



MSA DUBROVNIK 2019



UCG

Univerzitet Crne Gore

MSA Conference 2019

16th Annual Scientific Conference
of Montenegrin Sports Academy

**“Sport, Physical Activity and Health:
Contemporary Perspectives”**

BOOK OF ABSTRACTS

4th - 7th April 2019, Dubrovnik – Croatia

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ISSN 2536-5398 (Print)

ISSN 2536-5401 (Online)

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MONTENEGRIN SPORTS ACADEMY

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Edited by:

Bjelica, D., Popovic, S., Akpinar, S.

Hosted by the:

Montenegrin Sports Academy & University of Montenegro

ISBN 978-9940-569-24-2



Montenegrin Sports Academy & University of Montenegro:

Book of Abstracts of the 16th Annual Scientific Conference of Montenegrin Sports Academy
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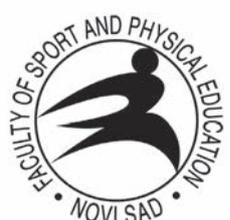
ISBN 978-9940-569-24-2

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Prepress by Idea Group, Bratstva jedinstva 65, Podgorica, Montenegro.

Printed by Art grafika, V proleterske 2, Nikšić – Montenegro.

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Welcome

Dear colleagues and friends,

on behalf of the Montenegrin Sports Academy (MSA), I am aware of the distinguished honor to announce Dubrovnik, the metropolis of Croatian tourism, as the host city of the 16th Annual Scientific Conference of Montenegrin Sports Academy “Sport, Physical Activity and Health: Contemporary Perspectives”. I also wish to welcome academicians and students from all over the world on 4 to 7 April, 2019.

Since the first event in Bar in 2003, the MSA Conference has been a huge success, providing a great opportunity to promote and develop Sports Sciences through networking, study and research. This year, under the traditional patronage of the Montenegrin Olympic Committee and in collaboration with Faculty of Sport and Physical Education, Faculty of Economics, Faculty of Law, Faculty of Mechanical Engineering and Faculty of Architecture at University of Montenegro as well as Faculty of Sport and Physical Education at University of Novi Sad, Faculty of Sport and Physical Education at University of Sarajevo, Faculty of Kinesiology at University of Split, Faculty of Kinesiology at University of Zagreb, Faculty of Science of Sport and Physical Education at University of Coimbra, and European College of Sports Science, we have put together a high profile scientific programme with plenary and parallel sessions (oral and poster), accompanied by social events and free time to discover and enjoy the amazing city of Dubrovnik. The upcoming conference aims to contribute to the development of global approaches in the different specialized areas and to provide an even broader view of Sports Sciences. Hopefully, sport scientists will be able to find the best paths through the field.

We are confident you will enjoy the whole conference experience, the sharing of knowledge and contribution this will make to our institution and to our field of study and work.

Dubrovnik is an open city: open to the various people, to various cultures, to the world and to science. What better place in which to join forces in developing sport performances.

See you to Dubrovnik and Adriatic Coast!

Prof. Duško Bjelica, PhD
Conference President





Organization

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Invited Presentations

SCREEN, SIGHT, SOUND AND SLEEP- A SNAPSHOT OF A THREE-YEAR SURVEILLANCE STUDY ON SCREEN TIME, QUALITY OF LIFE, SLEEP AND PLAY AMONG PRESCHOOL CHILDREN IN SINGAPORE

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The aim of the research was to examine the use of digital media among preschool children aged 2-6 years in Singapore. The online SMALLQ™ (Surveillance of digital Media use in earLy chiLdhood Questionnaire), developed by the Singapore team was used to garner 4187 responses from parents of children aged 2-6 years who attended preschools in Singapore. SMALLQ™ is a 25-item questionnaire that enquired about parent and child digital media habits, child's non-digital habits, sleep and eyesight, parent concerns, knowledge and enforcement of guidelines for child digital media use. An online version of the Pediatric Quality of Life Parent-proxy Questionnaire (Varni, 1991) was also administered to the same population of parents. Baseline results show that among preschool children, aged 2-6 years, daily screen time exceeded the guideline for use per day of 1 hour by 0.89 hours and 1.59 hours, respectively, on the weekday and weekend day. Playtime met daily guidelines of 180 minutes where indoor play exceeded outdoor play by 74% on the weekday and 25% on the weekend. Heavy child users of digital media were significantly ($p < .05$) older, have greater body mass, lower quality of life, less night time sleep on the weekday, higher rates of wearing spectacles, and, have parents with lower educational qualifications, and came from households with lower income brackets than light child users of digital media. Heavier child users of digital media have parents who are also heavy users of digital media ($r = 0.38$) and who were less likely to enforce the 1-hour guideline for daily use for preschoolers. Schooling was a 'digital shield' on weekdays and is a model of how young children should engage with media as part of learning and play. Within the school, digital media use is regulated, guided and facilitated by the teacher. Its use is age-appropriate, not self-indulgent and maximizes learning, and also promotes social interaction among children. While total daily play met guidelines, indoor play exceeded outdoor play, especially on weekdays. Playing outdoors allows preschool children to engage in energetic or more rigorous physical play and this is important for developing motor competence and physical fitness. Time spent outdoors is also linked to a reduced and later onset of myopia in children. Greater parent education and school-parent cooperation in best practices for child development are recommended in order to maximize the positive and minimize the inimical effects of digital media screen exposure among preschool children in Singapore. References: American Academy of Pediatrics. (2011). Policy statement: Children, adolescents, obesity, and the media. *Pediatrics*, 128(1), 201–208. SMALLQ™- Surveillance of digital Media use in earLy chiLdhood Questionnaire, trademarked under TM120494 Class 41 in Singapore in 2018. Varni, J.W. (1991) Pediatric Quality of Life. Retrieved 9 September 2017 from http://www.pedsq.org/about_pedsq.html.

