or injury prevention, this paper adopts a holistic perspective. By merging scientific recommendations with field expertise, the proposed approach aims to provide coaches with a comprehensive tool for TL management encompassing planning, prescription, monitoring, and correction. Ultimately, this integrated approach seeks to empower coaches in optimizing performance and implementing effective injury prevention strategies throughout the competitive season.

## S8

### Adolescent Physical Activity: Two Decades of HBSC Insights and Exploring Future Directions

Zdenek Hamrik

Faculty of Physical Culture, Palacky University, Olomouc, Czech Republic

Purpose: Monitoring adolescent physical activity through studies like the Health Behaviour in School-aged Children (HBSC) is crucial for further research and policy development. The presentation will address the past and future challenges and developments in measuring physical activity within the HBSC study and outline potential future directions considering the World Health Organization's new recommendations for adolescent physical activity. The main aim is to evaluate current levels of adolescent moderate-to-vigorous physical activity (MVPA), physical inactivity (PI), vigorous physical activity

(VPA), and their association with age, gender, and socio-economic status. Methods: Data from 279,117 adolescents aged 11, 13, and 15 years from 44 countries and regions in Europe, Central Asia, and Canada, participating in the 2021/2022 HBSC survey, were collected by asking about their physical activity levels (MVPA and VPA). Results: Only 25% of boys and 15% of girls achieved 60 minutes of MVPA daily. While 60% of adolescents met the WHO recommendation for VPA, both MVPA and VPA decreased with age, with a more pronounced decline in girls. On average, around one in four adolescents were found to be highly inactive, and rates of 0-2 days of MVPA increased with age. Adolescents from low-affluence families were less likely to participate in MVPA and VPA. Conclusions: Adolescents exhibit consistently insufficient levels of physical activity, with significant disparities based on age, gender, and socio-economic status. Girls are generally less active than boys, and higher family affluence correlates with greater activity levels. Physical activity-promoting interventions should be specifically tailored for both boys and girls in this age group. Particular focus should be directed towards adolescents from low-affluent families and older age groups.

## Oral presentations

### O1

#### Smart sport assistance for blind and visually impaired pupils: Bell ball

Arnold BACA<sup>1</sup>, Philipp KORNFEIND<sup>1</sup>

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Physical education and sports lessons (PE-lessons) are often perceived as a field with particularly diverse barriers to participation. Pupils with disabilities often experience themselves as not being included, have low physical activity levels and delays in movement development. The group of pupils with blindness and visual impairments is particularly affected. PURPOSE: The goal of our project is to promote the activity of blind and visually impaired children. METHODS: Difficulties and opportunities perceived by blind and visually impaired pupils in PE lessons were identified and possible improvements and future solutions developed. The findings were translated into a catalog of needs and requirements that was and is being used for the design and development of prototypes for assistance systems identified as necessary. One of the required pieces of sports equipment was a bell ball, which emits acoustic signals not only when moving but even when stationary. RESULTS: In cooperation with pupils from schools for higher technical education and applying an agile development approach two prototypes of bell balls have been developed based on integrated inertial sensors and a signal generator or loudspeaker. Different functionalities such as variations in the acoustic and additional visual signals emitted have been implemented. CONCLUSION: Positive feedback from the target group when using the prototype balls suggests that the final product will be accepted and used regularly in sports lessons.

### O2

#### Urban-rural differences in physical literacy levels among Croatian adults Barbara

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Physical literacy (PL) is an important factor for maintaining optimal levels of physical activity and general well-being. The

majority of previous research has focused on investigating children and adults, while there is a lack of studies examining the specifics of PL in adults. **PURPOSE:** This study aimed to examine whether adults differ in their PL levels according to the living environment. **METHODS:** The research included 530 participants aged 26.16±10.20 years, with 335 living in urban, and 195 living in rural living environments). The Perceived Physical Literacy Questionnaire (PPLQ) translated into the Croatian language was used to assess PL levels, with calculated total PL scores and PL domains including knowledge, understanding, confidence, motivation, physical activity behaviour, and physical competence domains. Urban-rural differences in PL total score and PL domains were calculated using the Mann-Whitney U test. **RESULTS:** Participants had high PL scores (PL total score of 4.30±0.31, with 5 being the maximum score). There were no statistically significant urban-rural differences in any of the PL variables. **CONCLUSIONS:** The lack of urban-rural differences could be explained by the nature of the selected sample and generally high PL levels. Precisely, most of the included participants were kinesiology students, coaches, and active population, which means that our sample does not represent the general adult population. Therefore, future research on a similar topic should be conducted on a more heterogeneous sample regarding physical activity involvement.

### O3

#### **Recommendations for physical activity of the population in mature age**

Dejan SAVICEVIC<sup>1</sup>, Aleksandar MILETIC<sup>2</sup>, Marija BOSANCIC<sup>3</sup>

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Since today's society places a lot of emphasis on physical appearance and health, it is not surprising that in the last 20 years researchers have developed a great interest in the topic of exercise recommendations for adults. **PURPOSE:** The aim of the research is to indicate exercise recommendations for people over 35 years of age. **METHODS:** A search strategy was used, using internet search engines Kobson, Web of science, Google Scholar and Pubmed. Journals in the field of sports science for sports medicine, physical fitness, sports, recreation were searched. The internet domain search was limited to studies conducted in the last 10 years. **RESULTS:** It can be noted that the general recommendation for middle-aged people is moderate physical activity, 2-3 times a week (30- 45 minutes), intense physical activity 2 times a week (about 30 minutes) for a total of 150 minutes. Exercises with weights, aerobic activity such as fast walking, cycling, nordic walking are recommended. **CONCLUSION:** For better results, a greater frequency of exercise is necessary and in this way the occurrence of diseases characteristic of the 21st century will be reduced.

### O4

#### **Urban Planning and Physical Activity: How to Activate Public Open Spaces**

Desislava KOSEVA-KOVACHEVA<sup>1</sup>

<sup>1</sup>University of Architecture, Civil Engineering and Geodesy, Faculty of architecture, Sofia, Bulgaria

**PURPOSE:** The following article aims to analyze one of possible

way to encourage the physical activities through the aspect of the built environment. Today the process of urbanization leads to rapidly moving from rural areas to big cities. In Europe 74% of the population is living in urban areas, according to a UN report (2018). The increasing population and the lack of free land in the big cities demands enormous efforts on the preservation of public health by supporting physical activity. Considering these problems, already build public open spaces such as parks, green spaces outdoor gyms can be activated by appropriate strategy and architectural design for spontaneous, unorganized sport and recreation. **METHODS:** Based on case studies and a survey on what kind of physical activities the citizens of Sofia prefer, this article analyses the possible ways to activate the open spaces in the city. **CONCLUSION:** Further urbanization will increase the health detrimental lifestyles and harmful environmental exposures so the urban planning must develop the opportunities of different physical activities. The already build public open spaces in the cities can be activated with good strategies achieved by the collaboration between the all that are involved: architects, urban designers and sport and health science.

### O5

#### **Exogenous Ketosis at High-Altitude: Influence on Oxygenation During Rest and Maximal Exercise**

Domen TOMINEC<sup>1</sup>, Myrthe STALMANS<sup>2</sup>, Benjamin NARANG<sup>1,3</sup>, Gregoire P. MILLET<sup>4</sup>, Chiel POFPE<sup>2</sup>, Tadej DEBEVEC<sup>1,3</sup>

<sup>1</sup>University of Ljubljana, Slovenia, <sup>2</sup>KU Leuven, Belgium, <sup>3</sup>Institut Jozef Stefan, Slovenia, <sup>4</sup>University of Lausanne, Switzerland

Increasing blood ketone bodies concentration via ketone ester (KE) ingestion might alleviate the progressive drop in blood oxygenation and concomitantly augment muscle oxygenation during cycling in hypoxic conditions. **PURPOSE:** We sought to determine whether exogenous ketosis – induced by intermittent KE ingestion during a 3-day-long sojourn at high-altitude – attenuates the oxygenation decline at rest and maximal exercise and consequently improves altitude exercise performance. **METHODS:** Healthy recreationally-trained men and women underwent incremental cycling test on the 3rd day of a high-altitude sojourn (Refugio Torino; 3375 m). In a randomized manner the participants, received either a placebo (n = 17) or KE (n = 17) supplements throughout the altitude exposure. Gas exchange, blood and muscle oxygenation were continuously measured throughout the incremental test and subsequently analysed as 20 s averages at rest and maximal exercise. A mixed-model analysis or an independent t-tests were employed to evaluate differences between the experimental conditions. **RESULTS:** No significant effect of KE was noted for oxygen uptake, ventilation, nor blood and muscle oxygenation at both rest and maximal loads. Peak power output was also comparable between the experimental conditions (p = 0.823). **CONCLUSION:** Our data indicates that exogenous ketosis does not improve oxygenation at rest or at maximal exercise, and thereby does not augment maximal exercise performance at high-altitude.

### O6

#### **The effect of neuromuscular warm-up on muscle contractility of elite female football players**

Frederika PAJONKOVÁ<sup>1</sup>, Rút LENKOVÁ<sup>1</sup>, Jaroslav SUČKA<sup>1</sup>, Monika VAŠKOVÁ<sup>1</sup>

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Neuromuscular warm-up positively affects motor abilities and mus-

cle performance. **PURPOSE:** The purpose of the study was to extend the knowledge about the effect of neuromuscular warm-up on the level of muscle contractility in female football players. **METHODS:** The research sample consisted of experimental (EG, n=20) and control (CG, n=16) groups of female football players. The intervention lasted 12 weeks. The neuromuscular warm-up was implemented in the experimental group, while the control group performed a standard warm-up. Muscle contractility was assessed in dominant (DLE) and non-dominant (NDL) legs using tensiomyograph TMG-S2 with emphasis on m.biceps femoris (BF), m.gastrocnemius medialis (GcM), m.gluteus maximus (GM), m.vastus lateralis (VL), and m.vastus medialis (VM). Muscle contractility was assessed with an emphasis on contraction velocity (Vc). Wilcoxon test was used to determine significant differences. **RESULTS:** Upon completion of the intervention, there was a statistically significant improvement in the contraction velocity of VL DLE ( $p=0.040$ ,  $r=0.342$ ) and VM NDL ( $p=0.048$ ,  $r=0.330$ ). In contrast to the findings, applying the standard warm-up we observed a statistically significant improvement in the contraction velocity of VM NDL ( $p=0.011$ ,  $r=0.422$ ) and a decrease in the contraction velocity of BF, GcM, and VL muscles of dominant and non-dominant legs, although this decrease was not significant. **CONCLUSION:** This study highlights the need for research to objectify neuromuscular warm-up with other muscle groups used in football.

O7

#### **An investigation of sex differences in relation to the eating habits and nutrient intakes of physically active young people**

Hayriye ÇAKIR-ATABEK

Eskişehir Technical University, Faculty of Sport Sciences, Department of Coach Training in Sports, Eskişehir, Turkey

**PURPOSE:** This study aimed to investigate the eating habits and nutrient intakes between physically active males and females. **METHODS:** Thirty-five males (mean age:  $22.09 \pm 2.45$  years) and 25 females (mean age:  $19.96 \pm 2.91$  years) volunteered to participate in this study. All participants were instructed to maintain their normal dietary habits during the investigation and to complete a diet recall for three days: two weekdays and one for weekend. The diet recalls were used to quantify the average intake of calories, protein, carbohydrate, fat, vitamin C, vitamin A, vitamin E, and etc. which were analyzed using a computerized dietary assessment program (BEBİS, version 6.1, Turkey). **RESULTS:** The findings of the current study showed that there were significant differences between males and females for intake of calories (Kcal) and protein (g) ( $1568.5 \pm 418.9$  vs  $1356.3 \pm 254.9$ ;  $1356.3 \pm 67.6$ , respectively). When protein was expressed as %, there was no differences between sexes. On the other hand, no significant differences were observed for fat, carbohydrate, fiber, polyunsaturated fat, and cholesterol. Additionally, except vitamin B6 no significant differences were observed for all examined vitamin and minerals contents (A, E, C, B1, and B2; Na, K, Ca, Fe, and Zn). **CONCLUSION:** Even though the physical activity and gender may influence the nutrition habits, in the current study males and females had similar nutrition habits.

O8

#### **Consequences of Covid-19 Pandemic on Injury Rate of Athletes**

Hrvoje AJMAN<sup>1</sup>, Matej JAGUSTIN<sup>1</sup>, Matej BUHAČ<sup>2</sup><sup>1</sup>Faculty of kinesiology Osijek, Josip Juraj Strossmayer University in Osijek, Osijek, Croatia, <sup>2</sup>Gymnasium Matije Antuna Reljkovića, Vinkovci, Croatia

During the COVID-19 pandemic, the normal course of the

sports seasons was disrupted and the injury risk of athletes significantly increased. The most common injuries in sports such as football and volleyball are hamstring and adductor rupture, ACL and MCL rupture and ankle sprain. The rupture of these muscles and ligaments is often caused by performing explosive actions and muscle imbalances. **PURPOSE:** The primary goal of this paper is to explain how coronavirus disease is reflected in athletes. **METHODS:** Data was collected from professional football and volleyball teams regarding the incidence of injuries during the COVID-19 pandemic period. Scientific papers that contained medical records, injury reports, and training regimens were reviewed to assess the prevalence and types of injuries. **RESULTS:** Studies have found a 20-30% rise in injury rates among professional football and volleyball players during the pandemic compared to previous seasons. For football, there has been an increase in ACL and MCL ruptures by 15%, while in volleyball ankle injuries have increased by 25%. Athletes who contracted COVID-19 had a 10-20% reduction in aerobic capacity and respiratory function. **CONCLUSION:** Adapting training and competition plans is crucial in the face of the COVID-19 pandemic's disruptions, requiring professional clubs to deploy expert staff for individual load testing. Success in navigating these challenges demands a holistic strategy, including customized training programs, continuous workload management, and monitoring of health indicators.

O9

#### **The effect of spectators on situational efficiency in football - an analysis on the sample of the English premiership league during the COVID-19 pandemic**

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During the COVID-19 pandemic, one of the strategies to prevent the spread of the virus was the cancellation of public gatherings, so among other things football matches were played without the presence of spectators. **PURPOSE:** The main aim of this study was to analyze how the presence of spectators during a game impacts the situational efficiency of professional football players. **METHODS:** The sample consists of performances carried out by 20 English Premier League teams in the last 18 rounds (180 games) during the 2019/2020 season. A total of 30 technical and situational parameters were collected for each game through SofaScore app. All data were descriptively analyzed and T-test was used to determine the differences between games with and without spectators. Finally, binomial logistic regression was used to establish the influence of the observed parameters on the outcome in conditions with and without spectators. **RESULTS:** Results showed that the presence of spectators impacts yellow cards, big chances, passing accuracy, dribbles, duels, possession lost, interceptions, and clearances. Shots, yellow cards, big chances, saves, and passes significantly impact the score when spectators are present. Without spectators, shots, chances, saves, pass accuracy, dribbles and possessions lost have a significant effect on the outcome. **CONCLUSION:** Players seem to be more aggressive when spectators are present while their technical abilities decrease significantly in these conditions. On the other side, players' technical-tactical knowledge has a greater influence on the score when spectators are absent. Coaches should use these findings in both tactical and mental preparation for games.

O10

**Isokinetic knee muscle strength parameters and anthropometric indices in athletes with and without hyperextended knee**Ivana ČERKEZ ZOVKO<sup>1</sup>, Saša BAŠČEVAN<sup>2</sup>, Barbara GILIĆ<sup>3</sup><sup>1</sup>Faculty of Science and Education, University of Mostar, Mostar, Bosnia and Herzegovina, <sup>2</sup>Policlinic Patella, Zagreb, Croatia, <sup>3</sup>University of Split, Faculty of Kinesiology, Split, Croatia

Hypermobility has been linked to decreased knee performance, including isokinetic and isometric knee strength. **PURPOSE:** This study aimed to determine whether athletes with and without knee hyperextension have different hamstring-to-quadriceps strength (H/Q) ratios and to investigate the association between knee hyperextension indices, H/Q ratios, and anthropometric characteristics. **METHODS:** The sample consisted of 47 subjects, healthy male athletes without knee injuries, aged 23.48±3.54 years. Variables included the degree of knee hypermobility, isokinetic parameters of leg musculature, and anthropometric indices. Differences between athletes with and without hyperextension were calculated using independent samples t-test and discriminant analysis, while associations between the variables were checked by Pearson's correlation coefficients and multiple regression analysis. **RESULTS:** Athletes with hyperextended knee had shorter legs (t-value=-2.23, p=0.03) and shins (t=-2.64, p=0.01) and lower H/Q ratio at angular velocity of 60°/s (t=-2.11, p=0.04) compared with non-hyperextended group, and these differences were supported by discriminant analysis (Wilks' L=0.60, p=0.01). The H/Q ratio at an angular velocity of 60°/s was associated with the degree of knee hypermobility (R=-0.29, p=0.04). **CONCLUSIONS:** This research showed that athletes with knee hypermobility have weaker hamstring strength, and thus the H/Q strength ratio at lower angular velocities. These findings suggest that targeted strength training programs for the leg muscles should help with knee hypermobility disorders.

Key words: sports rehabilitation, preventive treatment, joint health, physical therapy, sports performance

O11

**Active Architecture: Designing Sports Facilities and Urban Spaces to Promote Physical Activity and Health**Ivana STEFANOVSKA-CVETKOVSKA<sup>1</sup><sup>1</sup>University of Architecture, Civil Engineering and Geodesy, Faculty of architecture, Sofia, Bulgaria

**PURPOSE:** This article examines the symbiotic relationship between architecture, sport, physical activity, and public health. It explores how innovative architectural design and urban planning strategies can foster active lifestyles, enhance community well-being, and address public health challenges. **METHODS:** Through a multidisciplinary approach encompassing research in architecture, urban planning, sports science, and public health, this study investigates the integration of sport and physical activity into the built environment. Case studies and examples of exemplary sports facilities, recreational spaces, and active urban designs are analyzed to identify effective design principles and strategies. **RESULTS:** The analysis highlights the significant impact of architecture on promoting physical activity and improving public health outcomes. Architectural features such as accessible sports facilities, pedestrian-friendly infrastructure, and inclusive public spaces are found to encourage active living and contribute to healthier communities. **CONCLUSION:** Em-

phasizing the importance of active design principles, this article advocates for collaborative approaches among architects, urban planners, policymakers, and public health professionals to create environments that prioritize physical activity and support community health and well-being. By incorporating sport and physical activity into architectural practice and urban development initiatives, we can build more resilient, inclusive, and healthy cities for all.

O12

**Evaluating active range of motion of the cervical spine with a head-mounted inertial measurement unit: Intra-rater, test-retest and inter-rater reliability in healthy adults**Izabela LUZNIK<sup>1</sup>, Maja PAJEK<sup>1</sup>, Ziva MAJCEN ROSKER<sup>1</sup><sup>1</sup>University of Ljubljana, Faculty of Sport, Ljubljana, Slovenia

Assessing active range of motion (AROM) of the cervical spine is a common and essential aspect of evaluating cervical spine function in sports and clinical practice. **PURPOSE:** The aim of the study was to evaluate the intra-rater, test-retest and inter-rater reliability of AROM test of the cervical spine using a head-mounted inertial measurement unit (IMU) in healthy adults. **METHODS:** Thirty-seven participants were included in the study who performed the following head and neck movements (6 repetitions): flexion, extension, left and right rotation, left and right lateral flexion. The test was carried out on three occasions and performed by two different examiners (examiner A and B). The first and second assessments were conducted on the same day and the third assessment was conducted 2-3 days later. AROM parameters for each movement were expressed in degrees. **RESULTS:** The intraclass correlation coefficients (ICC) obtained showed moderate to excellent intra-rater (ICC: 0.54-0.95) and inter-rater reliability (ICC: 0.66-0.91), while the test-retest reliability ranged from good to excellent (ICC: 0.76-0.93). **CONCLUSION:** In addition to their practicality, simplicity and cost-effectiveness, IMU sensors allow quantitative evaluation of the mobility of the cervical spine through three-dimensional motion analysis. The results of this study suggest that measurements with IMU sensors are reliable for the assessment of cervical AROM.