FREE WEIGHT BENCH PRESS MUSCULAR FITNESS AND 1.5 MILE DISTANCE TREADMILL RUNNING NORMATIVE DATA FOR ADULTS AGED 20-29 YEARS

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There is no methodologically developed and practically usable national physical fitness and conditioning standard for a healthy general population; therefore, health related physical fitness testings for the general population is fairly simple and generic. These non-standard tests do not adequately measure components of cardiorespiratory endurance and muscular fitness. Therefore, the aims of the present study was to generate normative values for muscular strength, muscular endurance, and cardiorespiratory fitness for 20- to 29-year-olds for men and women. We recruited healthy 707 subjects for this study. 401 males (mean \pm SD, age=23 \pm 2 yr, height= 176 \pm 7cm, body mass=83 \pm 15kg) and 306 females (age=23 \pm 3 yr, height=166 \pm 6cm, body mass=66 \pm 11kg) aged 20 to 29 years from different universities comprised the subject pool. Data collected from the bench press test included relative strength test (the ratio of 1 Reptition Maximum (RM) to body weight), the relative total training volumes of the 4 sets of 65% of 1 RM bench press test ((total repetitions \times resistance) to body weight) with 30 second rest periods between sets, and the 1.5 mile distance treadmill running tests. Percentile rank norms and descriptive statistics for the bench press exercise and 1.5 mile distance treadmill running for men and women were generated. Our results provide, for the first time, reference standards for the general population aged 20 to 29 years sex-and age-specific free weight bench press relative strength, relative training volumes of the 4 sets of 65% of bench press test with 30 second rest periods between sets and maximal speed of 1.5mile run distance treadmill running.

EXERCISE IN NON-ALCOHOLIC FATTY LIVER DISEASE

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Non-alcoholic fatty liver and in some cases steatohepatitis are very common non-communicable diseases. In recent decades the prevalence increases among non-diabetic and young population, even adolescents. The complication of the disease is the development of liver cirrhosis or malignancy. There is a strong link between the fatty liver disease and the peripheral insulin resistance so it is often present in diabetes, prediabetes or in metabolic syndrome. It seems that physical exercise might significantly improve the condition. Usually, a reduction of weight by 10% improves the condition, but that reduction is rarely achieved. The most interesting fact is that the improvement by exercise happens regardless of the change in body weight. Exercise benefits in NAFLD: The exercise benefits might be observed through reduced inflammation, reduced liver enzyme concentrations, decreased hepatic lipid content and improved insulin resistance, depending on the study. There is still no consensus about which exercise modality provides the greatest benefits Nevertheless, those meeting vigorous exercise intensity of over 7 METS experienced significant improvements. The effects of the resistance training were studied in a lesser extent but with some promising results. A significant reduction of liver fat content might be achieved in 8 weeks of resistance training. That is especially important as proinflammatory state in hepatosteatosis induces sarcopenia, which should be counteracted with strength training and adequate nutrition. In a progressed liver disease, like cirrhosis, the vigorous intensity may not be applied. The reason for that is the role of liver in lactate removal cycle. Also, ammonia removal by liver might be im-

paired in cirrhosis, but muscles might be an important alternative detox route in preventing hepatic encephalopathy. Recommendations: The current recommendations for NAFLD might be as follows: the start of the program should be graduate with frequency of aerobic exercise of 4-5/wk, intensity 5-6 on Borg 1 to 10 RPE scale, corresponding to 75-80% of HRmax for most patients and maintaining the ability to talk. The strength training should be incorporated 2-3/wk, at 60-70% of 1 RM and higher number of repetitions (10-15), aiming to reach 3 sets per exercise and 7-8 exercises/ session. The breaks between sets should be longer than 1 min in order to reestablish circulation. The flexibility regime should always follow the strength training session. In case of liver cirrhosis and increased portal pressure the regime should be adjusted. References: Chalasani N, Younossi Z, Lavine JE et al. (2012). *Hepatology*, 55(6):2005–23. Hallsworth K, Fattakhova G, Hollingsworth KG, Thoma C, Moore S, Taylor R, Day CP, Trenell MI.(2011). *Gut*;60(9):1278–83. Locklear CT, Golabi P, Gerber L, Younossi ZM.(2018).*Medicine (Baltimore)*, 97(42):e12774. Zou TT, Zhang C, Zhou YF et al. (2018). *Eur J Gastroenterol Hepatol*, 30(7):747-755.

MORALLY STRUCTURING SPORT TO SUPPORT PEACEFUL INTERNATIONAL RELATIONS

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The use of sport to help diminish conflict across the world can be realized while fully understanding the world's past and ongoing presence of war as pointed out by Oyos (2017) and O'Connel (1989). Reducing world conflict through the use of sport requires morality, genuine commitment, and trust gained through networking. Sport needs to be grounded in moral values beginning with leadership. The importance of morality on the part of leadership of the sport organization is further reinforced by Yunxiang (2014) who spoke to the immorality of employees when they are part of an immoral structure and by Beerli, Dayan, Vignoda-gadot, and Werner (2013) who claimed that the ethics of employee behavior is a reflection of the organizational culture. Mill's utilitarianism centered on his Greatest Happiness Principle (Mill, 1863/1969) is a suitable moral theory from which to establish sport, as it appeals to all human beings regardless of cultural difference. The sport manager's intrinsic prioritization of progress toward peace as the top outcome resulting from sport is necessary, while at the same time interpersonal interactions taking place throughout the process of sport must bring about trusting relationships among members of the sporting community. Critical, is the transfer of the sport domain's newly formed trusting relationships, to the domain of international government politics, for the purpose of supporting the peace process and improving peace across nations. Transitioning across domains is difficult (Kartakoullis, Karlis, Loizou, & Lyras, 2009) and will require on-going efforts on the part of the sport manager. If the relationships established in the sporting domain can effectively be transferred to the domain of international politics and help improve the larger goal of improving global peace, the overall endeavor is and will continue to be a worthy one.

PHYSICAL MODELING IN SPORTS

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We cannot talk about sports only by talking about one science – it is always an interdisciplinary issue. Psychology, physiology, anatomy, kinesiology ... it is always a mix of several sciences with different



percentage of contribution as its outcome. To make it worse, the change of contribution percentage is, in most cases, variable regarding time of the day, mood, ambient temperature, relationship problems, ambient humidity, health status and many more (probably countless) different influences that can, for example, change the outcome of two shot put throws on the same competition. Sometimes the percentage changes are unwanted; sometimes they are welcomed because one can benefit from them. There is one thing they have in common: they are unpredictable. When people talk about sports, we can often hear that the aforementioned unpredictableness is charming and that it makes sports interesting. On the other side, coaches and sports related scientists (as well as some fans) rarely find it charming; it is rather 'nervebreaker' for them. In all that uncertainty, there is one thing we can always count on – physics. Each movement and every static position in sports can be explained by three Newton's law of motion. Knowing some basic laws of physics allow us to predict, calculate and model movement (or static states) with a certain amount of error. Modelling and simulation in sports is commonly used in situations where it is necessary to predict or calculate the outcome of an activity by changing the input parameters of the model without the need for actual practice of this activity. It is almost impossible, due the complexity of implementation, to ask (for example) shot putter to throw a shot identical several times in a row, varying only the angle of release to determine the influence of the angle on the length of throws. This is one example where mechanical modelling can be of great help.

IDENTIFICATION OF TALENTS IN ELITE SPORT

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Identification of talented sports individuals and their timely introduction into the training process of a sport that corresponds the most to their abilities is one of the most demanding processes in the modern sport science. Wrong decisions are frequent and usually very painful. Elite sport is an area of human creativity which Slovenians value extremely highly. In terms of population size, Slovenia is one of the most successful "sport countries" in the world. Due to the smallness of the biological base, a well deliberate and professional approach is required in the identification of individuals for a specific sport. The Faculty of Sport has developed certain expert systems and methods for evaluation and identification of children's talents, the purpose of which is to help parents and experts adopt the correct decisions concerning the introduction of children in a sport. These methods are based on the application of specific tests for establishing individual motor abilities. A battery of 13 morphology tests, 14 tests of special motor abilities and 3 tests of running motor abilities was used. It was established that special tests of explosive power and speed had the highest predictive power for children's talents. It should be emphasised that despite the state-of-the-art technology and methodology in the measurement procedures, it is impossible to predict talent with absolute certainty, let alone the future sport achievements. Human body is an extremely complex system that is determined by many unpredictable factors. Undoubtedly, the results of the expert methods can be used as guidance in the process of choosing a specific sport for a person.

Oral Presentations

Adapted Physical Activity

TEACHING INCLUSIVE PE IN SECONDARY SCHOOL: OPPORTUNITY OR CHALLENGE?

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Introduction: Physical Education (PE) and Sports have great value in promoting health and well-being, this is true of people in general, and perhaps even more so for students with disabilities (SWD) living in developing country like Kosovo is. Kosovo as a newborn country is getting ready for a challenge of being democratic and inclusive society. 21st century schools are supposed to be an important setting for SWD to get involved in, and through school-based inclusive activities, regardless of their abilities students should share common experiences and develop social inclusion and have fun. The education of all students regardless of their (dis) ability within mainstream education is a relatively new concept in Kosovo education system (KCF, 2011). Methods: In-depth semi-structured interviews, observations were also carried out with a sample of PE teachers. The participants of this study were eight urban and rural secondary school PE Teachers (N=6 males; and n=2 females) from eight lower secondary schools, with two to thirty eight years of teaching experience. This research used a qualitative approach to identify school-based opportunities/and or challenges toward Inclusive PE, barriers facing PE Teachers on daily basis about inclusion of SWD into GPE. Results: Study results indicated that many barriers to inclusion in General Physical Education (GPE) were highlighted ; (a) lack of in- service PE Teacher Development Programs (Training programs for Inclusive PE in accordance with international standards) (b) lack of awareness rising activities (Paralympic School Day, Special Olympics, Deaflympics etc.) into inclusive school environment , (c) negative attitudes of non-disabled students (d) lack of extracurricular inclusive activities and recreational opportunities, (d) lack of adapted high-quality teaching and learning resources (special needs assistants, native language web sites, APE sport equipment). Discussion: This study supports literature that says schools are useful settings for inclusion of students with disabilities into mainstream education (Block & Obrusnikova, 2007), and the preferred starting point for social inclusion. Inclusion of SWD in GPE (APE and APA) helps them to develop the self-esteem they need to re-enter activities in integrated settings, including school, social acceptance (Block, 2007) and work. Attitudes and intentions of able body people- classmates without disabilities plays a critical role in the successful inclusion of SWD. The inclusion of SWD in GPE may be an uncommon experience and may completely transform their perception of disability, focusing their attention on strength, ability, and a common love for the game and activities rather than on disability and difference. References: Block, M., & Obrusnikova, I. (2007). Inclusion in physical education: A review of the literature from 1995-2005. *Adapted Physical Activity Quarterly*, 24(2), 103–124.