O13

**How do elite football goalkeepers train during the competitive microcycle?**Jakov VLADOVIĆ<sup>1</sup>, Ivan ZELJKO<sup>2</sup>, Toni MODRIĆ<sup>1</sup><sup>1</sup>University of Split, Faculty of Kinesiology, Split, Croatia, <sup>2</sup>Faculty of Science and Education, University of Mostar, Mostar, Bosnia and Herzegovina

For successful dealing with high physical demands of contemporary football, an appropriate distribution of external training load (ETL) is essential. **PURPOSE:** This study aimed to evaluate ETL among elite-level goalkeepers, considering days preceding the match day (MD minus) and subsequent playing status. **METHODS:** The ETL of three Croatian top league goalkeepers was assessed using GPS technology across 67 training sessions during competitive microcycles with one match per week. Variables included distances covered, acceleration frequencies, dives and jumps. **RESULTS:** Significant differences among training days were found for total distance, total dives, and high-intensity accelerations and decelerations (f= 3.02-7.28, all p<0.05, all small-to-medium effect sizes (ES)), peaking on MD-3 and decreasing on MD-2 and MD-1. Compared to the starters, nonstarters performed more medium jumps on MD-4 (large ES); more low jumps on MD-3 (medium ES); more total dives (medium ES), left-side dives (medium ES), right-side dives (small ES), and low jumps (medium ES) on MD-2; and more left-side dives (small ES) and low (medium ES) and medium

jumps (small ES) on MD-1. CONCLUSION: The study demonstrated that elite goalkeepers experienced peak ETL on MD-3, decreasing on MD-2 and MD-1. Starters and non-starters had similar ETL on MD-4 and MD-3, but non-starters showed slightly higher ETL on MD-2 and MD-1, indicating differing daily training demands.

#### O14

##### **Determination of movement abilities parameters by movement games in older school age boys**

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Purpose: The aim of the work was to contribute to the extend the knowledge about the level and development of selected movement abilities of older school age boys by the application of movement games. Methods: Our research has a character of school physical education experiment that lasted 8 weeks. There were involved 38 pupils in experimental group and 37 pupils in control group. Boys passed input and output measurements with test battery: standing broad jump, sit-ups in 1 minute, overhead medicine ball throw (2 kg), 50 m sprint and 12 minutes run. Processing and evaluation were done with basic statistical methods (arithmetic mean, standard deviation, Fisher-Snedecor F-test, parametric t-test for dependent and independent groups) and with logical methods. Results: The level of selected movement abilities of boys was in all test significantly lower comparing former testing of Slovak population (both 1990 and 2011). By application of movement games significantly improved results in some tests in experimental group (standing broad jump, sit-ups in 1 minute and 50 m sprint) while in control there were proved significant improvement in test overhead medicine ball throw and worsening in test 12 min run. Conclusions: From these results we can recommend the used movement games like training mean for improving explosive power, running speed and strength of trunk muscles in conditions of school physical education lessons.

#### O15

##### **Masks, goggles and snorkels. Should we use these aids in learn-to-swim programs for non-swimmers or not?**

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The use of masks, goggles, and snorkels has become popular in some swimming schools, because these swim aids may provide important benefits for non-swimmers, such as unobstructed vision, normal breathing, and thus, easier face immersion. Submerging the face during floating assists buoyancy and can help to increase a beginners' confidence, allowing them to break physical contact with the bottom or the edge of a pool. Face immersion also helps to place swimmers in the correct horizontal body position, simplifying the complex coordination of arms, legs and breathing needed for other swimming activities. On the other hand, there is a risk that the use of mask, goggles and snorkel may increase swimmers' dependency on those aids, which, in turn, would hinder their acquisition of correct swimming techniques and might later increase fear of swimming when the ergogenic aids are not available. Unfortunately, there are only a few studies that deal with swimming didactics. Therefore, until recently, there were no clear conclusions as to whether or not the use of these swimming aids was suitable for programs for non-swimmers. The aim of this presentation is to discuss this topic and answer the question posed with the results of our latest research. We investigat-

ed the effects of using goggles and snorkel during the learn-to-swim program on the aquatic skills of young non-swimmers.

#### O16

##### **Positional Variations in Internal Training Intensity and Psychometric Responses During Soccer's Pre- Competitive Phase**

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Increasing training loads during the pre-competitive period enhances performance and prepares players for the competitive season's demands. PURPOSE: The main aim of this study was to explore the differences between playing positions in internal training intensity (ITI) and psychometric variables over the first two-week (1 game per week) and the second three-week part (2 games per week) of the pre-competitive intensified training (IT) period in soccer players. Moreover, the study explored the relationship between training load and well-being status. METHODS: Twenty-five professional soccer players from the Croatian second league volunteered to participate in the study (mean  $\pm$  SD: age:  $21.7 \pm 4$  years; body height =  $185.2 \pm 6.1$  cm; body mass =  $78 \pm 5.9$  kg; BMI =  $22.7 \pm 1.4$  kg·m<sup>-2</sup>; VO<sub>2</sub>max =  $52.3 \pm 3.7$ ). RESULTS: There were significant differences between first and second part of IT in ITI<sub>mean</sub> ( $p < 0.001$ , ES [2.33]), ITI<sub>sum</sub> ( $p < 0.001$ , ES [2.33]), WB ( $p = 0.006$ , ES [0.79]), DOMS ( $p = 0.028$ , ES [0.33]), stress ( $p = 0.017$ , ES [0.45]), and mood ( $p < 0.001$ , ES [0.33]). One-way ANOVA revealed that goalkeepers had lower values of ITI<sub>mean</sub> ( $p < 0.002$ ,  $F = 5.92$ , ES [0.61]), higher values of sleep ( $p < 0.024$ ,  $F = 5.92$ , ES [0.47]), and higher values of mood ( $p < 0.019$ ,  $F = 5.92$ , ES [0.48]) than other playing positions. All significant correlations between ITI<sub>mean</sub> and well-being measures were found when the second part of IT was observed ( $r$  values ranged from -0.35 to -0.16). Lastly, large positive correlations were found between CMJ and fatigue ( $r = 0.55$ ,  $p < 0.01$ ) and DOMS ( $r = 0.52$ ,  $p < 0.01$ ). CONCLUSION: Positional differences were seen mainly between goalkeepers and outfield players, with goalkeepers undergoing unique training programs. This was expected outside the in-season period, where positional training differences are expected. Despite the initial higher training intensity, psychometric responses were more pronounced during the second part, which featured two weekly games.

#### O17

##### **Sociological variables in football talent development: An analytical exploration of strategy, chance, and societal dynamics with practical applications**

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PURPOSE: This research delves into the impact of environmental and social factors on the career trajectories of Slovenian national team soccer players. Moreover, the study seeks to pinpoint crucial factors that shape the transition to professional football careers, with the goal of offering practical advice for youth development initiatives. METHODS: The research involved 184 active and retired Slovenian national team players, employing Pierre Bourdieu's cultural capital theory. Utilizing IBM SPSS statistics, a retrospective questionnaire examined two socio-cultural dimensions of soccer players through exploratory factor analysis and binary logistic regression. In-depth semi-structured interviews with eight former national team players, covering those who played abroad and those who did not, consti-

tuted the qualitative aspect. RESULTS: Exploratory factor analysis identified four factors in the "soccer cultural capital dimension" and five in the "family and school cultural capital dimension." Binary logistic regression emphasized specific factors influencing migration abroad, such as playing references and parental support. Interviews underscored the profound influence of parents on career success and emphasized the significance of choosing a club with robust organizational capacities. CONCLUSION: This research sheds light on the intricate interplay of environmental and social factors shaping the football career trajectories. The findings reveal the significance of cultural capital, highlighting the crucial role played by parents and the choice of clubs with strong organizational support. This knowledge can serve as a valuable resource for youth development initiatives.

O18

### The links between specific motor performance and fitness parameters

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Today, sports can be characterized by the advent of modern technology. Various apps are used in elite sports but also in physical activities of the general population. PURPOSE: The aim of this paper was to assess motor performance through the Phyphox mobile app and subsequently define the relationships with strength and endurance parameters. METHODS: Altogether 15 students of physical education completed the 3x3 min. Burpee Movement Program (BMP), consisting of repeated execution of the Burpee with maximum effort at regular intervals triggered by a sound signal. During the load phase, the intensity of the Burpee and the fatigue index expressed in percentages was evaluated by means of acceleration recorded through a mobile phone. In the second part of testing, we evaluated the performance parameters during a bench press, squat and a Leger beep test. RESULTS: The average intensity of the Burpee ranged from 3.12 to 11.12 ms<sup>-2</sup>. The fatigue index ranged from -21.95% (which represented an increase in performance) to 33.63% (which represented a decrease in performance). The performance during a bench press ranged from 58 to 480 W and from 175 to 696 Wkg<sup>-1</sup> during the squats. The distance in shuttle running ranged from 540 to 2000 meters. The intensity of the Burpee showed a significant correlation dependence with the performance achieved in bench press and squat  $r = (0.71 - 0.79)$ . The fatigue index showed a significant correlation dependence with the Leger beep test  $r = -0.67$ . CONCLUSION: The resulting relationships indicate that the BMP can be used as a suitable test for assessing the strength and endurance abilities.

O19

### Associations between physical literacy knowledge questionnaire and physical literacy self-description in high-school students; gender-stratified analysis

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Physical literacy (PL) involves not only the mastery of fundamental movement skills but also knowledge and understanding of the concepts related to physical activity. PURPOSE: The goal of this study

was to investigate whether there is an association between two distinct questionnaires for PL which assess two different domains (i.e., knowledge and physical competence). METHODS: The research included 81 high-school students (40 girls, 41 boys) aged 14-20 years. PL was assessed using the Canadian Assessment of Physical Literacy knowledge questionnaire (CAPL-KNO) and Physical Literacy Assessment for Youth (PLAYself) questionnaires for assessing knowledge and physical competence PL domains, respectively. The associations between CAPL and PLAYself variables (i.e., environment, self-description subdomains) were checked using Spearman's rank order correlation coefficients, while gender differences were determined using the Mann-Whitney U test. RESULTS: Girls had higher CAPL scores compared to boys ( $Z=2.13$ ,  $p=0.03$ ), while there were no differences in PLAYself variables. There were no significant associations between CAPL-KNO and PLAYself for the total sample nor gender-stratified. CONCLUSIONS: The results of this study indicate that the knowledge domain and physical competence domain are two distinct factors. Indeed, results support the hypothesis that PL is a complex concept and various distinct domains contribute to the overall PL level.

O20

### Factors influencing the choice and remaining of subjects in group Fitness programs

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The group fitness programs represent the modern forms of organized exercise under the guidance of professional trainers. The group fitness programs are divided into four major categories: cardio programs, muscle programs, cardio muscle programs and body and mind programs. AIM: The main aim of this research is to establish factors that influence the choice and remaining of targeted subjects in the group fitness programs. METHODS: The sample of 583 subjects (age 19 to 51+) includes all randomly selected people who voluntarily filled in the survey through a Google online form, regardless of age, sex and previous experience in group trainings. RESULTS: Subject addressed hygiene of the exercise area as the most important factor ( $M=4,73$ ,  $SD=0,6$ ), followed by trainer's correction of subjects' workout ( $M=4,69$ ,  $SD=0,66$ ), the atmosphere at training, i.g. connection with other people ( $M=4,54$ ,  $SD=0,81$ ) and the trainer's expertise ( $M=4,53$ ,  $SD=0,79$ ). The least important factors were the additional benefits in the area ( $M=2,67$ ,  $SD=1,16$ ), the title of the group training ( $M=2,69$ ,  $SD=1,23$ ) and the trainer's appearance ( $M=3,01$ ,  $SD=1,18$ ). CONCLUSION: All results considered, the work of group program trainers, as well as the owners, should be based on increasing the quality of the training itself through increasing the quality of knowledge, skills and abilities of trainers, as well as through increasing quality and cleanliness of the exercise area.

O21

### Differences in the speed and power of elite u12 and u13 croatian soccer players

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Identification of talent and continuous evaluation of players' abilities is an indispensable part of the selection process. PURPOSE: The main goal of the research was to determine the differences in speed

and power of elite U12 and U13 young Croatian soccer players with different roles in the team. **METHODS:** Out of the 38 total HNK Hajduk Split players, 18 players were U12 age category while 20 players were U13 age category. Players were divided by the coaches in the groups of higher quality (key players) and lower quality (rotation players). Players were tested with 2 tests to assess explosive power and 3 tests to assess speed. **RESULTS:** Results obtained with Student's T-test showed that there are no significant differences in the speed and the power between the two observed group of players for each age category. For U12 category key players demonstrated better results than rotation players in the standing long jump and the medicine ball throw (183.89/566.44cm vs. 177.22/511.89cm, respectively). Additionally, key players performed better in 5-, 10- and 20- m sprint (1.11/1.93/3.43s vs. 1.14/1.96/3.52s). U13 key players performed similar with rotation players in 5-, 10- and 20- m sprint (1.12/1.97/3.44s vs. 1.13/1.97/3.47s), but interestingly, U13 key players were slightly worse than rotation players in the standing long jump and the medicine ball throw (194.33/587.67cm vs. 194.75/606.50cm). **CONCLUSION:** Many variables and abilities may determine soccer success. For the observed participants it seems likely that other abilities could have been more decisive for status differentiation in the team.

## O22

### The impact of COVID-19 lockdown measures on physical fitness of 6-7 year old children in the Czech Republic

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**Purpose:** The aim of the study was to assess the effect of lockdown on fitness in children aged 6 to 7 years in relation to COVID-19 disease (year 2020/2021). **Methods:** The research was conducted between 2018 and 2022. A total of 25940 children (12327 boys and 13613 girls) participated in the research. The children were tested in 8 tests (sit-and-reach, T run, shortened sit up, stork stand, 50 m run, 800 m run, standing long jump and basketball throw). All raw scores were converted to standardized scores using T scores and compared (statistical significance by unpaired t-test and practical significance by Cohen's d). **Results:** The decrease in overall fitness was statistically significant (t-value 20,03, Cohen's d=0,39 - compared 2021/22 to 2018/19). The largest decreases in performance in each test occurred in T-run test (t-value 17,77, Cohen's d=0,348 - compared 2021/22 to 2018/19). In contrast, there was no decrease in performance in the sit-and-reach test (t-value 0,855, Cohen's d=0,017 - compared 2021/22 to 2018/19). **Conclusion:** The society's lockdown in the context of the COVID-19 disease epidemic showed that its impact on children's fitness was high. On the other hand, the decline in performance in the individual test items was mainly associated with the speed-coordination domain. It was not as significant for other motor qualities.

## O23

### Smart sport assistance for blind and visually impaired pupils: Edge of pool detection in swimming

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Physical education lessons (PE-lessons) are often perceived as a field with particularly diverse barriers to participation. Pupils with disabilities often experience themselves as not being included. The group of pupils with blindness and visual impairments is particularly affected. **PURPOSE:** The goal of our project is to promote the

activity of blind and visually impaired children. **METHODS:** Difficulties and opportunities perceived by blind and visually impaired pupils in PE lessons were identified and possible improvements and solutions elaborated. The findings were translated into a catalog of needs and requirements that is used for the design and development of prototypes for assistance systems identified as necessary. One device required is a feedback system to avoid collisions with the edge of the pool during swimming. **RESULTS:** Two different approaches have been followed. One uses the potential of intelligent computer vision cameras to automatically track the swimmers. A prototype system has been trained by taking 3600 single images of swimming persons and shows a high recognition rate (0.95). The other uses a compressed air system positioned below the surface of the water, which emits a steady stream of air bubbles to inform the swimmer of the approaching edge. Haptic feedback is perceived better than acoustic feedback. **CONCLUSION:** In any system finally implemented, the notification from the edge of the pool should be tactile.

## O24

### Social Marketing in Raising Awareness about BMI Index and Opportunities of Sport's Activities for Qualitative Life

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Social marketing strategies are important for raising awareness about BMI Index and opportunities of sport's activities for qualitative life for all generations. It is important to go to exams and talks with physicians, in order to define health condition, food's diet, sport's activities, the plan of sport's activities. It is important to have confident in physicians with different specializations, in sport's instructors, in friends and family supports. In the paper will be given the special focus on generation's segmentation for taking care about BMI Index. Special aspect of the analysis is type of sport that people use, such as swimming, running, yoga, or group's sports, such as basketball. Unique aspect will be on storytelling about BMI index in different media, such as journals, movies, advertisements. It is very important to raise awareness that good lifestyle give chance for qualitative life. **PURPOSE:** The goal of the paper is to research theoretical approach of social marketing in raising awareness about BMI Index and opportunities of sport's activities for qualitative life. **METHODS:** After theoretical review, the paper will present case studies. Using in-depth interviews with physicians, professors of sports, professional sport's instructors, physiotherapists the paper will give opinion about effectiveness of sports, rehabilitation's and relaxations on qualitative life. **RESULTS:** Results indicate that social marketing influence on raising awareness about BMI index and opportunities of sport's activities for qualitative life. **CONCLUSION:** The findings prove that social marketing raise awareness about qualitative life.

## O25

### Prevalence of anemia, iron deficiency anemia and associated factors among children aged 1 to 5 years in the high Andean rural environment, Perú

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Child anemia and malnutrition is one of the major public health problems worldwide and occurs in the most vulnerable populations

where there is a situation of poverty and lack of access to basic health and education services. The objective of this study was to evaluate the prevalence of anemia, iron deficiency and its factors associated with anemia in a rural high Andean area of Peru. The methodology was cross-sectional with 150 children aged 1 to 5 years from the high Andean rural areas of Apurímac, Peru. Sociodemographic characteristics, anthropometric background, and hemoglobin examination were considered. The prevalence of anemia was assessed using rapid capillary blood tests using fingerstick in the field. Venous blood samples were analyzed for serum ferritin, serum iron, and total iron-protein binding capacity (CRP) in the laboratory. In the results, anemia was found in 71% of patients, with an iron deficiency in 2.5% according to the diagnosis by adjusted ferritin and 17.2% according to transferrin saturation. Indicators of iron deficiency did not correlate significantly with low hemoglobin levels. Fever and malnutrition are the factors that were associated with anemia in rural high Andean areas. It is concluded that anemia control should be treated with intervention programs in nutrition and disease prevention in children.

## O26

### Observing secular trends in physical fitness of Slovenian children with ACD.Si study in the past 40 years: design of study

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**BACKGROUND:** ACD.Si is one of the oldest ongoing studies in the world examining secular trends in anthropometry and physical fitness of children and adolescents, conducting every decade already for 50 years. **PURPOSE:** The primary objective of this research is to examine secular trends in physical fitness across five generations of Slovenian children aged 6 to 14. The purpose of this contribution is to present a design of the study. **METHODS:** The study will evaluate secular trends in physical fitness of children using 10-year interval measurements (1983-1993-2003-2013-2023) on the national representative sample in the same schools, utilizing 35 anthropometric measurements (lengths, circumferences, skinfolds, widths) and 12 motor fitness tests (cardio-respiratory endurance, strength, power, balance, agility and coordination), as well as several determinants of physically active behaviour. **RESULTS:** In the 2023 study, a total of 2031 children from 6 to 14 years were enrolled, with around 115 children in the same age and sex category. Analysis of the results will be conducted in the following months after cleansing the data and merging it with the data from previous decades. **CONCLUSION:** Results of the statistical analysis will provide insight into secular trends of Slovenian school children and will serve as the foundation for development of different interventions. In the continuation of the ACD.Si study, approximately 1200 upper secondary school students will be included in the year 2024, further enriching our understanding of secular trend of physical fitness among Slovenian youth.

## O27

### Utility of glucose threshold determination during exercise in trained cyclists

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**Purpose:** Glucose can be measured cost effectively during exercise testing. Given the previously suggested association between indi-

vidual glucose threshold (IGT) - representing the lowest glucose value during an incremental exercise test - and individual anaerobic threshold it could prove useful in training and testing intensity determination. **Methods:** In the present work we sought to determine glucose kinetics during a graded incremental cycling test in 27 young cyclists (mean age  $17.7 \pm 1.0$  years;  $V_{O2max}$  mean  $70.7 \pm 4.5$  ml.kg.min<sup>-1</sup>). Values of lactate and glucose as well as ventilatory variables were continuously monitored throughout the test. Subsequently, individual glucose threshold (IGT) and other lactate and ventilatory variables related thresholds were calculated and compared. **Results:** Mean IGT values were obtained at  $305 \pm 41$  W, corresponding to 83.8% of  $V_{O2max}$  and 75.2% of  $W_{max}$ . IGT showed moderately positive correlations with lactate threshold ( $r = 0.54$ ,  $p = 0.03$ ), onset of blood lactate accumulation ( $r = 0.68$ ,  $p < 0.01$ ), lactate threshold calculated with Dmax method ( $r = 0.68$ ,  $p < 0.01$ ) and respiratory compensation point ( $r = 0.59$ ,  $p < 0.01$ ). Correlation analysis thresholds based on relative oxygen uptake also showed moderately positive correlations for LT ( $r = 0.57$ ,  $p < 0.01$ ), onset of blood lactate accumulation ( $r = 0.61$ ,  $p = 0.01$ ) and Dmax method ( $r = 0.77$ ,  $p < 0.01$ ), there was no significant correlation with RCP ( $0.26$ ,  $p = 0.19$ ). **Conclusions:** These findings suggest that IGT can serve as a reliable indicator of individual anaerobic threshold and also corresponds to other lactate and ventilatory variables. Due to availability and low cost it represents a valuable tool for coaches and athletes to monitor training and performance effectively.

## O28

### How is low back pain associated with low education and why? A systematic review with meta-analysis

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Low level of socioeconomic status is associated with poor physical health and various diseases and conditions such as musculoskeletal disorders and low back pain (LBP). Existing literature focusses on comprehending the intricate factors connecting the level of education and LBP. Social factors can play a crucial role in managing functional recovery from back pain. **Purpose:** Our aim was to determine the scientific evidence regarding the relationship between level of education and LBP and, to illustrate potential reasons for this connection. **Methods:** We conducted a systematic literature search on PubMed. Two independent reviewers screened studies, extracted data, and assessed risk of bias. Meta-analyses were performed to estimate the odds ratio (OR) of the association between low back pain and level of education. **Results:** Seven articles were included with 9973 persons with LBP. When pooling data from three studies, low level of education (OR 1.16 95% CI 1.06, 1.27,  $p = 0.001$ ) and middle level of education OR 1.10, 95% CI 1.01, 1.20,  $p = 0.04$ ) were associated with LBP, but there was not association with high level education (OR 0.65, 95% CI 0.58, 0.72,  $p = 0.00001$ ). **Conclusion:** Lower levels of education may encourage LBP, along with factors such as physical demanding occupations, poorer health care, lower income, poorer health literacy and limited access to health services.

## O29

### Potential doping behavior in professional handball; analysis of specific predictors

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**BACKGROUND:** Doping behavior is one of the most important problems in nowadays sport, but studies rarely examined predictors of potential doping behavior (PDB) in professional players. **PURPOSE:** This study aimed to identify PDB in top-level handball players and to evaluate correlated of PDB in professional players. **METHODS:** Participants were professional handball players from Kosovo ( $n = 103$ , 34 females,  $21.01 \pm 4.01$  years of age), who were tested by structured questionnaires on PDB (criterion), and sport-, and sociodemographic-predictors by closed previously validated questionnaires. Differences between genders were established by Mann Whitney test (for ordinal variables), Chi square (for nominal variables), and t-test (for interval variables). Logistic regression was calculated to establish the associations between predictors and binomized criterion (positive PDB vs. negative PDB). **RESULTS:** Players were rarely tested on doping (88% reported ever been tested), and only small proportion were of the opinion the doping was used in handball (6% of players reported positive opinion about doping presence in handball). Males showed stronger tendency toward PDB than females (Odds Ratio: 3.41, 95%CI: 1.16-9.96), with 32% of males and 13% of females reporting positive PDB. No significant correlations between sociodemographic factors and PDB was found. Better sport success was correlated with lower likelihood for positive PDB in males (OR = 0.87, 95%CI: 0.80- 0.97). **CONCLUSION:** Male handball players were evidenced as being more vulnerable to PDB than their female peers, which is likely to be a consequence of general acceptance of doping among males than among females. Further studies are needed in order to explore studied associations in other countries and other sports.

### O30

#### Forms of risky behavior of young people via social media

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Cyberspace becomes equal to real space, as a place for establishing and maintaining social relationships, both for young people and adults. **PURPOSE:** The research was conducted with the aim of identifying and distinguishing the categories of participants in cyberbullying. **METHODS:** The sample included 285 respondents from Sremska Mitrovica (141 boys, 144 girls), aged 18 to 20 years. In this research, a modified version of the RCBI scale was used, with the subscales bullying and victimization, with the addition of the witness subscale. The respondents declared about their previous experience on social networks. **RESULTS:** About 40% of respondents do not participate in bullying in any way, 14.7% of respondents are witnesses, and 44.9% of respondents can be said to be involved in bullying as bullies, victims and bully-victims. As for risk factors, there are differences by gender, in relation to parental involvement, time spent online and time spent on social networks. **CONCLUSION:** The obtained results mainly confirm the risk factors identified in foreign research and their knowledge enables

the planning of preventive actions in this area and the reduction of risks, and therefore the improvement of the mental health of young people.

### O31

#### Motivation for Physical Education in Students Aged 13 to 15 – Structure Analysis

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The quality of Physical education (PE) largely depends on the degree of students' motivation to participate in various kinesiological activities, whereby the level and structure of the motivational space are important. **PURPOSE:** The aim of this research was to analyse the level and structure of student's motivation to perform tasks in PE classes, as well as gender differences. **METHODS:** The research was conducted on 32 female and 29 male primary-school students from Split, Croatia, grades seven and eight. Motivation assessment was carried out using the Motivation for PE questionnaire. Gender differences were analysed using ANOVA. Using cluster analysis, three clusters were defined according to motivation level, separately for male and female students. **RESULTS:** The findings confirmed a significant difference in motivation between genders. Differences were identified in the area of extrinsic motivation of the external regulation type and intrinsic motivation of the stimulation type. Cluster analysis revealed a difference in the structure of below-average, average and above-average motivated female and male students. **CONCLUSION:** The research pointed to a complex structure of the motivational space of male and female students for the implementation of PE activities. Also, the intrinsic factors defined as accomplishment and stimulation stood out in highly motivated students. Knowledge of the described structure will enable teachers to recognize and intervene in students' motivation, aiming to optimise work effects in kinesiological education.

### O32

#### Does recreational skiing impact the local economy?

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The tourist potential of a country is often reflected in its geographical location, historical context, and the utilization of natural resources for tourism purposes. Tourist expenditure is commonly associated with summer destinations, but the contribution of winter tourism and the spending associated with it should not be overlooked during that period. **PURPOSE:** The aim of this paper is to present a structural analysis of recreational skiers' consumption in order to determine the magnitude of their economic potential as consumers, and consequently, the level of their impact on the economy of a specific destination. **METHODS:** The research pertained to an offline and online questionnaire that encompassed individuals from the Republic of Croatia who went skiing, regardless of their previous skiing experience. **RESULTS:** The research results showed that recreational skiers, through the diverse structure of their consumption, contribute to the increase in revenue for both their home destination and the destination they visit for skiing. However, the consumption structure indicates that the most significant impact of their spending is reflected in the destination they visit, particularly through accommodation costs, hospitality services, and ski passes. In contrast, the spending they generate through various means in their home destination is much lower.

**CONCLUSION:** Research suggests that skiing, as a form of entertainment in today's conditions, is quite expensive and therefore inaccessible to many. On the other hand, individuals who go skiing often do so on a yearly basis.

### O33

#### **Effects of physiotherapeutic neural mobilization techniques: A Systematic Review**

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**PURPOSE:** to synthesize the evidence of previous studies on the effects of physiotherapeutic neural mobilization techniques in different pathologies and injuries. **METHODS:** a systematic review was carried out according to PRISMA guidelines with the descriptive terms: "neural mobilization" (in English and Spanish). In the following databases: Web of Science (Core Collection), Medline through Pubmed, and Scielo. The evaluation of the methodological quality of the studies was performed using the PEDro scale. **RESULTS:** 1036 studies were found according to the descriptors used (649 in the Core Collection of the Web of Science, 302 in Medline, 7 in Scielo and 78 in PEDro). Finally, there were 11 studies to be considered in the systematic review, original, of experimental type (controlled clinical trials). Three studies were conducted in Europe, five in Asia and three in Africa. The range of samples ranged from 21 to 62 university students. The main effects were studied in: radiculopathy (chronic unilateral cervical, lumbar due to disc herniation, chronic low back pain), nerve-related neck and arm pain, low back pain, carpal tunnel syndrome, Bell's palsy, patients after lumbar laminectomy, joint pain in patients with rheumatoid arthritis and cervicobrachial pain. **CONCLUSIONS:** the neural mobilization technique has favorable effects in the different pathologies or injuries in which it was applied. Radiculopathy was the most studied clinical condition.

### O34

#### **Do We Have a New Sport-Specific Gymnastics Balance Test?**

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Balance is a complex process involving the coordinated activities of multiple sensory, motor, and biomechanical components. Artistic gymnastics elements highly depend on neuromuscular control, rhythmic sense, complete body balance control, and a technical posture while performing on apparatus. **PURPOSE:** The study aimed to evaluate the reliability and validity of a newly constructed gymnastics balance test, developed to measure sport-specific gymnastics balance ability in gymnasts. **METHODS:** A total of 15 youth female gymnasts (average age 9.46±1.56 years, body mass of 32.77±9.33 kg, and body height of 139.49±8.53 cm) were involved in the study. The sample of variables included anthropometric indices (body mass and body height) and the result of a sport-specific balance test (duration in seconds). Test execution involved a one-leg standing position on a balance beam with extended hands over the head i.e. gymnastics "passe". Statistical analysis included inter-item class correlation to determine reliability and factor analysis for validity.

**RESULTS:** Analysis of results demonstrates good metric characteristics of the test. Precisely, the Cronbach Alpha coefficient shows good reliability (0.89) between the test (58.22±47.95 sec) and retest measurement (81.36±65.18 sec), with a high inter-item class coefficient (0.85). Furthermore, both test and retest are described by one factor (0.96) with an explained variance of 1.85 and a total proportion of 0.92. **CONCLUSION:** The results show good reliability and validity of the test. Therefore, this test could be used to determine the training regime for young gymnasts. Also, it could be an indicator in the process of identification or selection among young gymnasts.

### O35

#### **Knowledge on legal issues of anti-doping regulations in sport professionals; validation of the newly developed measurement tool**

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**BACKGROUND:** Doping is one the most important problems in contemporary sport, and sport professionals (i.e. coaches, strength and conditioning trainers, physiotherapists, medical doctors) are known to be of strong influence on doping behavior of athletes. However, problem of legal issues and knowledge on legal issues in this context is understudied. **PURPOSE:** This study aimed to evaluate the reliability and validity of the novel tool aimed at evaluation of knowledge on legal issues of anti-doping regulations (LADR) in sport professionals. **METHODS:** Test- retest design was applied with the sample of 113 sport professionals from Croatia, and Bosnia and Herzegovina. Participants were tested by LADR in a time frame of 3-5 days. Additionally, various educational-, and sport-factors were examined. To determine reliability of the LADR, Cohen's kappa coefficient (kappa) and the percentage of equally responded queries (total agreement) were calculated. Final result on the LADR was correlated with sociodemographic-, sport- and educational-factors to establish the validity of the measurement tool. **RESULTS:** Kappa coefficients of 0.70, and absolute agreement of 70-81% indicated proper reliability of the LADR. Medical doctors and coaches achieved better results than physiotherapists. Also, medical doctors, and strength and conditioning coaches who were more involved in sport (more experienced in sport) achieved better results on LADR than their less experienced peers belonging to corresponding professions. **CONCLUSION:** Study evidenced proper reliability and validity of the LADR. Our results support applicability of the LADR in sport professionals from the region. Further studies in other languages are needed to establish its reliability and validity in other regions.

### O36

#### **Physical literacy levels in the Croatian adult population; gender differences and associations with participation in organized physical activity**

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Most previous research concentrated on physical literacy (PL) examinations in younger groups, while such research is scarce

in the adult population. **PURPOSE:** This study aimed to determine the PL levels of the Croatian adult population. Also, the aim was to investigate whether individuals with longer participation in organized sports have higher PL levels and do males and females differ in PL levels. **METHODS:** The sample comprised of 561 individuals (321 females, 240 males) aged  $27.65 \pm 12.13$  years. PL levels were assessed by the Croatian version of the Perceived Physical Activity Questionnaire (PPLQ-Cro). Demographic characteristics included age, gender, and years of involvement in organized physical activity. Gender differences were calculated using the Mann-Whitney U test. Spearman correlation coefficients were used to determine associations between study variables. **RESULTS:** Males had significantly higher PL levels compared to females ( $83.10 \pm 16.17$  for males and  $74.27 \pm 20.07$  for females,  $Z = -6.88$ ,  $p = 0.001$ ). Years of organized physical activity were associated with PL levels ( $R = 0.4$ ,  $p = 0.001$ ). **CONCLUSIONS:** The finding that years of organized physical activity are associated with total PL supports the theory that PL is the cornerstone for participating in lifetime physical activity. The results of this study emphasize the importance of introducing the concept of PL in numerous institutions and organizations connected with organized physical activity.

### O37

#### **Hyperaemic Reactivity of Muscles During Freediving Training: a Case study**

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**Purpose:** Local vasodilatation which occurs in response to oxygen debt and accumulation of metabolic waste products due to interruption of blood flow is defined as reactive hyperaemia. There are a few possible reasons for the occurrence of such state: (i) a transient reduction in the Fahraeus effect (i.e. decrease in hematocrit level as blood flow goes from larger to smaller vessels); (ii) increased cardiac output (with concomitant redirection of blood flow to the working muscle) and vasodilation of downstream resistance arterioles. Examination of such trends in freediving is a novel area since these athletes endure a double anaerobic state, both breath-holding and diving. Therefore, this study aimed to determine the influence of the aforementioned factors on local muscle hemoglobin levels (THb) during freediving. **Methods:** The sample consisted of one 40-year-old amateur diver, with 6 years of training experience, that was monitored during 5 different diving disciplines used in diving training (static, bfin, dynamic no fins (DNF), dynamic no fins with snorkel (DNF+), monofin, and sneaking). Variables that were measured are local muscle THb in the vastus lateralis right and deltoideus right muscle (THb slope, minimal THb, maximal THb, THb during rest, and THb during work), heart rate (heart rate average, heart rate drop), blood lactate accumulation, hemoglobin, and hematocrit. Descriptive statistics were calculated for all measured variables. The sign test was used to determine the differences in THb variables across the whole training, and Spearman's rank analysis for the calculation of correlations between THb variables and other parameters. **Results:** The analysis of the results showed that only a significant difference between measured muscles is observed in the THb slope value ( $p = 0.04$ ). Furthermore, correlation analysis demonstrates that resting THb and drop in heart rate have a significant relation (0.94) in Deltoideus muscles. Vastus Lateralis perceived a significant correlation between heart rate drop with minimal THb (0.89), resting THb (0.89), and working THb (0.94). THb slope

correlates with lactate levels (0.83). Individual results of THb slope showed different values between disciplines (e.g., increase/decrease). **Conclusion:** The analysis of the results demonstrates that there is a reactive hyperaemia response during freediving training that occurs on the local scale of the Vastus muscle. This response is connected to the anaerobic nature of freediving, where vasodilatation occurs because of the lack of oxygen.

### O38

#### **Recommendations for physical activity of the population in mature age**

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Since today's society places a lot of emphasis on physical appearance and health, it is not surprising that in the last 20 years researchers have developed a great interest in the topic of exercise recommendations for adults. **PURPOSE:** The aim of the research is to indicate exercise recommendations for people over 35 years of age. **METHODS:** A search strategy was used, using internet search engines Kobson, Web of science, Google Scholar and Pubmed. Journals in the field of sports science for sports medicine, physical fitness, sports, recreation were searched. The internet domain search was limited to studies conducted in the last 10 years. **RESULTS:** It can be noted that the general recommendation for middle-aged people is moderate physical activity, 2-3 times a week (30-45 minutes), intense physical activity 2 times a week (about 30 minutes) for a total of 150 minutes. Exercises with weights, aerobic activity such as fast walking, cycling, nordic walking are recommended. **CONCLUSION:** For better results, a greater frequency of exercise is necessary and in this way the occurrence of diseases characteristic of the 21st century will be reduced.

### O39

#### **Ankle Mobility: Does It Affect Lower Body Motor Control?**

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Adequate motor control is important for movement functionality. Research has shown that various factors have influence on motor control, including pain that have negative effects. However, influence of limited mobility is insufficiently researched, especially among athletes. Ankle represents structure through which force transmission occurs via muscle-tendon unit during various movements. **PURPOSE:** Research aim was to examine influence of ankle mobility limitation on the motor control of lower body. **METHODS:** Study included 266 athletes of both genders, aged  $18.6 \pm 2.6$  years. Participants height was  $184.5 \pm 12.3$  cm, weight  $76.6 \pm 14.2$  kg, while the body mass index was  $22.3 \pm 2.4$  kg/m<sup>2</sup>. Ankle mobility was assessed using the Ankle clearing screen as part of functional movement screening, while the Lower body motor control screen was used to measure motor control level. Measuring included both, dominant and nondominant leg. **RESULTS:** Inadequate lower body motor control is significantly more frequent in participants with ankle mobility limitations ( $p < 0.01$ ), for both legs. It was obtained that inadequate motor control is significantly more frequent in participants with ankle mobility I and II limitation grades separately, compared to participants with adequate ankle mobility ( $p < 0.01$ ). However, no significant difference in frequency of inadequate

motor control was found between participants with grade I and II mobility limitations, in dominant ( $p=0.41$ ) and nondominant legs ( $p=0.24$ ). **CONCLUSION:** It was found that limited ankle mobility significantly negatively affects lower body motor control in both dominant and nondominant leg.

#### O40

##### **Time-course of changes in muscle geometry in youth athletes**

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Skeletal muscle fascicle length (FL) and anatomical cross-sectional area (ACSA) reflect muscle geometry. During growth, muscle geometry is modified due to changes in limb lengths and hormonal signaling. Regular exercise training may also induce changes in FL and ACSA, but the interaction of training and growth has not been examined in developing athletes. **PURPOSE:** This study examined the time-course of changes in gastrocnemius medialis FL and ACSA across an age range of 10 years. **METHODS:** FL and ACSA of gastrocnemius medialis were assessed in 84 female volleyball athletes, aged 8-18 years, using ultrasonography. Athletes were assigned to five groups: 8-10, 10-12, 12-14, 14-16, and 16-18 years. Height, body mass, leg and calf length were measured. **RESULTS:** FL increased by 25%, from  $3.45 \pm 0.24$  cm to  $4.31 \pm 0.59$  cm, from 8-10 to 12-14 years ( $p < 0.008$ ) and remained unchanged from 12-18 years ( $p > 0.575$ ). Similarly, ACSA increased by 47% from  $8.91 \pm 1.21$  cm<sup>2</sup> to  $13.08 \pm 2.95$  cm<sup>2</sup> from 8-10 to 12-14 years ( $p = 0.017$ ) and remained unchanged from 12-18 years ( $p > 0.061$ ). Significant correlations were found between FL and ACSA at all ages ( $r > 0.601$ ,  $p < 0.001$ ). **CONCLUSION:** Higher rates of FL and ACSA increases were observed in athletes aged 8-14 years, a time frame that is considered crucial for muscle growth. Importantly, muscle fascicle length and cross-section demonstrated a similar pattern of growth strategy in developing athletes.

#### O41

##### **The difference in breathing frequency and volume in recreational cyclists and runners as a fraction of VO<sub>2</sub>max**

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The accessibility of variables describing physiological responses in recreational activities has increased with the use of smart technology but not all of them are as reliable. **PURPOSE:** To investigate the correlation between the variable obtained by TymeWear Smart T-shirt with direct measurement by measuring breathing frequency and volume in recreational cyclists and runners. **METHODS:** Graded exercise tests (GXT) to time of exhaustion were taken on 35 recreational runners (age 25 – 65) and 31 recreational cyclists (age 25 – 65). During this GXT, participants wore a TymeWear Smart T-Shirt measuring, breathing frequency, breathing volume, and heart rate. Participants were also connected to a Cosmed K5 gas analyzing device (breath-by-breath measurements). A blood lactate was taken at the end of each ramp increase. **RESULTS:** A significant positive correlation was found with breathing frequency and breathing volume measurements on both cycling and running GXT between the TymeWear technology and direct air exchange measurement. Both LT1/VT1 and LT2/VT2 thresholds vary between cycling and running and between direct and indirect measurements. **CONCLUSION:** Even though a significant positive correlation was found, both with breathing frequency and breathing volume for runners and cyclists further research is needed to understand and develop

LT1/VT1 establishment using calculations with indirect measurements. The results provided a positive outcome helping recreational runners and cyclists to establish their training thresholds.