Anthropology

RELATIONSHIP BETWEEN STATURE AND HAND LENGTH MEASUREMENTS OF BOTH GENDER ADOLESCENTS FROM NORTHERN REGION IN KOSOVO

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Introduction: Kosovo is geographically clearly defined at the center of the Southwestern part of the Balkan Peninsula. Considering that Kosovo's population is part of the central area of population from the Dinaric Race, it was of special significance to complete a professional study and a realistic assessment of morphometric evaluation adolescents from the Northern Region of Kosovo. Wherefore, the first purpose was to examine the stature in Kosovar adolescents from northern region was to examine the stature in both Kosovar genders and its relationship between lengths of hand. Material & Method: The subject of this study was 177, students from high schools, in total there, Included are from Northern region of Kosovo, 87 are male and 90 females average of age is 18.29 ± 0.46 years old (range 18-20 years) and for male 18.25 ± 0.46 years old (range 18-20 years). The exclusion criterion was also being non-Kosovan and non-Northern region. Anthropometric measurements of stature and length of hand have been conducted according to the protocol of the International Society for the Advancement of Kinanthropometry (Marfell-Jones, Olds, Stewart, & Carter, 2006). The data was analyzed by Statistical Package for Social Sciences (SPSS) for windows 23. Results: The results obtained were analyzed through descriptive parameters: Means and standard deviation (SD) of the stature and length of hand of Kosovars, the ratio between stature and length of hand have been analyzed through correlation coefficient according to Pearson with reliability level of 95%. The linear regression analysis was carried out to examine extent to which length of hand can reliably predict of stature. In the end, these relationships were plotted as scatter diagram for both genders. Statistical significance was set at $p < 0.05$. Discussion: Throughout this work we can proved that the adolescents from Northern region of Kosovo are very tall with an average of 180.29 ± 5.72 centimeters for boys and 165.36 ± 4.56 centimeters for girls. The results proved that the adolescents from Northern region are tall on average, taller than male population in Macedonia with 178.10 centimeters and taller than female population in Macedonia with 164.58 centimeters (Popovic, et al., 2016), and are very closed to the data that was reached in the measurement of Serbians female 166.8 centimeters (Popovic, et al., 2013), but not taller than male population. References: Arifi, F., Bjelica, D., Sermahaj, S., Gardasevic, J., Kezunovic, M., & Popovic, S. (2017a). *IJM*. 35(3): 1161-1167. Arifi, F. (2017). *Sport Science*, 10(1); 92-95. Bjelica, D., Popovic, S., Kezunovic, M., Petkovic, J., Jurak, G., & Grasgruber, P. (2012). *Anthropological Notebooks*, 18(2), 69-83. Sunil, S., Dikshit, P.C., Aggrawal, A., & Rani, M. (2005). *JIAFM*. 27(4):0971-0973. Popovic, S., Bjelica, D., Georgiev, G., Krivokapic, D., & Milasinovic, R. (2016). *Anthropologist*, 24(3), 737-745. Popovic, S., Bjelica, D., Tanase, G. D., & Milasinovic, R. (2015). *SMJ*, 4(1), 29-36.

Biochemistry

SIGNAL TRANSDUCTION AND CATECHOLAMINE METABOLISM DURING EXERCISE

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Introduction: Growing popularity of exercise has been attributed to cardiovascular disease prevention and rehabilitation, as well as to exercise elicited positive (antidepressant, anxiolytic) mood effects, and decreased sensitivity to pain. The attempts are being made to further establish an involvement of noradrenergic and dopaminergic systems in the functional effects of exercise. Methods: Such evidences are coming from the studies using different approaches: stressing the systems by exercise, combined with pharmacological, surgical or transgenic manipulations, which inhibit or enhance a catecholamine metabolism. Results: Studies in rodents from our laboratory have demonstrated that the alterations in tissue's catecholamine, cAMP, adenylate cyclase, A kinase and cAMP phosphodiesterase activity depend on the duration, intensity of exercise and exercise training. Furthermore, the results from multiple studies demonstrate an acceleration of the dopamine metabolism in the central nervous system during exercise. However, a 6 hydroxydopamine lesion in the nigrostriatal dopaminergic pathway in rats decreases dopamine metabolism and treadmill running ability. Nevertheless, transplantation of dopaminergic grafts recovers a striatum dopamine metabolism and ameliorate motor imbalances in such hemiparkinsonian model rats. Transgenic mice lacking rate limiting enzyme in the synthesis of catecholamines tyrosine hydroxylase in the dopaminergic pathway showed a reduction in tissues dopamine accumulation and a considerable decrease in spontaneous locomotor activity. Another strain of transgenic mice, NT3 knockout mouse expresses alteration in the brain and cardiac catecholamine's metabolism and in endurance performance. We showed that NT3 knockout mice could not maintain increased the cardiac's sympathetic respond during exercise at the same level as wild type mice. These NT3 knockout mice display reduced treadmill running time. Conclusion: Further studies on the involvement of catecholamines in functional effects of exercise will have implications on potential therapeutic interventions for cardiovascular disease, parkinsonism, and depression. References: Kalinski MI, Dluzen D, Stadulis R (2001). *Brain Research*, 921, 160-164. Kalinski MI, Dluzen D, Stadulis R (2002). *Medicina Sportiva*, 6, 7-18. Dunbar C, Kalinski MI (1994). *Cardiac intra cellular regulation: Effects of exercise on the cAMP system and A kinase*, *Medicine and Science in Sport and Exercise*, 26, (12), 1459-1465. Kalinski MI, Antipenko A, Dunbar C, *Exercise and Intracellular Regulation of Cardiac and Skeletal Muscle*, Human Kinetics Publishers, Inc., Champaign, IL, 1995.