#### O42

##### **The Impact of a 6-Week Step Aerobic Training on Motor Abilities and Body Composition in Adult Recreational Women**

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**PURPOSE:** This study investigates the transformative effects of a structured 6-week step aerobic training program on the motor abilities and body composition parameters of recreational women. **METHODS:** From a total of 22 participants, 10 were involved in a step aerobic training group (SA) and 12 were control group (C). The control group didn't engage in any physical activity, but underwent comprehensive assessments. Motor abilities, including strength, agility, and endurance, were evaluated through standardized tests. Simultaneously, analysis of body composition parameters, using the OMRON BF511 body composition monitor, was conducted at three points (initial, control, and final). The experiment unfolded across 18 training sessions. **RESULTS:** The step aerobic training group exhibited statistically significant improvements ( $p < 0.05$ ) in motor abilities, embracing strength, agility, and endurance. In contrast, the control group displayed no statistically significant differences. While there were no observable changes in body composition and anthropometric measures within or between groups, the emphasis on refining motor abilities proved beneficial for fitness enthusiasts and trainers. **CONCLUSION:** This study emphasizes the efficacy of step aerobic training in strengthening motor abilities among recreational women. The emphasis on refining and improving motor abilities provides clarifying perspectives for those supporting a healthy and active lifestyle.

#### O43

##### **Wrestling-specific exhaustive test protocol for determining performance quality**

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The crucial actions appear when wrestlers are tired; hence exhaustive test protocols could have better applicability for distinguishing performance quality. **PURPOSE:** This research aimed to evaluate the differences between medal winners and non-medal winners in performance indices during exhaustive testing. **METHODS:** The sample consisted of 29 elite youth wrestlers aged  $17.62 \pm 1.86$  years who were divided into medalists and non-medalists according to the results in the National championships. The specific wrestling fitness test (SWFT) was conducted two times consecutively, and SWFT blood lactate and heart rate index were calculated as a measure of metabolic and cardiac response, respectively. Differences were determined using the t-test for independent samples. Additionally, multifactorial 2x2 ANOVA was used to examine the variations in performance between testing trials based on quality categories. **RESULTS:** Medalists had a higher number of repetitions ( $t=2.55$ ,  $p=0.01$ ), and a more favorable metabolic response ( $t=2.49$ ,  $p=0.02$ ) in the second testing trial compared to non-medalists, which was confirmed with ANOVA analysis ( $F=4.05$ ,  $p=0.001$ ). **CONCLUSIONS:** The most important finding is that wrestlers did not differ in performance indi-

ces during the first testing trial, while there were performance and metabolic differences during the second testing trial. This research supports the theory that exhaustive test protocols are more applicable for distinguishing performance quality which might lead to suggestions for sports science professionals to use similar protocols in talent identification and performance monitoring in wrestling.

#### O44

##### **Suitability of Cooperative Learning for Training Young Athletes from the Perspective of Coaches**

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In terms of visible learning, the pedagogical process should be centred on the student and the teacher. In order to achieve physical, cognitive and psychosocial goals, the training approach is also very important in competitive youth sport. **PURPOSE:** The aim of this study was to investigate the attitudes of coaches towards Cooperative Learning after they had completed their first units with this pedagogical model in youth athletics. **METHODS:** Four athletics coaches were interviewed after conducting 30 sessions of Cooperative Learning. They also wrote a reflective analysis after each session. Data were analysed using thematic analysis and constant comparison. **RESULTS:** Four themes were identified: (a) 'Attitudes towards Cooperative Learning', (b) 'The role of the coach and athlete in the training process', (c) 'Interpersonal and small-group skills' and (d) 'The transition to Cooperative Learning and the challenges involved'. Coaches and children developed very positive attitude towards Cooperative Learning and group work in general. **CONCLUSION:** Although it wasn't easy at first, both the coaches and the children got used to the new training approach over time. The children improved their interpersonal and small group skills and became active learners who had fewer problems taking on different roles. However, the coaches didn't feel that they had lost their relevance as coaches, but acknowledged that they would need additional training to be able to deliver a student- and coach-centred training process.

#### O45

##### **Profiling of the positional running performance among FIFA confederations – Analysis of the FIFA World Cup 2022**

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**PURPOSE:** The aim of this study was to identify positional running performance differences among FIFA confederations during the 2022 FIFA World Cup matches held in Qatar. **METHODS:** A sample of players (n=642) who played the whole match was used, including only matches played without extra time. Players were positionally classified according to their playing position as central backs (CB), full-backs (FB), defensive midfielders (DM), central midfielders (CM), wide midfielders (WM) and forwards (FW). The RP variables included total distance covered (m), Zone 1 running (0-7 km/h), Zone 2 running (7-15 km/h), Zone 3 running (15-20 km/h), Zone 4 running (20-25 km/h), Zone 5 running (>25 km/h), number of high-speed runs (Zone 4), number of sprints (Zone 5) and top speed achieved. ANOVA variance estimation was used to determine positional differences in RP. Scheffe Test was used for post-hoc analysis. **RESULTS:** Results shows statistically significant positional differences among confederations in total distance running (CBs, CMs and FWs), Zone 1 (CBs, FBs and FWs), Zone 2 (CBs and FWs),

Zone 3 (CMs and FWs), Zone 4 (DMs), Zone 5 (DMs), high-speed runs (DMs, CMs and FWs), sprints (DMs) and top speed (FBs, DMs and FWs). **CONCLUSION:** This study showed that the RP profile differs among confederations in all observed positions.

#### O46

##### **Associations Between Sport Participation and Mental Well-being in Czech Adolescents**

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**Purpose:** Physical activity is pivotal in enhancing mental well-being among children and adolescents. This study aims to explore the associations between individual and team sports participation and indicators of mental health in adolescents. **Methods:** This cross-sectional study was conducted in Nov-Dec 2023 in Olomouc region, Czech Republic. The sample consisted of 839 children (46.8% girls) from 5th, 7th, and 9th grades (mean age = 13.03). Participants were asked about their life satisfaction, self-rated health, well-being, and involvement in sports activities (individual sports, team sports, or both). The study utilized t-tests to assess LS and WHO-5 scores and chi-square tests for SRH, aiming to identify differences between the frequency of sports participation and measures of mental well-being. **Results:** The results show significant associations between regular sports participation and enhanced mental well-being indicators. Specifically, children active in sports at least twice a week reported better life satisfaction (LS), higher well-being scores (WHO-5), and improved self-rated health. These differences were evident across individual and team sports, with team sports participants frequently showing stronger associations. Notably, the benefits of sports participation were observed consistently among boys and girls and across different grade levels. **Conclusions:** The findings suggest a positive association between sports participation and mental well-being among young people, highlighting the significance of physical activity in promoting psychological health and life satisfaction. While causality cannot be inferred due to the cross-sectional nature of the data, the consistent associations across various forms of sports underscore the potential of structured physical activity in enhancing the mental health and well-being of children and adolescents.

#### O47

##### **Combine tests as a predictor of situational performance in the rookie NBA season**

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NBA Combine tests provide valuable scouting information for the clubs regarding player's abilities and skills and help them in the selecting process. **PURPOSE:** The main aim of this study was to explore the predictive validity of the standardized test procedure for young basketball players on their future performance in the NBA league. **METHODS:** The participants in this study were 249 young basketball players who conducted Combine testing before their selection on the NBA Draft in the previous five seasons (2018-2022). Variables included 13 anthropometric and motoric parameters from Combine and 16 parameters of basketball situational efficiency from the rookie NBA season. All data were descriptively analyzed and canonical analysis was used to determine relationships between two observed sets of variables. **RESULTS:** Results showed that only the first pair of ca-

nonical factors had a significant correlation ( $p < 0.001$ ). When observing the factor's structure, the highest correlation on the left set was for anthropometric parameters – body height (0.95), body mass (0.79), standing reach (0.91), wingspan (0.85), and hand length (0.62). On the right set, the highest correlation with the first factor was noted for total rebounds (0.51), defensive rebounds (0.41), offensive rebounds (0.62), and blocks (0.61). **CONCLUSION:** Anthropometric parameters seem to be an important factor in both the defensive and offensive phases of the basketball game on post positions.

O48

### Examining the Association Between Physical Activity, Burnout Symptoms and Academic Performance among Health Sciences Students from Eight South-East European Countries

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**PURPOSE:** The aim of this study was to examine the association between level of physical activity (PA), burnout symptoms and academic performance among health sciences students. **METHODS:** A cross-sectional study was conducted April-September in 2023 on a sample of 3473 students from 69 faculties in 8 countries (Slovenia, Croatia, Bosnia, Serbia, Montenegro, North Macedonia, Romania and Greece) using online survey. **RESULTS:** Sufficient weekly levels of PA ( $\geq 600$  MET) were reported by 86.7% of students, 56.5% students had moderate-level of PA (600- 3000 MET) and 30.2% had high-level PA ( $\geq 3000$  MET). The highest level of PA had students from Faculty of Medicine University of Montenegro (92.9%), while students from Faculty of Pharmacy, University Ovidius in Constanța (Romania) had the lowest PA (64.7%). Only male gender and higher years of study were significant positive predictors of higher PA levels. Higher PA levels were associated with higher academic performance. Sufficient PA was the positive predictor of academic achievement ( $\beta: 0.117$ , 95%CI: 1.313–2.347). Students from Faculty of Pharmacy, University of Sarajevo (Bosnia) had the highest level of physical, cognitive and emotional burnout, while students from Faculty of Medicine University of Montenegro had the lowest. Higher PA levels were associated with significantly lower burnout symptoms. Sufficient PA was the negative predictor of physical ( $\beta: -0.074$ , 95%CI: -2.795–-1.063), cognitive ( $\beta: -0.094$ , 95%CI: -3.021–-1.45) and emotional burnout ( $\beta: -0.067$ , 95%CI: -1.456–-0.493). **CONCLUSION:** The results indicate that it is necessary to implement appropriate programs to increase PA in the student population in order to prevent burnout and enhance academic performance of students.

O49

### Functional movement screen differences between two growth-sensitive period groups of various team sport athletes

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Functionality in physical exercise or sport can be regarded as a capability to perform numerous movements without pain or any limiting factor which could compromise the end result. One way to assess function is through Functional movement screen (FMS) by interpreting its composite score. Besides training, it is considered that active growth of an athlete can have various impact on motoric and functional development. When it comes to FMS differences between sports, age groups and gender, plenty of research has been carried out, but there is a scarce data revealing differences between growth-sensitive

periods. **PURPOSE** of this study is to show difference between two growth-sensitive period groups in composite FMS score and their result distribution. **METHODS:** Study included 563 athletes (age  $16.7 \pm 2.04$ ) from several team sports, divided into two groups based on their growth period. The instrument used was standard FMS battery which included seven tests and the final composite score was calculated. For data analysis t-test for independent samples was performed. **RESULTS:** Statistically significant t score was obtained and amounts  $t = -2.953$ . Rank order distribution shows higher frequency percentage favoring older group in trunk stability (45.63% of athletes got the score of 3), shoulder mobility (51.09%), active leg raise (49.45%) and inline lunge (49.19%). **CONCLUSION:** Physical growth can impact athletes mobility, trunk stability and inline lunge pattern.

O50

### Are physical literacy and physical activity levels correlated in children aged 9-10 years?

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Physical literacy (PL) is described as the motivation, confidence, physical competence, knowledge and understanding to value and engage in a physically active health lifestyle. It has been hypothesized that engaging in physical activity (PA) is associated with possessing PL, but studies rarely examined the problem in preadolescent children. **PURPOSE:** The aim of this research was to determine the possible associations between PL and level of PA in preadolescent children. **METHODS:** The sample comprised children from Split, Croatia ( $n = 97$ , 48 girls, 9-10 years of age). The PL was evaluated by PLAYself questionnaire and PA levels as assessed using the "Physical Activity Questionnaire for Older Children" (PAQ-C). Differences between genders, and age groups (3rd and 4th grade of elementary school) were established by 2-way analysis of variance ANOVA. Pearson's correlations between PAQ-C and PL were calculated for total sample, and separately for each gender, and age-group. **RESULTS:** ANOVA calculations did not reveal significant effects for gender ( $F$ -test = 1.00,  $p = 0.39$ ), or age group ( $F$ -test = 0.46,  $p = 0.50$ ). The PL and PAQ-C were not significantly correlated in total sample of participants, in boys (mixed ages), and in 3rd graders (mixed genders). Significant correlations between PAQ-C and PL were found for girls (mixed ages; 16% of the common variance,  $p < 0.01$ ), and for 4th grade children (mixed genders; 17% of the common variance,  $p < 0.01$ ). **CONCLUSION:** The significant correlations between PA and PL in girls, and in 4th graders could be attributed to the differences in participation in structured and unstructured activities. In brief, PA in these groups is primarily result of their participation in structured physical activities such as organized sports or physical education, which simultaneously result in higher PL.

O51

### The Impact of a Combined Exercise Model on Certain Dimensions of Exercisers' Anthropological Status

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Numerous studies have explored the impact of various group exercise programs on alterations in the anthropological dimensions of participants. **PURPOSE:** This study was conducted to investigate the effects of a combined model group exercise program on body composition, explosive power, and balance. **METHODS:** The sample consisted of 22 participants engaged in a three-times-weekly, 60-minute exercise

program over a three-month duration. The program included two medium-to-high-intensity training sessions and one medium-intensity session per week. The initial and final assessments of the participants included measurements of body composition, explosive strength, and balance. RESULTS: A statistically significant reduction was observed in body weight, body mass index, fat percentage, and visceral fat percentage, with  $p=0.00$ . There was a statistically significant increase in the percentage of water ( $p=0.05$ ), while no statistically significant differences were observed in the amount of muscle tissue. In tests of explosive strength, a statistically significant improvement was observed in the average values of countermovement jumps with the left leg ( $p=0.00$ ), while no statistical differences were found for the right leg. There were no statistically significant differences between the two sessions in any of the parameters related to balance. CONCLUSION: The implementation of a combined model of group exercise programs facilitated successful interventions targeting the transformative effects on body composition and explosive strength. This suggests avenues for future research, enabling comparisons with alternative models of group training programs.

### O52

#### **Analysis of Game-Related Parameters and League Rankings in Men's Volleyball Across European Leagues**

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Game-related parameters play a direct role in distinguishing between winning and losing volleyball teams, directly influencing league rankings. PURPOSE: This study aimed to assess the impact of serve, reception, attack, and block parameters on higher and lower-quality leagues, while also examining their influence on league rankings. METHODS: Data from men's volleyball matches in higher-quality leagues spanning from the 2012/13 to 2022/23 seasons in Italy, Poland, and Turkey, and matches in lower-quality leagues spanning from the 2018/19 to 2022/23 seasons in Czech Republic and Belgium, were analyzed, totaling 820,769 points. The study compared league rankings across all leagues and evaluated serve, reception, attack, and block parameters for effectiveness and errors. RESULTS: Higher-quality leagues demonstrated a significantly greater number of points won through attacks ( $p=0.00$ ), perfect reception ( $p=0.00$ ), and errors during reception ( $p=0.00$ ), as well as a lower number of points won through serving ( $p=0.03$ ), attacking errors ( $p=0.00$ ), and points won through blocking ( $p=0.00$ ) compared to lower-quality leagues. No significant differences were observed in serving errors ( $p=0.82$ ). When comparing league rankings, statistically significant differences were found in the number of points won through serving ( $p=0.00$ ), points won through attacking ( $p=0.00$ ), points won through blocking ( $p=0.00$ ), reception errors ( $p=0.00$ ), and attacking errors ( $p=0.00$ ). CONCLUSION: Our findings underscore the importance of considering league quality when evaluating team performance and strategies in competitive volleyball.

### O53

#### **Forms of risky behavior of young people via social media**

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Cyberspace becomes equal to real space, as a place for establishing and maintaining social relationships, both for young people and adults. PURPOSE: The research was conducted with the aim of identifying and distinguishing the categories of participants in cyberbullying. METHODS: The sample included 285 respondents from Sremska Mitrovica (141 boys, 144 girls), aged 18 to 20 years. In this research, a modified version of the RCBI scale was used, with the subscales bullying and victimization, with the addition of the witness subscale. The respondents declared about their previous experience on social networks. RESULTS: About 40% of respondents do not participate in bullying in any way, 14.7% of respondents are witnesses, and 44.9% of respondents can be said to be involved in bullying as bullies, victims and bully-victims. As for risk factors, there are differences by gender, in relation to parental involvement, time spent online and time spent on social networks. CONCLUSION: The obtained results mainly confirm the risk factors identified in foreign research and their knowledge enables the planning of preventive actions in this area and the reduction of risks, and therefore the improvement of the mental health of young people.

### O54

#### **Different submaximal tests to evaluate aerobic endurance among older adults: Gait speed and heart rate**

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The benefits of exercise and physical function are well-known for quality of life and health. As longevity increases, paying attention to well-being and health is increasingly important. PURPOSE: This study aimed to assess the efficacy of different submaximal tests to evaluate aerobic endurance among older adults. METHODS: 42 older adults (60% women) aged 71.93 years  $\pm$  4.68 years old took part in three different submaximal endurance tests: A 6-minute walking test on the floor (6MWT), a 12-minute walking test on a treadmill and a self-paced 6-minute walking test on a treadmill. Heart rate (BPM) was monitored with heart rate monitors in tests. RESULTS: Significant correlation between the 6-minute walking distance (6MWD) on the floor and self-paced 6MWD on the treadmill ( $r = 0,874, p < 0,05$ ) and between 6MWD on the floor and heart rate (HR) ( $r = 0,486, p < 0,05$ ). A significant difference was also found in the distance walked in 6 minutes walking on the floor and self-selected 6MWT on the treadmill. A significant difference was also found in HR between 6MWT on the floor and 12MWT on the treadmill. CONCLUSION: The results indicate that older adults walk shorter distances in 6MWT on the floor compared to a 6-minute treadmill walk with self-selected speed, and the heart rate is expected to be higher and tends to drift more upwards as participants walk further. The findings suggest that decreased gait speed influences submaximal endurance testing performance within older adults with different heart rate responses..

## Poster presentations

### P1

#### **Legal and sociological analysis of the methodology in sports law**

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The creation and editing of laws governing sports legal relations is a fundamental process, not just a set of rules. From the point of view

of practice, it includes various institutions, including national courts and sports associations. **PURPOSE:** Disclosure of legal-sociological trends of the methodology in sports law, peculiarities of manifestation on a national and global scale. Opportunities for streamlining and optimization as an important element of law-making processes and specific to the sports industry. **METHODS:** In order to solve the main tasks, achieve the goal and prove the hypothesis, a complex methodology of researching literary and normative sources, comparative-legal, sociological-axiological and content analysis was applied. **RESULTS:** In universities, theory related to law does not always correspond well with practice, and sport is one of the fastest growing sectors. There is a difference in the way of researching methodological problems in our country and in Europe, where there is a highly developed legal theory with a strong interdisciplinary character, in the USA United States theoretical directions linked to real sports problems are placed in a central place. **CONCLUSION:** Sports law has traditions at NSA „Vassil Levski“ and is developing as a relatively new branch of law as a legal and academic discipline and is positioned as a sub-branch of civil law.

## P2

### **The Influence of Strength Training and repeated sprint training in the Pre-season Period on motor abilities of elite level women football players**

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**PURPOSE:** The objective of this study was to determine the influence of 12-week strength training and repeated sprint training on motor abilities. During COVID-19 pandemic, official start of the season was postponed for several weeks, and thus the pre-season period for elite level women football players lasted for 12 weeks. **METHODS:** The sample of respondents consisted of professional women players, members of the first team that competes in the highest rank of league football in China. Initial testing was conducted before preseason preparation on first training, while final testing was conducted after 12 weeks of training programme. **RESULTS:** The results show statistically significant differences ( $p < 0.05$ ) in all observed variables (Countermovement Jump; Squat jump, Plank hold, Bench Press, Long jump, and 30m Sprint) for testing motor abilities. **CONCLUSION:** The training plan and program conducted that lasted 12 weeks have made significant improvements in almost all players in their motor ability test results. It can be concluded that the authors' training plan with emphasis on strength training in the gym and repeated sprint abilities training on the pitch produced desired effects. Improvements in the motor abilities of women football players, which are important for situational efficiency and overall performance, are significant.

## P3

### **Teachers' and Students' Needs Analysis Regarding the Usage of English for Specific Purposes**

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Accession to the European Union and the implementation of the Bologna reform have led to the fact that university teaching staff in Croatia are expected to implement English Medium of Instruction (EMI) as an integral part of their teaching inventory while students are encouraged to enroll in academic subjects taught in English. **PURPOSE:** The goal of this study is: 1) to examine, analyze and provide practical guidelines derived from teachers' and students'

attitudes towards using English as their medium of instruction, i.e. using English for Specific Purposes (ESP) as an integral part of subjects held in English; 2) to provide feedback to all the ESP teachers regarding the necessity of creating adequate teaching materials for teaching ESP. **METHODS:** The study sample consisted of 32 teachers and 91 students randomly selected from the Faculty of Kinesiology University of Split. Data was collected using an adapted questionnaire. The reliability of the questionnaire was confirmed since the t-test for dependent samples showed no significant differences between the first and second measurements ( $p > 0.05$ ) and correlation was high and significant ( $r$  ranged from 0.71 to 0.89;  $p < 0.05$ ). **RESULTS:** The results show that the usage of ESP enhances the teaching and learning process and enriches students' general knowledge of English. **CONCLUSION:** The findings suggest that the number of teaching hours for subjects held in English should accumulate, the availability of subjects held in English should increase and, to achieve this, the government should work in conjunction with university management and teachers.

## P4

### **Cognition and Sport: How Does Sport Participation Affect Cognitive Function?**

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Cognitive-executive functions are essential processes for daily activities, academic, occupational and sporting success, health and quality of life. One way to improve them is through regular participation in physical activities. **PURPOSE:** The aim of the study is to assess the effect of sports training on cognitive-executive functions. **METHODS:** A total of 328 boys (220 young soccer players and 108 boys without participation in sport training) aged 12.0–14.9 years performed tests to assess their cognitive-executive functions (Deary-Liewald task, Corsii block test, Trail Making test). Two Way Anova was used to evaluate the significance of differences in cognitive functions in terms of two factors - sport (sporting vs. non-sporting boys) and age (12, 13 and 14-year old boys) and their interaction. Presented results are a part of the research grants projects VEGA 1/0481/22 and ERASMUS+ Sport no. 622594-EPP-1-2020-1-SK-SPO-SCP. **RESULTS:** Two Way ANOVA showed a significant effect of sport (in favour of soccer players) and age (increasing performance due to age in the soccer players group, ambiguous results in the non-sporting group) in the Deary-Liewald task assessing simple and choice reaction time. There were no significant effects of the observed factors in the Trail Making test and Corsii block test tasks. No effect of group\*age interaction was demonstrated in any of the cognitive-executive tasks. **CONCLUSION:** The results indicate the influence of age and training process, especially in sports games, on reaction abilities. Short-term memory and visual control, perception, working memory, and cognitive flexibility are not significantly affected by participation in sport.

## P5

### **Assessment of Movement Functionality of Young Female Athletes**

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The movement functionality contributing to the correct, economical and efficient execution of the movement. With muscle mobility and joint interaction it gives the quality, volume and control of the

movement in both static and dynamic mode. **PURPOSE:** The study aimed to evaluate the movement functionality in young female athletes. **METHODS:** A total of N=60 female athletes aged 10-12 years divided into two groups (N1=30 gymnastics and N2=30 basketball) were tested with a Functional Movement Screening - FMS battery of 7 tests. In order to establish the differences in each individual test, Chi-square test was applied. For composite score an independent t-test was used. The significance level was set at  $p \leq 0.005$ . **RESULTS:** The results indicate that there is a statistically significant difference in four analyzed variables in favor of gymnastics athletes: hurdle step movement ( $\chi^2 = 7.937$ ;  $p = 0.005$ ), linear lunge action ( $\chi^2 = 19.200$ ;  $p = 0.000$ ), active leg lift ( $\chi^2 = 14.549$ ;  $p = 0.001$ ) and trunk stability push-ups ( $\chi^2 = 34.381$ ;  $p = 0.001$ ). A composite FMS score was  $19.43 \pm 0.817$  and  $16.03 \pm 1.752$  for gymnastics and basketball athletes, respectively. **CONCLUSION:** Early specialization, without first practicing the basic sport, can lead to insufficient stability and mobility in the joints. Lack of movement control in the joints results in unbalanced movement with the compensatory role of other parts of the body, which leads to the possibility of injury and asymmetric development through adulthood.

## P6

### Differences in Anthropometric Characteristics and Body Composition between Professional Montenegrin Footballers and Karate Athletes

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**BACKGROUND:** Athletes should have anthropometric characteristics that correspond to their specializations. Therefore, it is considered that there should be certain differences in anthropometry and body composition between athletes in different sports. **PURPOSE:** This study aimed to determine the differences in anthropometric characteristics and body composition between professional Montenegrin football players and karatekas. **METHODS:** This study consisted of a total of 34 professional male athletes from Montenegro divided into two groups: Football players (n=19, 20.74±4.32 years) and Karate athletes (n=15, 20.47±4.91 years). Anthropometric 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 (UIS), lower leg skinfold (LIS), body mass index (BMI), fat percentage (FP), and muscle mass percentages (MP). The differences in anthropometric characteristics and body composition between football players and karatekas were determined using a statistical procedure with a t-test for small independent samples. **RESULTS:** It was determined that there are no differences between football players and karate athletes in anthropometric characteristics and body composition, except in lower (.000) and upper leg skinfold (.000). **CONCLUSION:** The results suggest that there are some differences in anthropometric characteristics between football and karate athletes, mainly relating to legs skinfold. Specifically, this is because in karate, the dominant leg is used for strikes and is more engaged, while in football, the weaker leg is stationary and endures the greatest load during various activities such as acceleration, deceleration, etc. However, for more comprehensive conclusions, an analysis should be conducted on a larger sample of athletes.

## P7

### Physical literacy, physical activity, sedentary behavior and sport participation; analysis of the associations in preadolescent children

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It is often hypothesized that physical activity (PA), sedentary behavior (SB), and physical literacy (PL) are associated to sport participation (SP). However, gender-specific analyses of this problem are rare in preadolescent children. **PURPOSE:** The aim of the study was to identify gender-specific associations between PL, PA, SB and SP in children aged 9-to-11 years. **METHODS:** We observed 137 children (46% boys) from Mostar, Bosnia and Herzegovina aged 9 to 11 years. Their PA, PL, SB and SP were evaluated in February 2024. Associations between study variables were analyzed for total sample, and separately for boys and girls, by Pearson's correlation coefficient. **RESULTS:** When observing total sample (not dividing boys and girls), PL was correlated with SP and PA ( $r = 0.23$  and  $0.46$ ,  $p < 0.05$ ), but not with SB. In girls, SP was correlated with PL ( $r = 0.23$ ,  $p < 0.05$ ), and PA ( $r = 0.67$ ,  $p < 0.05$ ). Among boys, the correlation between PL and PA was significant but lower than in girls ( $r = 0.25$ ,  $p < 0.05$ ), while SP was correlated to PA to a greater extent than in girls ( $r = 0.41$ ,  $p < 0.05$ ). **CONCLUSION:** Despite significant associations between SP, PL and PA, the SB was not significantly associated to any of the studied variables, indicating that background of SB in preadolescent children should not be associated to active lifestyle. Further studies should explore the background of these associations in more details.

## P8

### Impact of football set-pieces in the European club tournaments in the 2022/2023 season

Danail Ivanov

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Set pieces (standard situations) in football are an important part of the game. Research on goal performance in major championships is important and can lead to evolutionary trends in soccer. Purpose of this research is to track the success of the teams from the strongest club tournaments in Europe - the "Champions League" and the "Europa League". **METHODS:** the present research was conducted in period of September 2022 to June 2023 year. For video processing of the data, we used the most modern equipment and software: Wyscout for a database of video recordings from the meetings, Hudl studio for video editing and presentation. We applied mathematical and statistical methods to process the obtained values. **RESULTS:** we analyzed all 372 goals from the Champions League, scored in 125 matches and scored in the second most powerful competition - 381 goals in 141 football matches. In the Champions League, 59 goals were scored from set pieces and 34 penalty kicks were taken. And in the "Europa League" the same indicators were 67 from standard situations and 35 penalties, respectively. In-depth analysis of Europe's most elite tournaments shows that set-pieces can be a game-changer at the highest level of modern football. **CONCLUSION:** The moments from set-pieces in UEFA tournaments brings with it prerequisites for more shots on the opponent's goal and top ranking.

**P9****Motor competencies among athletic population of 9- and 10- year old children**

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**PURPOSE:** The purpose of the study was to examine basic motor competencies of primary school children relative to their sport participation. **METHODS:** The testing was carried out in a group of sporting population of children of younger school age (n=86). The monitored group consisted of sport population (n=53) and non-sport population (n=33). The focus was the comparison of the obtained data of selected movement competences of the monitored group of children of younger school age, obtained through the MOBAK 3-4 test battery. **RESULTS:** The results of the research show that children who play sports receive a similar level of movement skills as non-sporting children in the motor area of object-movement. Statistically significant value was recorded in the field of self-movement. The fact is confirmed that children with regular sports activities achieve a statistically higher level of physical literacy, which is reflected in the level of measurable physical competences. **CONCLUSION:** The study responds to the scientific research requirement of expertise in educational practice. It points to the necessity of using diagnostics of movement competences in school practice and its educational utility in favor of creating a solid foundation for current and future physical education. The study was supported by the scientific project No. 1/0162/22 "Learners' motor competences in the context of primary education - determinants and possibilities of stimulation", and by the Project (GaPU) no. 26/2023 with the title: Basic motor competencies of 9-10- years-old sport participating children.

**P10****Sports for all management model through the application of different marketing concepts**

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The understanding of the concept of marketing is connected with its application as a modern management approach for the implementation of effective policies in different areas. The most significant contribution of marketing today is that it helps shift the focus of management from production and product to market and consumer needs. **Purpose:** The aim of the present research is to prepare a model for studying and managing the system of sports for all in Bulgaria, in different directions, at the national, regional and institutional level, based on some marketing concepts. **Methods:** The following scientific methods are used to implement the research: theoretical analysis of the application of Traditional (Business) Marketing, Relationship Marketing, Network Marketing and Social Marketing in the system of sports for all. Monitoring included of complex implementation of marketing activities in the Bulgarian Sports for All Federation. Case study for the analysis of specific key situations in the activities of the Federation. **Results:** The analysis of the application of complex marketing concepts in the management of sports for all builds a model that will serve as a mechanism for imposing policies, developing strategies and programs, realizing the main goals and tasks, according to the socio-economic conditions, in which it functions. **Conclusion:** such a marketing approach contributes to revealing the processes reflecting the formation and satisfaction of people's sports interests and needs.

**P11****Kinematic Analysis in ball release phase for Free Throw in Basketball**

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The study includes a total twenty elite basketball players from the Kosovo Super League teams: K.B. Prishtina, K.B. Kerasani and K.B. Lipjan. **PURPOSE:** The purpose of this study was kinematic analysis of the ball release phase, for the free throw shoot in basketball. **METHODS:** Video recordings of the shooting performance techniques are done with three Canon HD cameras, set at 90-degree angles, which can reproduce sixty pictures per second. 10 variables were selected for kinematic analysis. Only one successful shot from each player was taken for analysis. Analysis is done with Kinematic Analysis System (APAS), outputting the required results and values of the kinematic indicators. The data collected were processed by statistical analysis software "IBM SPSS 20", and statistical parameters were determined using the methods: arithmetic mean, standard deviation, minimum score, maximum score, Skewness and Kurtosis. **RESULTS:** The confirmation of the mutual influence of the variables was done by the Pearson's coefficients correlation method. At the results of the Pearson correlation coefficients of the kinematic analysis of the ball release phase, for free throw shoot, variables that showed high correlations with statistical significance at the level ( $p = 0.01$ ) are: Distance between center of gravity and ball at starting position (DCGSP), and the Height of the balls release (HBR) with correlation coefficients in the value of (0,68); Distance between center of gravity and ball in final position (DCGFP), and the Height of the balls release (HBR) with correlation coefficients in the value of (0,61); **CONCLUSION:** The scientific contribution of this research also provides new insights into the optimal model of ball release phase of free throw in basketball for Elite Athletes of Kosovo.

**P12****Test batteries for the assessment of motor skills of preschool children**

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An adequate level of physical activity combined with a healthy diet throughout life it can prevent most diseases in both children and adults. Early childhood is a period of life in which healthy lifestyle habits can be adopted, considering that this is the age sensitive period, developing maritime skills is very important. **PURPOSE** The goal of this paper is to determine the most frequently applied batteries of motor tests in research on the motor behavior of preschool children. **METHODS:** Searching reference electronic databases by typing keywords: preschool children, motor skills, testing. Electronic databases that will to be used are: Web of Science, Google Scholar, Scopus and PubMed. **RESULTS:** by searching reference databases based on keywords 112 scientific articles were found. By studying the downloaded articles, it was found that in when testing the motor behavior of preschool children, they most often apply the following battery of tests: PREFIT, TGMD2, BOT2 and KTK. **CONCLUSION:** By testing and monitoring progress the physical education teacher or trainer provides individual training for children in motor skills monitoring the child's progress, but the results can also be com-

pared with the norms determined by the battery tests they have. The data obtained from children's motor tests show the quality of the program which is applied.

### P13

#### Physical activity and mental health of students

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Apart from the great importance in the prevention of primarily cardiovascular, and other non-communicable diseases, physical activity can help in the prevention and treatment of some mental disorders such as anxiety. "Fear of fear", as some also call anxiety, is present in adults, younger, and even students. PURPOSE: The research problem is the mental health of students, and the aim is to examine the impact of physical activity (FA) on the manifestation of anxiety symptoms (DAS) in sports and psychology students. METHODS: The sample of respondents consisted of 159 students, of which 43 were male and 116 were female, aged 22,  $22 \pm 6.04$  years. All respondents are undergraduate students of the Faculty of Sport and Psychology, TIMS, from Novi Sad. The short version of the Depression, Anxiety and Stress Scale (DASS-21) and the short form of Godin Leisure-Time Exercise (GSLTPAQ) were used as measuring instruments. Spearman's correlation coefficient for non-parametric statistics was used for data processing. RESULTS: The obtained results clearly indicate that students who practice intensive physical activities had a negative correlation with the degree of anxiety (Correlation Coefficient  $-.161$   $p=0.045$ ), in contrast to students who practiced light and moderate activities where there is no statistically significant connection,  $p=0.626$   $p=0.318$ ). CONCLUSION: The obtained results confirm that regular exercise of intensive physical activities can help students to prevent mental disorders such as anxiety.

### P14

#### Investigating Anthropometric and Weight Parameters among Youth Montenegrin Football Players: Differences between Top and Bottom Table Teams

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BACKGROUND: Findings related to anthropometry and weight status of players are of great importance for football. It is known that there are differences in anthropometric characteristics among football players of different levels of competition; however, differences in anthropometric profiles between youth football players from the top and bottom teams have not been sufficiently investigated. PURPOSE: This cross-sectional study aimed to determine the differences in anthropometric and weight parameters between youth football players from the teams of the top vs bottom of the league. METHODS: This study consisted of a total of 136 youth football players from the first cadet league of Montenegro divided into two groups: players from the top-ranked teams ( $n=61$ ,  $16.04 \pm 0.63$  years) and players from the bottom-ranked teams ( $n=75$ ,  $16.00 \pm 0.76$  years). The standard international biological procedure was used to determine anthropometric characteristics. Anthropometric characteristics were evaluated by a battery of 7 variables: arm span (AS),

body height (BH), body mass (BM), body mass index (BMI), waist circumference (WC), hip circumference (HC), and waist-to-hip ratio (WHR). RESULTS: Based on student the independent t-test, it was determined that there are some differences between groups in anthropometric characteristics. Football players from the top teams had higher values of body mass index (.017), waist circumference (.000), and waist-to-hip ratio (.000), while players from the bottom teams had higher values of hip circumference (.005). There were no differences between the groups in other parameters. CONCLUSION: The results showed that there are certain differences between cadet groups, with players from better teams having higher values of weight-related parameters. However, for future research, it would be necessary to examine these differences among youth footballers relative to their position within the team.

### P15

#### The impact of physical activities and sports on the morphological structure and motoric abilities for girls in schools in Pristina

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The purpose of the research was to analyze data on the impact of physical activities and sports on the morphological structure and motor abilities of students for a healthier life. The research was conducted with a sample of 154 girl's students from 7 schools in Pristina, with an average age of ( $11.71 \pm 0.75$ ) years old. The variables sample included 11 anthropometric measures that defined longitudinal dimensions and body mass, while six variables from motoric abilities. The results were analyzed with a statistical procedure according to the mathematical program SPSS for windows. The arithmetic averages of all variables will be analyzed which will be evaluated for the relationships between physical activity and morphological characteristics and motor skills for girls from Pristina. Such studies are a model for analyzing how much physical activity and sports young people do in addition to physical education and sports classes in schools, what is their morphological structure and motoric abilities and what are the suggestions for a more active life and doing sports throughout the year.

### P16

#### Strategic plan for the development of sports in Kosovo

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The purpose of this research is to design a strategy for the advancement of sports, through which programs and programming policies are created for the development of sports in Kosovo. The strategy will be compiled using the experiences of the countries in the region, which have previously designed such programs, qualitative and professional programs can contribute to the advancement of sports by promoting the country and the talents who can achieve culminating results in the European championships, world championships and Olympic games. The sample used in this research was implemented with 300 respondents from 25 sports federations, the Kosovo Olympic Committee and local government representatives.

This research can serve for the compilation of a professional strategy in our country which will have theoretical and practical values in the service of the sports community, relevant state institutions and sports organizations.

#### P17

##### **Predicting Performance Index Rating in U16 guard positions basketball players**

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Studies have shown that performance in basketball varies depending on various factors: player positions, level of competition, types competitions. Monitoring and recording various indicators and other events on the field during the game is called game performance statistics. It is often used as a criterion for the quality of basketball players and is part of the situational efficiency of players, which is of great use, above all to coaches. The International Basketball Federation (FIBA) proposed 13 standardized indicators of situational efficiency of basketball players. **PURPOSE:** The aim of this study was to create performance index rating prediction model which could be used as a tool for basketball coaches with the purpose to game performance improvement in high-level male U16 guard position basketball players. **METHODS:** Study involved 364 high-level male guard position basketball players all members of Serbian and Spanish national team U16 category. Prediction model was defined using the multiple regression analysis (backward method). **RESULTS:** The best model to predict performance index rating included consideration: PTS, 2PTS attempts, 3PTS attempts, FT, DREB, AST, PF, TO, STL ( $R^2_{\text{adjust}} = 0,27$ , Std. Err.Est = 9,71,  $F = 16,49$ ,  $P = 0,00$ ) **CONCLUSION:** By analyzing the obtained model the higher the values of PTS, DREB, AST, STL and lower values of 2PTS attempts, 3 PTS attempts, PF, TO the higher performance index rating will be.

#### P18

##### **Development of motor skills and aerobic fitness in School of Rowing**

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Previous research suggest that development of motor skills and aerobic fitness are proven to be related with health benefits of children and youth. **PURPOSE:** The aim of this research was to determine the differences between the initial and final assessments of selected basic fitness skills. **METHODS:** Participants were 8 girls and 18 boys, average age 12.4. The participants conducted a 6 months rowing training program in School of Rowing "Iktus", Osijek, Croatia. Tests used to assess fitness skills were: Squat jump (power), Australian pull-ups (repetitive strength), Coordination ladder (coordination), Sit and reach (flexibility), Beep test (aerobic endurance). The paired t-test was used to determine the improvement. **RESULTS:** The statistically significant differences were determined in all tests. The highest improvement was determined in coordination that is known to be in a sensitive stage of development in prepuberty. That is crucial because the decline of coordination is inevitable in puberty. The lowest improvement was in aerobic endurance. The most suitable age for development of aerobic endurance is still to come at the end of puberty and during the adolescence. **CONCLUSION:** Rowing is proven to develop skills and has a positive impact on children's growth and development. But still is

not the popular sport especially among youth. Further promotion of rowing needs to make it more interesting for the youth. It can not be based only on its health benefits.

#### P19

##### **Knowledge on legal issues of anti-doping regulations in professional team sport athletes; validation of the newly developed measurement tool**

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**BACKGROUND:** Problem of legal issues and knowledge on legal issues of anti-doping policy in sport is understudied, although doping is one of the most important problems in contemporary sport. **PURPOSE:** The aim of this study was to propose a newly developed questionnaire examining the knowledge on legal issues of anti-doping policy (LADR), and to evaluate its reliability and discriminative validity among professional athletes. **METHODS:** We applied test-retest study design to evaluate reliability of the LADR. Participants were 343 athletes involved in team sports from Croatia (all 18+ years, 113 females). Apart from LADR, participants responded to questions on sport-factors (i.e. sport experience, sport achievement) and socio-demographic factors. To determine reliability of the LADR, Cohen's kappa coefficient (kappa) and the percentage of equally responded queries (total agreement) were calculated. Discriminative validity of the LADR was evaluated by calculating differences between genders, and sports (volleyball, handball, soccer, basketball) by analysis of variance. **RESULTS:** Kappa coefficients of 0.69, and absolute agreement of >75% indicated proper reliability of the LADR in studied professional players. The best scores on LADR achieved basketball players, which indicated proper validity of the questionnaire, considering that basketball players had longest experience in sport comparing to other groups. **CONCLUSION:** Study evidenced proper reliability and validity of the LADR in professional team sport players. While in this study LADR was applied in Croatian language in team sport players, further studies are needed to establish its reliability and validity in other languages, regions, and sports.