Biomechanics

DIFFERENCES IN KINEMATIC PARAMETERS BETWEEN LINEAR AND ROTATIONAL TECHNIQUES OF ELITE MALE SHOT PUTTERS

Cerkez Zovko, I.¹, Coh, M.², Rezic, M.¹, Corluca, M.¹, Cavar, M.¹

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Introduction: The present study compared kinematic parameters between linear and rotational shot put techniques among elite senior and young senior male shot putters. Methods: Total of 24 athletes partici-

pated in this study with measurements conducted during regular competition (Winter throwing cup 2012). Performances of athletes were filmed with high frequency camera and the bests results were analyzed using 3-D high speed video motion analysis system (APAS). Digitalization of 18 reference points across different body segments (foot, lower leg, thigh, forearm, upper arm, trunk, palm, head) were performed for each video frame. Digitalization of athletic equipment and space (three-dimensional) was applied as well. Univariate analysis of variance, T test for independent samples and discriminative analyses were used to determine differences between kinematic parameters of linear and rotational technique. Results: Out of a total of 11 kinematic two anthropometric variables only 3 kinematic parameters were shown to significantly differentiate between two techniques. They were initial velocity of shot, the shot velocity at the lowest points, and the duration of the technique. Higher values were obtained for rotational technique. Discussion: Rear kinematic studies that compared linear and rotation shot put techniques (Gutierrez-Davila, 2009, Schaa, 2010) used only few kinematic parameters or demonstrated some methodological limitations. For example Gutierrez-Davila (2009) concluded about specificity of two techniques without any numerical data using only visual analysis of graphs. Current study applied more kinematic parameters and quantified differences between two techniques. Out of a total of 11 kinematic two anthropometric variables initial, velocity of shot, the shot velocity at the lowest points, and the duration of the technique differed significantly between two techniques. Because athletes using linear and rotational techniques achieved similar shot put results, we cannot talk about superiority of some technique but rather specificity. References: Gutiérrez-Davila M, Rojas J, Campos J, Gámezrav J, Encarnación A (2009). Biomechanical analysis of the shot put at the 12th IAAF World Indoor Championships, New Studies in Athletics 24, 3-45. Schaa W (2010). Biomechanical Analysis of the Shot Put at the 2009 IAAF World Championships in Athletics, NSA 25:3/4; 9-21. Zatsiorsky VM, Lanka JJ, Shalmanov AA (1981). Biomechanical analysis of shot putting technique. Exercise and Sport Sciences Reviews 9, 353-389.

BORN TO RUN: THE CHILDREN RADICALLY CHANGE THEIR FOOT STRIKE ALONG YOUR CHILDHOOD

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Introduction: Running shoes have been associated with the injury risk (Van Gent et al., 2007) since, heavily heeled cushioned trainers promote a rear foot strike (RFS) that has been associated with higher vertical loading (Hamill et al. 2011). The purpose of this study was to determine the RFS prevalence in children in relation to age, sex and shod-unshod condition. Methods: A total of 1642 children aged 3 to 16 years participated in this study. The participants were asked to run both with their own running shoes and unshod at a comfortable self-chosen speed. A sagittal and frontal-plane video (240 Hz) was recorded. Results: There is a significant increase of RFS prevalence in relation to age (preschool children= 46.65% vs. adolescent population=92.20%). RFS prevalence was similar between boys and girls in shod and unshod conditions. Finally, shod running alters FSP of running barefoot, producing a significant increase of RFS prevalence. Discussion: The main finding of this study was that the RFS in children is influenced by age and footwear. The RFS prevalence of preadolescents-children is lower compared to those found in the adult population (Latorre et al., 2015). Moreover, the change in RFS from shod to unshod running is a consistent finding in adults (Muñoz et al., 2015). Therefore, there is an influence of footwear on the

prevalence increased of RFS during childhood. References: Hamill J, Russell EM, Gruber AH, Miller R (2011) *Footwear Sci*, 3(1), 33-40. Latorre-Román PÁ, Jiménez M, Soto V, Sánchez J, Molina A, Fuentes A, García-Pinillos F (2015). *Int J Perform Anal Sport*, 15(2), 588-597. Muñoz-Jimenez M, Latorre-Román P A, Soto-Hermoso V, García-Pinillos F (2015). *J Sports Sci*, 33(19), 2035-2042. Van Gent RN, Siem D, van Middelkoop M, Van Os AG, Bierma-Zeinstra S, Koes B (2007) *Sport en Geneesk*, 41(8), 469-480.