#### P20

##### **Barefoot and shod performance in selected fitness tests**

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Physical fitness has an important role as health indicator and component of physical literacy. Higher fitness levels suggest better health outcomes in adolescents whereas individuals with lower levels of physical fitness are predisposed to an increased likelihood of developing chronic diseases, mental health disorders and are at higher risk for all-cause mortality. Numerous test batteries have been developed for assessing the physical fitness of both youth and adults over the years, with varying protocols for footwear implemented during fitness evaluations. The purpose of this study was to examine the differences between barefoot and shod performance of selected motor tests in adolescents. Eighty-six adolescents aged between 14 and 16 years performed standing long jump, 20-m shuttle run, and polygon backwards in both footwear conditions. A strong correlation ( $r=0.83-0.95$ ) was noted between both performances. No significant differences between barefoot and shod performance in the standing long jump and the backward obstacle course test were found, while significant differences

were noted in the 20-m shuttle run. In this test, both, boys and girls performed better in shod conditions. Interestingly, there were no significant differences in performance of all tests among those who are habitually barefoot and others. This study demonstrated that researchers could compare scores of samples in barefoot and shod performance of standing long jump and backward obstacle course tests. However, when comparing individual scores over different years, it is essential to maintain consistent footwear conditions, as differences in test conditions can provide a distorted picture of motor development.

#### P21

##### **Handstand, hang and support on bars: palm temperature differences after load**

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Contents of artistic gymnastics, the oldest organized physical activity, are often used in various forms of exercises. On parallel bars, pommel horse and high bar, the gymnasts' palms are in contact with the apparatus and there is a specific (unilateral) physical load. Different physical loads acting on the gymnasts' palms (the force of the body weight, the gripping force, the friction force and the pressure etc). have a specific impact on the temperature change of the palm and can lead to palm injuries. Our question was how different static body positions on bars affect hand temperature. Thirty-eight students from the Faculty of Sport at the University of Ljubljana were measured using a high-quality thermal imaging camera. The students performed 30 seconds of steady hang on high bar, support on parallel bars and handstand on small parallel bars. Palm temperatures were measured before loading, immediately after loading, and every 30 seconds for a period of 5 minutes after loading. Mean (XA), standard deviation (SD), maximum and minimum, and number of pixels were calculated. Our study showed that temperatures decreased significantly immediately after loading and then increased above pre-loading levels. After loading, temperatures reached a consistently higher level after 3 minutes. The lowest temperature decrease was after hang, 4,3 - 1,9 °C. After support and handstand temperature decrease was similar, between 2,5 - 1,8 °C. Further studies are needed to determine the time period in which the hand temperature reaches the pre-load temperature and to determine temperature changes after different loads.

#### P22

##### **Intersexual Differences and Relationship of Specific and General Muscle Strength of Young Sports Climbers**

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The accompanying studies show that the closest relationship to climbing performance is shown by tests focused on strength and muscle endurance of the fingers and shoulder girdle. **PURPOSE:** The aim of the study was to assess the intersexual differences and relationship of general and specific muscle strength of young climbers upper limbs. **METHODS:** The research sample consisted of 26 young climbers divided into two groups according to gender. To assess general muscle strength climbers performed

hand dynamometry, flexed arm hang and hang on bar. From the viewpoint of assessing specific muscle strength, testing included maximal flexor-finger strength test, flexed arm hang on hang-board, finger hang test. **RESULTS:** Results did reveal differences in studies variables between genders. The correlation analysis of boys muscle strength showed statistically significant relationship between the relative strength of the hand grip and maximum finger strength and also strength endurance of back and forearm muscles. Statistically significant relationship between general and specific strength endurance of back and forearm muscles was proven for girls muscle strength. **CONCLUSIONS:** The findings suggest that appropriate assessment of specific and general muscle strength could serve as a tool for sport-specific selection.

#### P23

##### **Intra-rater and test-retest reliability of cervical movement control test (the Butterfly test) in healthy older adults**

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The cervical spine plays an important role in the sensorimotor control system and research suggests that there is an association between advancing age and disturbances in sensorimotor control functions, including cervicocephalic kinaesthesia. **PURPOSE:** The aim of the study was to evaluate the intra-rater and test-retest reliability of the Butterfly test for the assessment of cervical movement control in healthy older adults. **METHODS:** Sixteen older adults performed the Butterfly test (NeckCare, Iceland) each assessed on two occasions within a single day with a head-mounted inertial measurement unit at three difficulty levels (repeated three times at random order). During the test, participants were required to track an unpredictably moving target along three predefined trajectories invisible to participants. Two-way mixed-effects intraclass correlation coefficient (ICC) for absolute agreement was used to study intra-rater and test-retest reliability. Parameters calculated were amplitude accuracy (AA; the average distance between the target and the head-mounted cursor) and time-on-target (ToT; directional accuracy). **RESULTS:** Intra-rater reliability was moderate to good, with ICC values ranging from 0.80-0.88 for AA and 0.72-0.84 for ToT, and good to excellent for test-retest reliability, with ICC values from 0.86-0.91 for AA and 0.80-0.90 for ToT. **CONCLUSION:** The Butterfly test proves to provide sufficient reliability for assessments of cervical spine movement control in older adults.

#### P24

##### **Popularity of Artistic Gymnastics in Ten-Year-Old Children**

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The success of talented gymnasts from Croatia at the international level have contributed to the great increase in the popularity of Artistic Gymnastics in that country. **PURPOSE:** The aim of this research was to determine the popularity of gymnastics among ten-year-olds during sports activities as part of the Summer Health School program. **METHODS:** A total of 91 children (56 girls and 35 boys) aged 10.46 years participated in the evaluation in the period from August 8 to September 3, 2023. The modified part of the PAC-Q (Physical Activity Questionnaire (Elementary School)) questionnaire was used to assess the representation and popularity of gymnastics during the Summer Health School. Using Statistica 14, basic descriptive indi-

cators and frequency tables were calculated. RESULTS: The results indicated that gymnastics was practiced once or twice a week. Children liked swimming (10.99%) and gymnastics (13.19%) the most. Football (17.58%), swimming (12.08%) and gymnastics (12.08%) were the most fun sports. The gymnastic elements that they learned are the back roll (40.44%) and the cartwheel (5.49%). Gymnastics is more popular among girls than among boys – 25% of girls mention gymnastics, while 2.86% of boys said it is less popular. Which activity was the most fun? Unlike other sports, gymnastics was mentioned by 30.36% of girls and 2.86% of boys. CONCLUSION: Artistic Gymnastics is a basic sport that can be adapted to different populations and different working conditions.

## P25

### Association between Game-Related Volleyball Parameters and League Placement in the Croatian Women Volleyball Superleague

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Volleyball's league rankings are influenced by various game-related parameters crucial for athletes and coaches. PURPOSE: This study aims to analyze these parameters' association with league ranking in the Croatian Women's Volleyball Superleague. METHODS: Data from 416 matches spanning the 2020/21 to 2022/23 seasons were examined, totaling 1,540 sets and 46,150 points. Teams were categorized into top and bottom six positions to compare competitive differences. The study focused on serve, reception, attack, and block parameters. RESULTS: Higher-placed teams exhibited a higher number of serves ( $p=0,00$ ), more points won through serving ( $p=0,00$ ), fewer poor service receptions ( $p=0,00$ ), more points scored through attacks ( $p=0,00$ ), and more points scored through blocks ( $p=0,00$ ). A statistically significant association with league placement was found with total number of serves ( $r=-0,89$ ,  $p=0,00$ ), points won through serving ( $p=-0,60$ ,  $p=0,00$ ), positive serves  $r=-0,84$ ,  $p=0,00$ ), total number of service receptions ( $r=0,72$ ,  $p=0,00$ ), total number of service reception error ( $r=0,79$ ,  $p=0,00$ ), poor service receptions ( $r=0,55$ ,  $p=0,00$ ), attacking errors ( $r=0,44$ ,  $p=0,01$ ), attacks resulting in opponent's points from blocks ( $r=0,39$ ,  $p=0,02$ ), points scored through attacks ( $r=-0,85$ ,  $p=0,00$ ) and points score through blocks ( $r=0,49$ ,  $p=0,00$ ). CONCLUSION: These findings highlight the importance of serving, reception, and attack efficiency as key components for achieving better rankings, providing valuable insights for coaches in prioritizing training processes.

## P26

### Are the existing teaching programmes optimal or they can be more effective for non-swimmer children?

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PURPOSE: The objectives of this study were to evaluate and compare the success of three teaching programs for non-swimmer children, equal in content and different in number of hours. METHODS: The sample of respondents consisted of students in the third grade of primary schools. The collected data of the final grades obtained based on the scale of swimming knowledge acquisition were analysed according to the frequency of the achieved preset criteria in the subgroups of non-swimmers according to the duration of

the programme. RESULTS: The success of the training programme for non-swimmers lasting 12, 16 and 20 hours did not significantly affect the level of swimming knowledge in relation to the criteria. The results show that the non-swimmer training program lasting 12 hours has a success rate of 28.95%, the 16-hour programme has the success rate of 34.29%, and the 20-hour non-swimmer training had a 76% success rate. CONCLUSION: The research determined that the success of the training program for non-swimmers lasting 12, 16 and 20 hours did not significantly affect the level of children's swimming knowledge of children in relation to the criteria that at least 70% of non-swimmers become swimmers and to swim a 25 meters, while the remaining non-swimmers should progress minimum of 5 grades according to the criterion of acquisition of swimming knowledge.

## P27

### Physical activity in the elderly; analysis of specific correlates

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BACKGROUND: Physical activity (PA) is important determinant of quality of life, particularly in elderly. Therefore, in order to intervene efficiently, correlates of PA in this age group should be evidenced. PURPOSE: The aim of this study was to evaluate health-related and sociodemographic factors associated to PA in elderly (+65 years) from Croatia, and Bosnia and Herzegovina. METHODS: We surveyed 312 participants (all +65 years of age; 41% females), and evaluated their health status (by Short Form Health Survey - SF-12), sociodemographic variables (i.e. gender, education level, urban/rural living environment), and physical activity levels (by Physical Activity Scale for the Elderly - PASE). Multinomial logistic regression was calculated for multinomial PA criterion (low-, average-, high-PA), with remaining study variables as potential predictors. Additionally, differences between specific subgroups (i.e. males vs. females; countries) were established by t-test (for interval variables), and Chi square (for nominal variables). RESULTS: Participants from Croatia were more physically active than participants from Bosnia and Herzegovina. Older age, and poor health status were associated with lower PA. Educational status was positively correlated with PA, even when controlling for confounding effects of country of residence, age, and health-status (OR = 1.44, 95%CI: 1.20-1.70, for high-PA with reference to low-PA). CONCLUSION: Higher PA in Croatian participants is most likely related to differences in geographical regions between countries (i.e. Croatian participants mostly resided in coastal region). In order to improve the PA in elderly, special attention should be paid on persons with lower educational status.

## P28

### Psychometric properties of the Croatian version of the revised Sports Motivations Scale (SMS-2-CRO) among youth athletes

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The revised Sports Motivations Scale (SMS-2) has not been checked for psychometric properties in the Croatian language. PURPOSE: This study aimed to determine the psychometric properties of the

Croatian version of the SMS-2 including factor structure, internal consistency, test-retest reliability, and discriminative validity in youth Croatian athletes practicing different sports. **METHODS:** This research included 83 participants (44 female and 39 male) 14 to 23 years of age. The study included demographic variables, sports variables, and sports motivation variables measured by the translated SMS-2 into Croatian language. Exploratory factor analysis with principal component analysis checked the factor structure of SMS-2-CRO. Internal reliability was checked using Cronbach's Alpha, composite reliability using McDonald's Omega, and test-retest reliability using the Intraclass Correlation Coefficients and 95% confidence intervals. Gender and sport type differences were calculated by the Mann-Whitney U-test. **RESULTS:** Factor analysis revealed four independent main factors which explained 69.98% of the variance. Internal consistency of the SMS-2-CRO was acceptable to good for all subscales (Cronbach's  $\alpha$  up to 0.86) except for the introjected regulation subscale. Likewise, composite reliability was acceptable for all subscales (McDonald's  $\omega$  up to 0.87) except for the introjected regulation. **CONCLUSION:** Included athletes had high autonomous motivation, while males had higher levels of external regulation compared to female athletes. SMS-2-CRO displayed satisfactory psychometric properties, and it can be used in future research and also by coaches to optimize the performance of their athletes.

**Keywords:** self-determination theory, autonomous motivation, sport psychology, adolescents.

## P29

### Artificial intelligence, a paradigm in the 21st century

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New technologies have always caused a revolution in the progress and development of society. Now we expect the same thing to happen with artificial intelligence, which is developing rapidly, beyond all the expectations of scientists in the field, but this new technology brings much more controversy and risks to society than any we have encountered so far. As it takes large steps towards superintelligence, this phenomenon threatens to surpass human intelligence in the near future, which would be an unknown and a challenge for the human race. Considering this, the world powers are careful and try to slow down the invasion of this technology, so that society and countries can prepare for this new platform that promises a more comfortable life and perspective in all spheres of life, and so that this new technology and its development can be fully controlled by people. The possibilities are enormous, if we know that this technology learns from experience and creates its own intelligence, which far surpasses human capacities. Of course, all these software capacities should be supported by hardware and large funds are needed for further development and research of this sophisticated phenomenon.

## P30

### Sport participation, physical activity and cannabis misuse; Cross sectional study in college students in post-pandemic period

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**BACKGROUND:** Pandemic period negatively influenced physical activity and sport participation, and increased likelihood

for substance misuse (SUM), including cannabis consumption (CC). Sport participation (SP) and physical activity (PA) are considered as being potentially protective against SUM, including CC, but there is a lack of knowledge on a problem in post-pandemic period. **PURPOSE:** This study aimed to identify the possible associations between sociodemographic factors (SDF), SP, PA and CC in college students in the first post-pandemic year. **METHODS:** Participants were college/university students from Croatia and Bosnia and Herzegovina ( $n = 444$ , 213 females, 19-26 years of age) who were observed over the first post-pandemic year on SDF, SP, PA, and CC. Previously validated questionnaires were used by online questioning. Differences between groups were established by Mann-Whitney test (for ordinal variables), Chi square (for nominal variables), and t-test (for interval variables). Logistic regression for categorical CC criterion (consumers vs. non-consumers) was calculated to identify the associations between study variables and CC. **RESULTS:** Results showed higher prevalence in Croatian students, with no significant difference between genders. Males were more involved in sports, but no significant differences in PA between genders and countries were found. Logistic regression controlled for "country" as covariate evidenced lower likelihood of CC in males who were more physically active (OR = 0.78, 95%CI: 0.65-0.96), but no significant association between SP and CC was found (OR = 1.01, 95%CI: 0.80-1.24). **CONCLUSION:** It seems that higher PA should be observed as being potentially protective against CC in college students. However, this association should not be connected with SP in this age. Since this research observed the problem in first post-pandemic year, it is possible that the period of study at least partially influenced the results.

## P31

### Relationship between injuries and motivation in recreational runners

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In recent years, running has become a popular form of recreational sports activity for adults. Multiple studies have shown that running can improve our health, but excessive loads and inadequate training can also cause injuries. **PURPOSE:** The aim of this study is to investigate the relationship between motivation for running and injuries among adult recreational runners. **METHOD:** The study involved 201 participants, consisting of 108 women and 93 men. Among them, 108 were part of a "running school" program, while the remaining 93 jogged on their own. The Behavioral Regulation in Exercise Questionnaire (BREQ-3) and the Oslo Sports Trauma Research Center (OSTRC) Questionnaire on Health Problems, which is based on the OSTRC Overuse Injury Questionnaire, were used for the research. **RESULTS:** The study found that pelvic injury was more severe in male participants, while women tended to experience serious back injuries that required them to take a break from training. All participants demonstrated high levels of intrinsic motivation. Multiple regression analysis revealed a positive correlation between injuries and intrinsic motivation in women, whereas in men, there was a negative correlation with introjected regulation. The "running school" participants showed a negative association between injury and external regulation compared to individual runners, where amotivation and injury were positively associated. **CONCLUSION:** The research findings suggest that the respondents possess an inherent motivation, which enhances their overall satisfaction. Even

though there is a slight correlation between varying degrees of self-determination and injury, it still serves as a crucial factor in preventing injuries.

### P32

#### Physical activity among health sciences students

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In the last decades, a sedentary lifestyle has become a serious problem exacerbated by the introduction of new technological inventions that have increased population immobility. Particularly concerning is the trend among young people, as it is associated with various metabolic syndrome disorders. **PURPOSE:** The aim of this research is to examine the level of physical activity among students. **METHODS:** The study involved 71 Health sciences students. For assessing physical activity, the extended version of the International Physical Activity Questionnaire was utilized. Additionally, basic anthropometric parameters were measured for the participants, including height, weight, percentage of subcutaneous fat tissue, and muscle mass. **RESULTS:** The average body mass index of participants in this study was 23.99 kg/m<sup>2</sup>. The time spent by participants in a seated position was 31 hours and 11 minutes on a weekly basis. The majority of participants were classified as moderately active individuals based on an average physical activity level of 2235.99 MET-minutes/week. **CONCLUSION:** The results of this study indicate that physical activity among the mentioned population does not significantly deviate from similar research findings. However, health sciences students should lead by example and educate others to promote a healthier lifestyle, thereby emphasizing the importance of physical activity.

### P33

#### Asymmetries in muscle contractile properties of lower limbs and in functional stability of young soccer players

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Soccer players often perform kicking, controlling the ball or other technical operations with the dominant limb. Non-dominant limb is used for stabilisation body during these actions. This could lead to development of asymmetries between limbs. **PURPOSE:** The aim of the article is to describe inter-limb asymmetry of muscle contractile properties and dynamic postural control of young soccer players. **METHODS:** 248 soccer players (age 11.5 – 15.5 y.) were tested to evaluate lower extremities asymmetries in terms of muscle belly properties using tensiomyography and functional stability using Y-balance test. Asymmetry was defined as the difference in function of one limb with respect to another in two cut-off levels  $\geq 10$  and  $\geq 15$  % differences. The study was co-funded by Erasmus+ grant no. 622594-EPP-1-2020-1-SK-SPO-SCP. **RESULTS:** The inter-limb differences recorded in Y-balance test occurred in the range from 1.2 % and 0.0 % of players, respectively, for composite score to 9.7 %, and 2.8 %, respectively, for normalized reach distance in posteromedial direction (on differences level  $\geq 10$ , and  $\geq 15$  %, respectively).

Higher prevalence of asymmetries was identified in muscle belly properties, ranging from 23.8 % (Vastus Medialis contraction time) to 72.2 % (Gluteus Maximus displacement) for asymmetry level  $\geq 10$  % and between 9.3 % (Vastus Medialis contraction time) to 54.8 % (Gluteus Maximus contraction velocity) for asymmetry level  $\geq 15$  %. **CONCLUSION:** Tensiomyography shows a higher accuracy in detecting the occurrence of asymmetries in athletes than performance-based diagnostic procedures. The results indicated that the prevalence of asymmetries is identifiable in young soccer players.

### P34

#### Elastic band, fitball and balance board exercises - methodology for building strength in order to balance the postural muscles and enhance good posture as part of the physical fitness program for healthy middle school students

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Resistance training using elastic bands and fitballs as part of physical fitness programs is considered as an important part of building strength, balance and coordination and leads to maintaining good postural control. **PURPOSE:** The purpose of the study is to apply elastic band, fitball and balance board exercises as a means of training the trunk muscles in order to stabilize the core and reflect on posture and children's health. **METHODS:** Static and dynamic exercises for improving strength, endurance and coordination were applied with resistance bands, fit balls and balance boards in the programs for fitness for healthy middle school children ages 11-14. **RESULTS:** Elastic band exercises and fitball exercises for training and control of postural muscles stimulate the interest and the engagement of children and increased the muscular strength and balance reflecting on posture. **CONCLUSION:** Elastic band exercises along with fitball and balance board exercises can be included in the methodology for building strength, endurance and coordination as part of physical fitness programs for children. They create a positive emotional stimulus during exercises, improve muscular strength, balance and postural muscle equilibrium which aids in postural correction and postural control training.