INFLUENCE OF RUNNING VELOCITY ON SPATIOTEMPORAL PARAMETERS AND LOWER-BODY STIFFNESS: A COMPARISON BETWEEN HIGH AND LOW PERFORMANCE LEVEL RUNNERS

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Introduction: This study aimed at examining the effect of running velocity on spatiotemporal parameters and lower-body stiffness of endurance runners, and the influence of performance level on those adaptations. **Methods:** 22 male runners (low-level of performance [LLG], n=12, and high-level [HLG], n=10) performed an incremental running test with a total of 5 different running velocities (10,12,14,16,18 km/h). Each condition lasted 1 min (30s acclimatization period, and 30s recording period). Spatiotemporal parameters were measured using the OptoGait system. Vertical (Kvert) and leg (Kleg) stiffness were calculated according to the sine-wave method (Morin et al., 2005). **Results:** A repeated measures ANOVA (2x5, group*velocities) revealed significant adaptations ($p<0.05$) to increased velocity in all spatiotemporal parameters and Kvert in both HLG and LLG. HLG showed greater flight time (FT) and step angle (at 18 km/h) ($p<0.05$), longer step length (SL) and lower step frequency (SF) ($p<0.05$), whereas no between-group differences were found in contact time (CT) nor in the sub-phases during CT at any speed ($p\geq 0.05$). HLG also showed lower Kvert values at every running velocity ($p<0.05$), and no differences in Kleg ($p\geq 0.05$). **Discussion:** The current study highlights the effect of increasing running velocity (10-18 km/h) on spatiotemporal parameters and lower-body stiffness – increases in Kvert with Kleg remained unchanged, in consonance with previous studies (Morin et al., 2005) -, as well as determining running kinematic differences between low- and high-level endurance runners at submaximal velocities. As for the effect of performance level on the biomechanical response to different speeds, the lack of methodological consensus makes the comparison with previous studies difficult (Ogueta-Alday, Morante, Gómez-Molina, & García-López, 2018). Lower SF and Kvert and, thereby, longer FT and SL, seem to be the main gait characteristics of high-level runners according to their low-level counterparts. **References:** Abt J, Sell T, Chu Y, Lovalekar M, Burdett R, Lephart S (2011). *J Strength Cond Res*, 25(6), 1479–1485. Morin JB, Dalleau G, Kyröläinen H, Jeannin T, Belli A (2005). *J Appl Biomech*, 21(2), 167–180. Ogueta-Alday A, Morante JC, Gómez-Molina J, García-López J (2018). *PLOS ONE*, 13(1), e0191688.

FORCE-VELOCITY PROFILES OF ELITE ATHLETES OBTAINED FROM SINGLE AND MULTI-JOINT TASKS

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Introduction: The present study explored the sensitivity of the force-velocity (F-V) modeling approach obtained from isokinetic measurements and maximal sprints on a leg cycle ergometer to detect selective changes of the muscle mechanical capacities associated with training history. Specifically, we assumed that the F-V relationship parameters such as maximum force (F₀), velocity (V₀), power (P₀) and slope would differ among individuals of different training backgrounds. **Methods:** In total 40 participants divided into four groups (Strength trained, Speed trained, Physically active and Sedentary individuals) were performed evaluation of the knee extensors at six velocities between 30 and 180 °/s as well as maximal sprints on a leg cycle ergometer loaded with 5% to 12% of body weight. The linear regression methods were applied on peak force (obtained from isokinetic measurements) or velocity values (obtained from loaded maximal sprints on a leg cycle ergometer) obtained at different conditions. **Results:** Findings suggest an exceptionally strong and linear the F-V relationship in the most participants ($r > 0.95$) in the single joint and the multi joint tasks. Sedentary individuals revealed lower values of F₀ values in the both tasks compared to the both athletes' groups ($p < 0.05$). In addition, power production of the all physically active groups were higher compared to the group of sedentary individuals evaluated from the multi joint task ($p < 0.05$). In addition, sport specific the F-V profiles have been observed in Strength trained athletes (i.e. force-oriented slope). **Discussion:** Evaluation of the maximum muscle mechanical capacities through the F-V modeling approach suggests a high sensitivity of this approach for distinguishing among participants with different training backgrounds. Therefore, the findings speak in favor of further research that could contribute to developing the F-V modeling approach into a routine test of muscle function. **References:** Bozic P, Bacvarevic BB (2018). Monten J Sports Sci Med, 7(1), 59-66.

ASSESSING AGREEMENT BETWEEN MARKER-BASED AND INERTIAL MEASUREMENT UNIT INTEGRATED MARKERLESS MOTION ANALYSES IN GAIT

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Introduction: Due to the short preparation time and absence of attached markers can affect natural movement, markerless motion analysis gained popularity in the last decade. This silhouette-based approach gives reliable results for joint movements, except for rotations. Inertial measurement units, on the other hand, very convenient and compact devices that compensate this drawback of markerless motion analysis. The first aim of this study was to extract reliable data by fusing the data obtained from the markerless motion analysis system and inertial measurement units. The second aim was to investigate the agreement between the fused data and the data obtained from marker-based motion analysis system which is accepted as the gold standard. **Method:** Eight male (Height: 178.6±4.8cm, Weight: 82.4±6.2kg) participants performed a four-meter walk. Four high-speed cameras recorded the performances at 100fps to be used in 3-dimensional motion analysis. Markers attached on the right leg and right leg's silhouette were

tracked for marker-based and markerless motion analysis, respectively. Five inertial measurement units collected data at 100Hz to complement silhouette tracking. The Bland-Altman method was used to measure agreement between two data sets, for each kinematic variables. Results: Preliminary results of the study indicated that, after data fusion, the agreement between the results of marker-based and markerless analyses were increased in most of the variables. As expected, the markerless motion analysis system couldn't give accurate results, particularly for fine rotational movements. Discussion: Our study showed that the inertial measurement unit integrated markerless motion analyses can be used as an alternative to marker-based motion analyses. Together with saving energy and time, this method also gives a more natural measurement environment to the researcher. References: None.

Coaching

COMPARISON OF HEART RATE AND CONCENTRATION OF LACTATE IN YOUNG ROWERS BETWEEN RUNNING AND ROWING

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Introduction: It was established that heart rate (HR) and VO₂ (i.e. energy expenditure) are linearly related over a wide range of submaximal intensities. With the development of the portable, wireless HR monitors, HR has become the most commonly used method to get an indication of the exercise intensity in the field. In addition, the HR zones which coincide with the accumulation of lactic acid (La) in the blood are often used to indicate various intensity zones (Achten & Jeukendrup, 2003). The aim of the present study was to compare HR and La during maximal work in rowing and running. Methods: The research included 30 young rowers, 16.51±1.63 years old, 185.21±7.38 cm height and weight 75.59±8.85 kg. They performed two tests: ergometric tests on rowing ergometer "Concept II" model C (Morrisville, Vermont, U.S.A.) (Marinović, 2011) and Shuttle run test (Leger et al., 1988). During the both tests HR was measured by using HR monitors (Polar, Electro Oy, Finland), and La was measured after maximal work, by using Accutrend Plus portable lactate analyzer (Roche Diagnostics GmbH, Mannheim, Germany). The statistic package Statistica 13, were used to calculate the basic descriptive parameters and T-test. Results: The analysis of the obtained results showed a statistically significant difference in both the observed parameters during rowing and running. Statistically significant lower heart rate was recorded when rowing (195.09±5.78) than running (199.73±7.88) ($p < .00$). There was a significantly higher concentration of lactate in the rowing process (12.88±2.36 mmol.L⁻¹) than in running (11.1±2.54 mmol.L⁻¹) ($p < .00$). Discussion: A higher concentration of lactate at the rowing can be explained by the higher muscle mass involved in the rowing movement. Although rowing belongs to a group of monostructural cycling sports, however, the stroke performance is not entirely easy. In the stroke, the large muscular mass of all extremities and body trunk is involved, which requires high coordination of movement in achieving the maximum force on the paddle. The very high level of coordination is a prerequisite for good rowing techniques, for which it takes longer to work. Therefore, the assumption that such a significant difference in HR quality is insufficiently adapted to rowing techniques in younger rowers. The same prevents them from maximizing the load during rowing. References: Achten, J., & Jeukendrup, A. E. (2003). *Sports medicine*, 33(7), 517-538. Leger, L. A., Mercier, D., Gadoury, C., & Lambert, J. (1988). *Journal of sports sciences*, 6(2), 93-101. Marinović, M (2011). (Unpublished doctoral dissertation).

Economics

THE IMPORTANCE OF LOYALTY TO A SPORT EVENT FOR THE LEVEL OF SPONSORSHIP AWARENESS

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Introduction: Global brands have integrated sports sponsorship into their strategic marketing programs, as it represents a long-term investment in creating a dynamic relationship between the brand and the consumer. Today it's not unusual to see a few company logos in places such as sports facilities or equipment, because sports and corporations have become inseparable. In addition, the development of sponsorship in the area of sport is such that it is almost impossible today to think about a professional sport without sponsorship. From the perspective of the sponsor, brand awareness among fans is crucial in understanding the value and return on investment. Previous literature suggests that brand exposure by consumers, as well as congruence between sponsors and sports entities, are crucial aspects for raising awareness about sponsorship (Biscaia et al., 2014). **Methods:** An anonymous online survey was conducted in the period from June to August 2017. The sample consists of 250 respondents from Montenegro. In order to interpret and analyze data from the survey, content analysis was conducted through tabular and graphical presentation of results, which enabled their classification and visualization, in order to facilitate conclusions. The statistical method has been applied to the processing of available data and examined phenomena for the purpose of its graphical presentation. **Results:** The results of the research have shown that consumers who are loyal to an event, organization or individual athlete have a higher level of sponsorship awareness, that is, a higher level of information and knowledge about sponsors. **Discussion:** The results of the empirical research on specific examples of sports events, organizations and athletes, have shown that greater brand exposure by consumers, as well as congruence between the sponsored and the sponsor, facilitates recognition of the sponsors. In addition, the research identified the factors that influence the effectiveness of sponsorship, in the form of activation and sponsorship management, as well as ambush marketing. Namely, the obtained results emphasize the importance of sponsorship activation, as the sponsoring investment itself is not enough to achieve the goals and the full potential effect of sponsorship. In addition, ambush marketing contributes to the creation of consumer confusion and is a threat to corporate sponsorship, but also a effective marketing tool for companies that carry out such activities. **References:** Biscaia, R., Correia, A., Ross, S. & Rosado, A. (2014). Sponsorship effectiveness in professional sport: an examination of recall and recognition among football fans. *International Journal of Sports Marketing and Sponsorship*, Vol. 16, No. 1. Papadimitrou, D. & Apostolopoulou, A. (2009). Olympic Sponsorship Activation and the Creation of Competitive Advantage. *Journal of Promotion Management*, Volume 15, Issue 1-2, 90-117. Sleight, S. (1989). *Sponsorship*. McGraw-Hill. London.