Keywords: resistance training, fitballs, posture, strength, fitness.

### P35

#### Field position and playing experience related differences in general motor-cognitive abilities of 10 – 17 years old soccer players

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In team sports like soccer, players must constantly make the accurate and rapid processing of dynamic and complex visual scenes based on the positions and movements of teammates and opponents. **PURPOSE:** The goal of the study was to analyze field position and playing experience related differences in the level of brain speed, disjunctive reactivity, and reaction speed of 10 – 17 years old soccer players. **METHODS:** A total of 142 male soccer players ( $13.27 \pm 2.35$ ) participated in the study divided by level of playing experience and field position. The diagnosis of brain speed, disjunctive reactivity and reaction speed was carried out using the BrainHQ Hawk Eye test, BrainHQ Agility test and Fitro Agility Check test. The study was supported by the project VEGA 1/0481/22 entitled "Relationship between motor docility and cognitive abilities of students. **RESULTS:** Soccer players with less playing experience demonstrated signifi-

cantly lower levels of lower limb reaction speed in all directions of the sagittal and coronal plane as well as lower level of brain speed and disjunctive reactivity than more experienced counterparts. Significant correlations were found for playing experience and quality of brain speed as well as disjunctive reactivity. CONCLUSION: The findings, relevant for talent selection and development, suggest that motor-cognitive abilities improve with increasing playing experience, and they differ depending on the player's field position.

### P36

#### Physical Activity Habits and Psychophysical Health of Adults During COVID-19 Movement Restrictions

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Group exercise, led by an instructor in fitness centres or dedicated spaces, involves multiple individuals. It boosts physical and mental health through motivation, social interaction, and a dynamic atmosphere. The COVID-19 pandemic disrupted group exercise with widespread restrictions and facility closures. PURPOSE: This research aimed to analyse the impact of the COVID-19 situation on participants' exercise habits and psychophysical health. METHODS: The study included 187 adults (27% male, 73% female), mostly aged 18-35, who regularly attended group exercise classes before facility closures. A comprehensive questionnaire covered participant details, exercise habits, sports engagement, physical capabilities, psychophysical well-being, and stress experiences. RESULTS: During COVID-19 movement restrictions, 44.9% of participants experienced a significant decrease ( $Z=-3.80$ ,  $p<0.001$ ) in physical activity frequency. Participants aged 50 and above confirmed expected reductions in flexibility (65%), endurance (54%), and strength (50%). Despite the decline in physical activity, the overall well-being rating remained unchanged ( $\chi^2=5.980$ ,  $p=0.113$ ) and stayed positive. While there was an anticipated increase in stress susceptibility during the epidemic (65% of participants), surprisingly, physical activity frequency showed no impact on stress levels ( $\chi^2=2.876$ ,  $p=0.414$ ). CONCLUSION: Throughout the COVID-19 period, group exercises and participants were significantly affected. Despite challenges, finding motivation for physical activity and considering adaptive strategies for sports engagement, even during times of restricted movement due to illness, remains essential.

### P37

#### Differences in Competitive Karate Athletes Within Physiological Characteristics

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INTRODUCTION: Contemporary Kata and Kumite disciplines have distinguished competition requirements. Top performance and sporting results in both disciplines are conditioned with a high level of physical and physiological demands. PURPOSE: To investigate differences between Kata and Kumite athletes in chosen physiological characteristics. METHODS: Forty male international-level karate athletes (N1=21 kata; age  $21.0 \pm 4.1$  years; BMI  $22.6 \pm 1.7$  kg/m<sup>2</sup> and N2=19 Kumite athletes; age  $21.7 \pm 3.0$  years; BMI  $22.7 \pm 1.5$  kg/m<sup>2</sup>) participated in cross-sectional study. Overall, 22 physiological variables were taken through spiro-ergometry maximal testing. All participants underwent the same testing procedure. ANOVA was used to obtain the differences between competitive disciplines,

with the significance level set at  $p \leq 0.05$ . RESULTS: Kumite athletes showed significantly better results in some spiro-ergometry variables regarding vital capacity, oxygen uptake, pre-exercise heart rate, ventilation parameters, maximum speed, and anaerobic threshold obtained. Differences in favor of the kumite group could be attributed to the specificity of the energy requirements and training process aimed at improving the relevant parameters of the aerobic capacity of the discipline. CONCLUSION: Aerobic capacity in kata athletes seems to have no fundamental reflections on sports performance but should be part of training preparation. Knowledge of athletes' physiological characteristics should be implemented in sports performance planning, with an obvious difference in the energy requirements of kumite and kata athletes.

### P38

#### Postural control and the use of Theraband exercise for building strength, muscle endurance and flexibility – systematic review

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Theraband exercises are widely used to increase strength, mobility and flexibility when used in rehabilitation. There are many studies that have found significant strength improving effects when using Theraband as a form of resistance training. PURPOSE: The purpose of the study is to investigate the effect of the Theraband exercises on posture, strength, muscle endurance and flexibility of the core muscles supporting good posture. METHODS: The study uses pedagogical research methods: theoretical and methodological analysis of specialized literature. Medical databases such as Science direct, Research gate, Medline were researched for articles including keywords- Theraband, posture, strength, endurance for the past ten years. RESULTS: In recent years, many new methods are used to build strength and the Theraband exercises can also be recommended for building strength, endurance and also to relieve pain. Through enhancing core muscles strength, the posture and the postural control improves. CONCLUSION: The result of this study suggests that the use of Theraband exercises is helpful for building strength and it is to be included in the methodology of physiotherapy in the treatment of posture correction.

Key words: theraband, strength, postural control, flexibility.

### P39

#### Differences in Pressure Pain Thresholds and Temporal Summation Between Sexes

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It is still unclear whether there are differences in pain thresholds and the effect of temporal summation between genders. PURPOSE: The goal was assessing pain thresholds (PPT) and temporal summation (TS) between age-matched males and females. METHODS: PPT were determined with an algometer on the forearm, lower leg and lower back. The Von Frey Filament was used for assessment of TS effect of the hand, foot and pectoral region. The distribution of the results was normal; therefore, the t-test was performed. RESULTS: The sample consisted of two groups: healthy men ( $n=32$ , average age  $27.0 \pm 2.98$ ), and healthy women ( $n=31$ , average age  $25.7 \pm 2.62$ ). There was no sig-

nificant difference in age between groups ( $p=0.067$ ). In men, higher PPT mean values were recorded (PPT forearm  $36.06\pm 15.99$  vs.  $29.15\pm 8.97$ ; PPT low back  $60.57\pm 33.84$  vs.  $55.42\pm 18.84$ ; PPT tibialis anterior  $54.36\pm 23.96$  vs.  $49.79\pm 15.17$ ), however, this difference was significant only for the forearm ( $p=0.039$ ). In women, higher effect of TS was recorded (TS hand dorsum  $14.00\pm 13.71$  vs.  $7.91\pm 6.56$ ; TS foot dorsum  $14.39\pm 14.01$  vs.  $9.49\pm 7.95$ ; TS pectoral  $13.61\pm 12.73$  vs.  $11.72\pm 9.10$ ), although significant difference was detected only for the hand dorsum ( $p=0.030$ ). CONCLUSION: Higher PPT was recorded in man and higher TS in women. These differences were not significant for all tested regions. Further research is needed, primarily on a larger sample.

#### P40

##### The effect of exercises with blood flow restriction on the limbs on the development of muscle strength and hypertrophy

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Resistance training with regulated blood flow on the limbs is characterized by low load intensity ranging from 30- 50% of the one repetition maximum. PURPOSE: The aim of the study was to assess the effect of resistance training with regulated blood flow on the limbs on changes in muscle strength and hypertrophy. METHODS: The research sample consisted of 5 probands aged  $26.4\pm 7.16$  years who performed 10-week intervention program. The weekly microcycle consisted of three training sessions, which intensity was regulated by inflatable cuffs placed on proximal parts of upper and lower limbs. Data collection was based on body composition assessment with InBody 720. Muscle strength of knee and elbow flexors and extensors was assessed with Cybex HUMAC NORM isokinetic dynamometer at four speeds ranging from 60-240%/s, supplemented by front squat and bench press with emphasis on speed during the concentric phase of the movement. RESULTS: As a result of training with regulated blood flow, there is an increase of body fat, which is also reflected in the distribution of visceral fat. The results showed an increase in knee flexor muscle strength that was not statistically significant. CONCLUSION: The present study points to the need for further verification of methods how to use regulated blood flow in training related to muscle strength and hypertrophy.

#### P41

##### Efficiency of Serve Reception Regarding the Zone of Service

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Efficiency in the serve reception phase is a prerequisite for a quick and successful attack. After a precise reception, setter can use more attacking options, so we can say that efficiency in the serve reception phase is the basis for efficiency in attack. PURPOSE: The aim of this paper is to determine whether there is a statistically significant difference in the efficiency of serve reception when the opponent serves "parallel" (from zone 1 to zone 5 and from zone 5 to zone 1) or "diagonal" serves (from zone 1 to zone 1 and from zone 5 to zone 5). METHODS: The research was conducted on a sample of 314 serve receptions performed by the senior women's team HAOK Mladost during six European matches played in the Champions League qualifiers and in the CEV Cup (European Volleyball Federation). RESULTS: The results showed that out of 314 service receptions, 207 were performed in zone 5, and 107 in zone 1. Of the 207 service re-

ceptions in zone 5, 104 of them were sent diagonally (from the opponent's zone 5), and 103 parallel (from the opponent's zone 1). Out of 107 serve receptions in zone 1, 50 of them were sent diagonally (from the opponent's zone 1), and 57 serves were sent parallel (from the opponent's zone 5). The Wilcoxon Rank Test revealed that serve reception was significantly better ( $p=0.00$ ) when the opponent served parallel than diagonal in both zones of reception (5 and 1). CONCLUSION: Considering the obtained results, we can assume that it is easier and simpler to receive serves that are performed parallel due to the shorter possible path (18 m) than those that are performed diagonally due to the longer possible path (20.12 m). By serving diagonally, the server can attack more aggressively with less possibility of error. This significantly complicates the serve reception, obviously affecting the reduction of the efficiency of service reception.

#### P42

##### The importance of modern medical imaging in diagnostics and treatment of sport-related injuries

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Adequate and prompt imaging diagnostics of sport injuries could be of crucial importance in treating sport injuries, and as early as possible return to sport activities in athletes. That means the choice of imaging modality (ultrasound (US), radiography, magnetic resonance (MR) and computed tomography (CT)), and time of examination and eventual control re-examination. PURPOSE: The goal of this paper is to search the available literature in determining the best imaging approach to sport-related injuries of muscles and joints. METHODS: Searching reference electronic databases by keywords: Medical imaging, sport injuries. Electronic databases used for analysis: Web of Science, Google Scholar, Scopus and PubMed. The research was conducted according to PRISMA guidelines. RESULTS: Ultrasound, as the most widely available diagnostic tool has advantages in prompt diagnostics of muscle injuries, but limited potential in joint injuries. Magnetic resonance is far most precise and reliable method in both muscle and joint injuries, but not as available as the ultrasound. Radiography plays the only role in bone injuries, and computed tomography is used rarely in complicated bone fractures. CONCLUSION: the review suggests that various imaging modalities have significant role in sport-related injuries. MR as most sophisticated method has the biggest potential as state-of-the-art diagnostic tool, if used timely.

#### P43

##### Secular trends in physical fitness among Slovenian children and adolescents from 1983 to 2014

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Introduction: Investigating secular trends in physical fitness among Slovenian youth from 1983 to 2014 highlights the evolving state of skill-related and health-related fitness, crucial for combating chronic diseases and enhancing cognition. Methods: This study examined 35,408 children and adolescents across four generations (1983, 1993/94, 2003/04, and 2013/14), measuring skill-related physical performance (speed, coordination, balance, flexibility) and health-related muscular fitness (standing long jump, bent-arm hang, sit-ups 60 seconds test), alongside anthropometric data. Results: Findings

indicated inconsistent changes in coordination, slight improvements in speed, reductions in flexibility, and an overall decline in muscular fitness. Leg muscle power and arm strength notably decreased, except in the oldest age group where some increases were observed. Repetitive core strength saw an overall increase. Trends varied over the decades, pointing to specific periods of decline and improvement. Discussion: The non-linear secular trends across different fitness components and periods suggest varied responses to societal and environmental changes. Positive trends in skill-related fitness were observed in early and later periods, contrasting with a marked decline in muscular fitness, especially from 1993/94 to 2003/04. Conclusion: These findings call for targeted interventions to enhance physical fitness among Slovenian youth, stressing the need for healthy lifestyle promotion, parental awareness, and governmental support to reverse negative fitness trends and mitigate health risks.

#### P44

##### **Analysis of differences between runners and rowers**

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This study aims to explore how physiological characteristics, in both absolute measures and relative to body mass, vary across athletes from different sports disciplines. PURPOSE: This study examines physiological profiles among long-distance (LD) runners, middle-distance (MD) runners, and rowers, aiming to identify differences influencing training and competitive strategies. METHODS: Participants included 13 LD runners (age 26.9±5.8 years, height 179.1±6.7 cm, weight 69.5±6.9 kg), 11 MD runners (age 18.8±2.2 years, height 180.1±5.5 cm, weight 69.5±6.5 kg), and 12 rowers (age 19.9±3.1 years, height 188.5±7.3 cm, weight 82.9±8.5 kg). All underwent a graded exercise test on sport-specific ergometers to record maximal absolute and relative VO<sub>2</sub>max values using Cosmed CPET device for spiroergometry. RESULTS: Rowers had the largest body frames and highest absolute VO<sub>2</sub>max (5.7±0.8 lO<sub>2</sub>/min), followed by LD runners (4.7±0.5 lO<sub>2</sub>/min) and MD runners (4.3±0.5 lO<sub>2</sub>/min). Relative VO<sub>2</sub>max was highest in rowers (69.1±7.1 mlO<sub>2</sub>/kg/min), then LD runners (68.5±4.2 mlO<sub>2</sub>/kg/min), with MD runners having the lowest (62.6±4.9 mlO<sub>2</sub>/kg/min). Significant differences (p<0.05) in both absolute and relative VO<sub>2</sub>max among the groups were observed. CONCLUSION: Significant physiological differences among athletes in various sports highlight the need for customized training strategies. Rowers showed superior aerobic capacity with the highest absolute VO<sub>2</sub>max, due to their larger body frames. But considering relative values, unexpectedly rowers also had the greatest values, which indicates the importance of aerobic capacity in rowing. These insights underscore sport-specific conditioning's importance, leveraging unique athlete group characteristics.

#### P45

##### **How Consumer Choices Drive Sustainability Efforts**

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Achieving the goals of the 2030 Agenda is one of the main tasks that humanity has established. Increasing the area under sustainable farming systems is one of the solutions. Organic farming is recognized as a sustainable agricultural practice, and as such represents an essential driving force in sustainable food production. PURPOSE: The main objective of this research was to estimate consumers' awareness of

their influence on sustainability, and whether they are aware of how far-reaching their impact is. METHODES: For data collecting, the technique of surveying was applied. The primary instrument was a questionnaire with mostly closed, multiple-choice questions. The survey was conducted on 200 consumers of sustainable and non-sustainable products, with a focus on sustainable and non-sustainable agriculture products. RESULTS: Following the results, a high percentage of respondents associate the terms organic agriculture with sustainable practices and know how to recognize organic products. Almost 70% of participants are aware of the importance of organic agriculture in environment protection, in maintaining and increasing soil fertility, and it is ready to increase the consumption of organic products. CONCLUSIONS: The results of this research showed that consumer awareness of the importance of sustainable farming systems in food production is high, and they are willing to increase the consumption of organic products, but it must be in accordance with their standard of living.

#### P46

##### **Problematic use of the internet among medical students**

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Introduction: Excessive use of the Internet is a growing problem today. This phenomenon is most noticeable in the younger population. Purpose: The purpose of the research is to establish whether there is problematic use of the Internet among medical students. Methodology: The sample consisted of medical students of the Faculty of Medicine in Novi Sad. PIUQ18 questionnaire was delivered to them through informal groups and profiles on social networks. Results: The results showed that there is a significant difference between students of different years of study on the neglect dimension (F(5,224)= 1.96, p= .08, η<sup>2</sup>= .04). The LSD contrast test showed that there are significant differences between students in the 6th year (M=2.08, SD=.88) of study and students in the 1st year (M= 2.64, SD= .97), 6th year and 2 year (M= 2.5, SD= .82), 6th and 3rd year (M= 2.78, SD= .99), 6th and 5th year (M= 2.65, SD= 1 .01). There are no gender or age differences. Conclusion: Medical students do not fall into the category of problematic Internet users. Respondents achieved the highest scores on the neglect dimension, and the lowest on the obsession dimension. There is a statistically significant difference between 6th year students on the dimension of neglect compared to other years of study.

#### P47

##### **Impact of a six-week training program on rowers' muscular endurance**

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Students paper, supervised by Sandra Vujkov, PhD

The rowing sport demands exceptional muscular endurance, relative strength, repetitive strength, and aerobic capacity. Work intensity is frequently within the anaerobic threshold. PURPOSE: The research aimed to assess the effects of a six-week training program on improving rowers' muscular endurance, with a focus on reducing the time needed to complete a standard 2000-meter rowing course on the Concept II rowing ergometer. METHODS: Overall N=8 nationally ranked juniors (Age 17,4 ±0,33 years; Weight 66,98±12,54 kg) with an average of four years of rowing experience participated in this study. Muscular endurance and VO<sub>2</sub>max assessment was conducted using tests of indoor rowing 2000m and 6000m on the Concept II rowing ergometer (Nottingham, UK). Research shows

that the ergometer simulates the same biomechanical and metabolic rowing as on water. Tests were performed on two separate days with 24h rest intervals in between. The results are shown as a percentage of improvement compared to initial measurements. RESULTS: The training program individually improved muscular endurance, with maximum power outputs increasing by 6.95% (at 2000m) and 15.19% (at 6000m), relative strength by 6.29% (at 2000m) and 16.55% (at 6000m). The VO<sub>2</sub>max value increased by 6.91%, measured only at 2000m. CONCLUSION: These findings highlight the positive effects of a carefully planned and individualized six-week training program on rowers' muscular endurance, relative strength, and aerobic capacity of individual rowers.

#### P48

##### Arrangement of facial wrinkles in women and influence of certain harmful factors on their appearance

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Facial wrinkles are caused by skin aging and mimic. Nowadays, there is a need to measure wrinkles, examine their occurrence time and pattern among different age groups, and the influence of risk factors (ultraviolet (UV) radiation, smoking and alcoholism). PURPOSE: Determine the arrangement and length of certain facial wrinkles of our female population and whether there are significant differences considering age and risk factors for their occurrence. METHODS: 90 respondents were divided into three age groups - the first group: 18 to 35, second group: 36 to 50 and third group: 51 and older - were photographed and filled out a survey. The arrangement and length of the wrinkles was then analyzed and measured in "ImageJ" program. RESULTS: The average distribution of wrinkles: first group - no wrinkles, and the average length of nasolabial wrinkles is 9 mm; second group - 2 frontal wrinkles, 1 periorbital on each side, the nasolabial is 29.4 mm, and the mental wrinkles are 3.5 mm on average; third group - 2 frontal wrinkles, 2 periorbital, 2 vertical glabellar, the nasolabial is 36.23 mm and mental wrinkles are 16 mm on average. CONCLUSION: The number of wrinkles and length of nasolabial and mental wrinkles increases as the age group increases. No significant correlation was found between risk factors and the number and length of wrinkles.

#### P49

##### Perception of Personal Physical Appearance Among Female and Male Students of the Faculty of Kinesiology

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In contemporary society, personal contentment regarding one's physical appearance has emerged as a pivotal aspect in the development of identity and self-assurance among youth. PURPOSE: This research examines the perception of personal physical appearance among female and male students at the Faculty of Kinesiology, aiming to explore potential gender differences and their implications for body image and self-esteem within this academic community. METHODS: The sample consisted of 69 students. The research utilizes the Body Shape Questionnaire (BSQ) as its primary assessment tool. The questionnaire consists of a total of 34 items that inquire about participants' feelings over the past month. Participants respond to these questions using a Likert scale ranging from 1 to 6. RESULTS: The normality of the distribution was tested using the Kolmogorov-Smirnov test, which indicated that the data were not normally distributed, and

subsequently, the Mann-Whitney U test was employed. Although in the majority of questions there was no significant difference, in some, female had poorer responses, such as "Has feeling bored made you brood about your shape?" (p=0.02), "Have you avoided wearing clothes which make you particularly aware of the shape of your body?" (p=0.00). CONCLUSION: Female students have lower satisfaction with their physical appearance, possibly indicating a higher prevalence of body image concerns among this demographic.

#### P50

##### Functional training in kickboxing

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Functional training has become increasingly important in the sports community due to its focus on improving physical abilities and adapting to specific sports requirements. Kickboxing is a highly dynamic combat sport that requires specific motor skills that could be developed through functional training. The primary goal is to demonstrate how personalized functional exercises can directly enhance the effective performance of a series of kicks, blocks, and punches in kickboxing. The secondary goal is reducing the risk of injury and optimizing the energy systems of athletes. The implementation of functional training could correlate with general principles and the specific sports demands: a) the power required for powerful blows, b) agility for rapid changes of direction, c) reaction speed to opponents' actions and impact escapades, d) balance for stability and reduced risk of injury, e) endurance to maintain intensity during a match, f) flexibility for a wider range of movements and strokes, g) coordination of movements for accuracy of movements and h) explosiveness to perform fast and powerful strikes. The application of specific functional exercises improves athletic performance reflected through the improvement of specific movement and intra- muscular and inter-muscular coordination. By emphasizing the correct approach to exercise, the potential for increasing endurance, reducing injuries, and improving specific motor skills in kickboxers is underlined. Considering the specific weaknesses and strengths of each athlete, personalized exercises could contribute to a more efficient training process.

#### P51

##### Crisis communication in emergency situations

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Emergency situations arise as a result of various events, resulting in losses, damages, and human suffering. The role of state authorities in such emergencies entails effective crisis communication. PURPOSE: This research focuses on crisis communication, with a special emphasis on COVID-19. The purpose of crisis communication is to impartially inform the population about the emergency situation, which can be of crucial importance for the further development of the emergency situation and crisis management. RESULTS: The research showed that during the COVID-19 pandemic, the main actors of crisis communication in the Republic of Serbia, but also in most countries of the world, were doctors and representatives of the political leadership. It was found that the main tools used in crisis communication were press conferences, special shows and television specials, interviews with experts, websites and social networks. Measures for successful communication should refer to the most im-

portant general rules of effective crisis communication. The public should be accepted as a partner, know the needs of the public and various mass media and communicate information clearly, simply, timely and reliably. **METHODS:** Specific key words "emergency situations", "crisis communication", "COVID-19" were used to search relevant databases. **CONSLUSION:** The research has significant implications for understanding the process of communication in emergency situations and for developing strategies for better management of future emergency situations. There is a need for additional research that would explore more deeply the effectiveness of different types of communication in dealing with emergencies.

## P52

### **Body Image and Self-Confidence: A Study of Attitudes Among Students of the Faculty of Kinesiology**

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In contemporary society, personal contentment regarding one's physical appearance has emerged as a pivotal aspect in the development of identity and self-assurance among youth. **PURPOSE:** Amid contemporary beauty standards emphasizing external appearance, the study among students investigates the growing significance of body image and self-confidence by examining their perceptions. **METHODS:** The research involved 55 students in the first and second year of the Undergraduate Study Program in Kinesiology at the Faculty of Kinesiology in Osijek, with 23 first-year students and 22 second-year students participating. The body image and self-confidence were assessed using the Body Shape Questionnaire (BSQ). **RESULTS:** The normality of the distribution was tested using the Kolmogorov-Smirnov test, which indicated that the data were not normally distributed; subsequently, the Mann-Whitney U test was employed. A statistically significant difference was observed in the questions "Have you been worried about your flesh not being firm enough?" ( $p=0.02$ ), where first-year students exhibited poorer self-image and lower self-confidence compared to second-year students, while in the questions "Has being with thin women made you self-conscious about your shape?" ( $p=0.01$ ) and "Have you felt happiest about your shape when your stomach has been empty (e.g., in the morning)?" ( $p=0.00$ ), an inverse situation was observed. **CONCLUSIONS:** The study among Faculty of Kinesiology students reveals significant disparities in body image perception and self-confidence between first-year and second-year students, underlining the necessity of addressing mental health concerns in fostering a positive body image and self-confidence among young adults.

## P53

### **Trends in physical activity levels and sedentary behavior in preadolescence; gender specific analysis**

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Physical activity level (PAL) and sedentary behavior (SB) are important public health concerns, particularly during childhood. However, studies rarely examined the trends in Pal and SB among preadolescent children from southeastern Europe. **PURPOSE:** This study aimed to evaluate trends of PAL and SB in children aged 9-to-11 years. **METHODS:** Participants were 137 children (54% boys) involved in regular school system, from Mostar, Bosnia and

Herzegovina whose PAL and SB were evaluated by standardized questionnaires. Analyses of differences among children of different chronological age (9-, 10-, and 11-years of age) were done by analysis of variance (ANOVA), with consecutive post-hoc test. **RESULTS:** Results showed no significant differences in PAL and SB between age-groups for total sample (F-test = 2.64,  $p = 0.07$ , and F-test = 1.52,  $p = 0.22$ ), and among boys (F-test = 0.57,  $p = 0.56$ , and F-test = 1.58,  $p = 0.21$ , for PAL and SB, respectively). Meanwhile, PAL of girls differed significantly among ages (F-test = 3.16,  $p = 0.06$ ), with no significant differences for SB (F-test = 0.55,  $p = 0.57$ ). Significant post-hoc differences for PAL among girls were identified between 10 and 11-year-old, with lower PAL in older girls. **CONCLUSION:** Although our results did not confirm dramatical changes in PAL and SB in preadolescence, it seems that decrease of PAL occurs in girls earlier than in boys. However, for a more profound analyses, further studies on larger samples and other regions are needed.

## P54

### **Health and sport advancement through implementation of innovative applications and technologies in smart cities infrastructures**

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In the era of rapid development and technological advancements, integrating and enhancing citizens' everyday well-being experiences into smart city infrastructure is crucial for delivering high-quality services and fostering sustainable urban living. **PURPOSE:** The aim of this study is to research the impact of implementing modern solutions such as applications and technologies on advancing the well-being of citizens in smart cities. **METHODS:** Focusing particularly on health and sports, keywords used while searching available literature and existing data were "health advancement", "sport", "fitness", "smart cities", "smart technology", "urban well-being", and "innovations". The research involved a comprehensive approach including literature review, data analysis and comparative testing of public health and fitness applications and devices. **RESULTS:** This research demonstrates significant improvements not only in health and sport, but also in the overall well-being of citizens, both physical and mental, when utilising applications and technologies embedded in smart cities infrastructures. The study indicates that enhanced accessibility to diverse everyday health and physical activity information through available sources increases levels of citizens' interest and engagement thus encouraging development and maintenance of healthy lifestyles. **CONCLUSION:** Results of this study emphasises the impact of integrating smart solutions, such as applications and technologies, into smart city infrastructure showing significant enhancements in the overall citizens' well-being. It also stresses the critical role of accessible information related to health and physical activity in promoting and sustaining healthy lifestyles within urban smart communities.

## P55

### **Construction of a Specific Test for Measuring Static Strenght in Rhythmic Gymnastics**

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Rhythmic gymnastics is an artistic sport in which flexibility, coordination and balance are primary motor abilities. However, strenght also plays a very important role in the performance of body and apparatus elements, but the structure of measuring strength in rhythmic gym-

nastics is not yet sufficiently known. **PURPOSE:** the goal of this study is to construct a measurement test for strength evaluation specifically to rhythmic gymnastics. **METHODS:** The sample consisted of 30 rhythmic gymnasts aged 10 – 13 and all of them are members of the same gymnastics club from Osijek. Three familiar tests for measuring static strength have been used: Side plank test, V-sit test and Biering-Sorensen test. Also, the new test has been constructed – Ladder grip test for measuring static strength in rhythmic gymnastics. **RESULTS:** The statistical analyses have shown that the new constructed test measures static strength, which is required for performing high-valued body elements. There is a statistically significant difference between individual measurements and a statistically significant correlation between individual measurements, so this test is considered reliable. **CONCLUSION:** These results confirm the hypothesis that the newly developed test measures static strength, but only in the observed sample, in this case rhythmic gymnasts. It would be good to implement the new test when selecting children for rhythmic gymnastics as well as during transitive measurements in the training process.

**Keywords:** ability, newly developed test, rhythmic gymnasts, evaluation, performance, body elements.

## P56

### Effects of four-week plyometric exercises on explosive strength in children

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Students paper, Supervised by Sandra Vujkov, PhD

Explosive strength is one of the primary successfactors for competitive karate, regardless of competitive discipline. Therefore, proper development and maintenance of explosive movements can be crucial for sports performance, especially in children. **PURPOSE:** This program aimed to determine the effects of a four-week plyometric exercise program on explosive strength in children. **METHOD:** The study involved overall 21 children of both genders (Aged  $11.38 \pm 2.63$  years; Height  $153.86 \pm 16.13$  cm, and weight  $48.12 \pm 14.47$  kg). Explosive strength was assessed through three tests: Vertical Jump (VJ), Standing Long Jump (SLJ), and Triple Jump (TJ). The program was carried out three times per week (20-30 minutes) through regular training. The measurements were carried out 4 weeks apart, under the same conditions. **RESULTS:** The obtained results showed a statistically significant difference ( $t=3.761$ ,  $p=0.001$ ) only in the SLJ after the 4-week intervention. The other two tests also showed better results after intervention but without statistical significance (VJ:  $t=1.622$ ,  $p=0.120$ , STJ:  $t=1.713$ ,  $p=0.102$ ). **CONCLUSION:** Well-planned and programmed plyometric exercises can lead to improvement in explosive strength in children. However, coaches should keep in mind individual physical responses to a training exercise in each child, even when performed under the same conditions. This kind of exercise program should be implemented in regular children's training, with an accent on sensitive periods for the development of explosive strength.

## P57

### Morphological characteristics of clear cell renal tumor - five-year experience of one institution

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**Introduction:** Kidney tumors can be benign and malignant, while

malignant are much more clinically significant. Clear cell carcinoma of the kidney (clear cell RCC) represents 2% to 3% of all malignancies, occurring in the 6th or 7th decade. **Material and methods:** Retrospectively, patient's medical records pathohistologically diagnosed with this tumor were analyzed for the time period 2017- 2023 at the Center for Pathology and Histology of the University Clinical Center of Vojvodina in Novi Sad. **Results:** Totally 240 samples of clear cell RCC was verified, male population was more affected (142 patients, i.e. 59.1%). The average female's age was 61.2, and for the male population 62.1. The most common method for obtaining material was radical nephrectomy. Looking the laterality of affected kidney, primary tumors occurred more often in the right kidney. The largest diameter of the tumor was 22 cm, and the smallest 1.3 cm. **Conclusion:** Primary kidney tumors are more common in men. Clear cell carcinoma of the kidney has a greater tendency to involve the right kidney. The most common localization of primary kidney tumors is the upper pole of the kidney. The average size of primary kidney neoplasia is 5.9 cm. Using the TNM classification, kidney tumors are most often detected and surgically treated in the pT1 stage of the disease, which indicates a positive association with the five-year survival of patients.

## P58

### Interrelation between relative age effect and goal scoring in bulgarian football

Danail Ivanov

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In soccer, particularly at the pinnacle of competitive endeavors, an enduring pursuit of exceptional performance on an individual basis has consistently existed. Purpose of the study investigates how the performance of soccer players is affected by grouping them based on their birthdates, a concept known as the relative effect of age (RAE). This factor has the potential to impact the success of soccer players and their abilities to score goals. The research method is to collect the birth data of the top scorers from the three highest leagues in Bulgaria (First League, Second League, and Third League) in the last 5 years. **Results:** In our research, the birth dates of all the top 5 goal scorers were taken and divided into the first, second, third and fourth quarters of the year. 150 goalscorers was analyzed. These indicators were compared to track whether those born in the first quarters of the year scored more goals in Bulgarian football. The performance in soccer is usually measured by evaluating collective results or by individual statistical parameters that comprehensively describe players. **Conclusion:** 48% of top scorers in the first division were born in the fourth quarter, showing that at the highest level, those born in the first half of the year do not have a clear superiority in scoring goals.

## P59

### Body composition of professional football players

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In the world of professional sport every point of excellence counts. In recent years body composition is one of the main points of controlling body composition in professional football. Rapid testing of this component is possible using InBody 270 body composition analyzer. **PURPOSE:** The aim of the following study is to reveal body composition of professional Bulgarian football players. **METHODS:**

For the study we use data from InBody 270 analyzer for a period of 6 months. All data is analyzed via descriptive statistics. RESULTS: We monitor several indexes such as muscle-fat analysis, segmental lean analysis, total body water, weight etc. All measurements are made on a weekly basis for operational control of players body composition. In the results are also included height and weight of soccer players. Based on the body composition results, we have extracted data that allows us to show the current level of professional soccer players. CONCLUSION: Body composition data for professional football players is an excellent way for controlling the sport form. Also, it can be used as a guidance for selection among adolescent players.

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#### P60

##### **The effect of priming session on match performance in soccer**

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No study has examined the effect of priming sessions on match performance in official soccer matches so far. PURPOSE: This study investigated how a morning priming session, involving

stretching, mobility exercises, core and lower-body resistance training, and reactive agility exercises, impacts the performance of elite-level soccer players during matches. METHODS: Data on physical and technical performance were gathered from competitive matches (n = 32). A linear mixed model was used to examine the effect of priming sessions on players' physical and technical performance. The influence of playing position, match location and outcome, quality of the opponent, and type of pitch were controlled for as contextual factors. RESULTS: The results indicated significant improvements in various aspects of physical performance during matches following a priming session, including increased overall distance covered (Cohen's d (d) = 0.34, p = 0.011), moderate-intensity running (d = 0.52, p = 0.001), high-intensity running (d = 0.30, p = 0.024), and frequency of duels (d = 0.26, p = 0.050), compared to matches without a priming session. CONCLUSION: These findings suggest that implementing a morning priming session on match day can effectively enhance players' physical performance without any detrimental effects on technical performance.

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Revised Maj 2021

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Use Times New Roman font, size eleven (11) point.

Number (Arabic numerals) the pages consecutively (centering at the bottom of each page), beginning with the title page as page 1 and ending with the Figure legend page.

Include line numbers (continuous) for the convenience of the reviewers.

Apart from chapter headings and sub-headings avoid any kind of formatting in the main text of the manuscripts.

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Indexed

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- A structured abstract of less than 250 words;
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- The author signs a formal statement that the submitted manuscript complies with the directions and guidelines of MJSSM.

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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

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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.

#### 2.1.5. Affiliations

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.

If an author belongs to more than one institution, all corresponding superscript digits, separated with a comma with no space in between, should be present behind the family name of this author.

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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.

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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.

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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

Nepocatyč, 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., Soinen, R., Mottonen, M., Harila-Saari, A., & Niinimäki, 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 tests 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

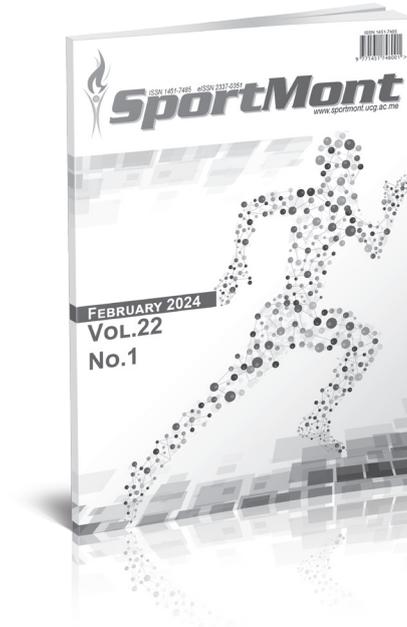
Signs should be placed immediately preceding the relevant number.

✓ 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*



ISSN 1451-7485

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**Publication date:** Summer issue – June 2024  
Autumn issue – October 2024  
Winter issue – February 2025



## MONTENEGRIN SPORTS ACADEMY

Founded in 2003 in Podgorica (Montenegro), the Montenegrin Sports Academy (MSA) is a sports scientific society dedicated to the collection, generation and dissemination of scientific knowledge at the Montenegrin level and beyond.

The Montenegrin Sports Academy (MSA) is the leading association of sports scientists at the Montenegrin level, which maintains extensive co-operation with the corresponding associations from abroad. The purpose of the MSA is the promotion of science and research, with special attention to sports science across Montenegro and beyond. Its topics include motivation, attitudes, values and responses, adaptation, performance and health aspects of people engaged in physical activity and the relation of physical activity and lifestyle to health, prevention and aging. These topics are investigated on an interdisciplinary basis and they bring together scientists from all areas of sports science, such as adapted physical activity, biochemistry, biomechanics, chronic disease and exercise, coaching and performance, doping, education, engineering

and technology, environmental physiology, ethics, exercise and health, exercise, lifestyle and fitness, gender in sports, growth and development, human performance and aging, management and sports law, molecular biology and genetics, motor control and learning, muscle mechanics and neuromuscular control, muscle metabolism and hemodynamics, nutrition and exercise, overtraining, physiology, physiotherapy, rehabilitation, sports history, sports medicine, sports pedagogy, sports philosophy, sports psychology, sports sociology, training and testing.

The MSA is a non-profit organization. It supports Montenegrin institutions, such as the Ministry of Education and Sports, the Ministry of Science and the Montenegrin Olympic Committee, by offering scientific advice and assistance for carrying out coordinated national and European research projects defined by these bodies. In addition, the MSA serves as the most important Montenegrin and regional network of sports scientists from all relevant subdisciplines.

The main scientific event organized by the Montenegrin Sports Academy (MSA) is the annual conference held in the first week of April.

Annual conferences have been organized since the inauguration of the MSA in 2003. Today the MSA conference ranks among the leading sports scientific congresses in the Western Balkans. The conference comprises a range of invited lecturers, oral and poster presentations from multi- and mono-disciplinary areas, as well as various types of workshops. The MSA conference is attended by national, regional and international sports scientists with academic careers. The MSA conference now welcomes up to 200 participants from all over the world.

It is our great pleasure to announce the upcoming 21th Annual Scientific Conference of Montenegrin Sports Academy "Sport, Physical Activity and Health: Contemporary Perspectives" to be held in Dubrovnik, Croatia, from 18 to 21 April, 2024. It is planned to be once again organized by the Montenegrin Sports Academy, in cooperation with the Faculty of Sport and Physical Education, University of Montenegro and other international partner institutions (specified in the partner section).

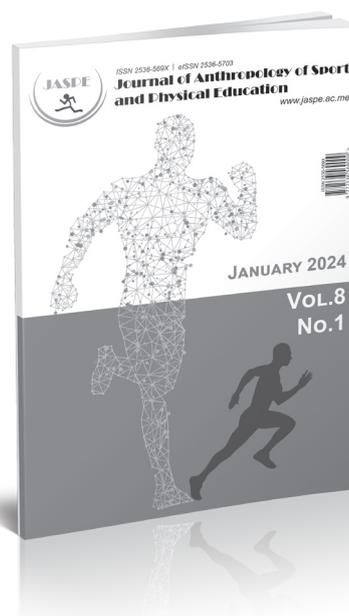
The conference is focused on very current topics from all areas of sports science and sports medicine including physiology and sports medicine, social sciences and humanities, biomechanics and neuromuscular (see Abstract Submission page for more information).

We do believe that the topics offered to our conference participants will serve as a useful forum for the presentation of the latest research, as well as both for the theoretical and applied insight into the field of sports science and sports medicine disciplines.





## **Journal of Anthropology of Sport and Physical Education**



ISSN 2536-569X

Journal of Anthropology of Sport and Physical Education (JASPE) is a print (ISSN 2536-569X) and electronic scientific journal (eISSN 2536-5703) aims to present easy access to the scientific knowledge for sport-conscious individuals using contemporary methods. The purpose is to minimize the problems like the delays in publishing process of the articles or to acquire previous issues by drawing advantage from electronic medium. Hence, it provides:

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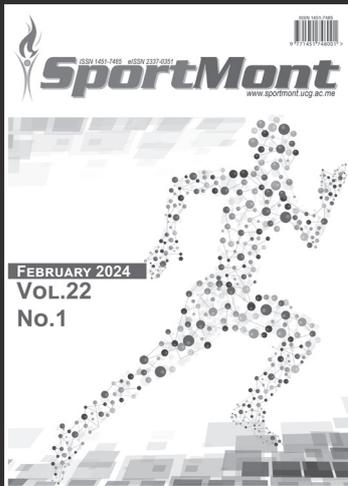
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