LIFESTYLE MOBILE APPLICATIONS AS AN INNOVATIVE TOOL OF BRAND PROMOTION ON THE SPORTS MARKET

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Introduction: Thanks to the current trend of a sustainable and active life, the popularity of mobile lifestyle applications is growing. Such applications can fulfil the function of a trainer, dietitian, and motivator. Brands are increasingly treating lifestyle applications as an innovative communication tool for the company with the users. These types of applications have not only educational and entertainment, but also business potential. The use of mobile applications by brands means that they are perceived as applying innovative solutions and following the latest technological trends (Chiem et al.2010; Song, Seal 2010; Furner at al., 2014). The aim of the paper is the evaluation of the mobile sports application as the tool of promotion for commercial brands. Mobile sports applications not only give the possibility of registration of regular participation in physical activity for people but also are the innovative marketing instrument of promotion for brands. The prepared publication is therefore empirical-cognitive, resulting in the identification of opinions of the sports-active people on the presence of brands in mobile apps and the impact of this presence on the purchasing behaviors. **Methods:** The empirical part of the paper was prepared on the basis of surveys conducted in 2016 and 2018 by one of the authors, on the sample of over 2400 Polish runners. The information was collected using the CAWI method, i.e. using an electronic questionnaire. A selection of a snow ball was used for individual respondents, as well as voluntary selection (using running portals). **Results and discussion:** In the scientific literature, the availability of results of in-depth studies and analyzes concerning the running market is very limited (Waškowski, Jasiulewicz 2017). In addition, it should be noted that there is a lack of research on the use of lifestyle mobile applications to create brand image on the sports market. The considerations in this article focus on the marketing potential of runners using mobile apps. Under this concept, the authors understand the opportunities that appear for producers and distributors of products and services dedicated to runners, related to building the image of brands through the possibilities created by sports applications. Based on the empirical evidence it may be observed that marketing potential of sports mobile apps is promising for vendors. **References:** Chiem R., Arriola J., Browers D., Gross J., Limman, Nguyen P.V., Sembodo D., Song Y., Seal K. Ch. (2010), The critical success factors for marketing with downloadable applications: Lesson learned from selected European countries, "International Journal of Mobile Marketing", Vol.5, No.2, 43-56. Furner, Ch. P., Racherla, P., Babb, J.S. (2014). Mobile app stickness (MASS) and mobile interactivity: A conceptual model. The Marketing Review, Vo.14, No.2, 163-18. Waškowski Z., Jasiulewicz A. (2017), Sport Activity Of Polish Runners And The Resulting Marketing Potential, Journal of Education, Health and Sport, 7(6), 844-851.

Health and Fitness

EFFECTS OF AN EIGHT WEEKS TAEKWONDO COURSE ON THE HEALTH-RELATED FITNESS OF UNIVERSITY STUDENTS

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Introduction: Taekwondo is a martial art that is included in the Olympic Games and is practiced by a multitude of people. The martial art can provide some fitness benefits (Fong & Ng, 2011; Kim et al. 2011). Considering that the aim of physical education (PE) is to provide fitness to students, the aim of this study is to determine if there was evidence that Taekwondo can be useful as a PE course for university students. **Methods:** Twenty students registered for a taekwondo course offered by their university. The course was conducted twice a week for eight weeks. Each session was 50 minutes and taught different training drills: punching, kicking, forms, steps/stances, and free sparring, etc. Fitness training was achieved by 50 push-ups and 100 curl-ups, 2 sets for each session, at the beginning and end. Sitting stretches and various kicking technique were done to increase flexibility. Footwork/step for all directions and combinations of kicking technique were taught for speed, agility and reaction time. Three minutes of free sparring was to train muscular strength and endurance. The cardiovascular training was done with five minutes of circuit training. Mental training and strategies for fighting were also taught through routine training and sparring. The following health-related fitness parameters were evaluated before and after eight weeks: cardiovascular fitness using 1.6 km run, muscular endurance using 60 seconds curl-up test, trunk flexibility using the sit-and-reach test, and explosive leg strength using the standing long jump test. The data were tested for normality using the Shapiro-Wilk Test in order to determine whether parametric or non-parametric tests would be used to compare the data obtained before and after the course. Differences with $p \leq 0.05$ and effect size (ES) ≥ 0.2 were considered as evidence for any improvements in the fitness parameters. **Results:** The data were normal, thus, they were investigated using the paired t-test. All of the tested parameters, apart from body composition, improved from pre to post ($p \leq 0.05$ and ES ≥ 0.2). **Discussion:** A limitation of the study was the lack of a control group. Another limitation was that not many students registered for the course. Despite these limitations, there is evidence that the training drills improved the respective fitness parameters of the students. This is because the drills target certain fitness parameters, and regular training improves these parameters. **References:** Fong SSM, Ng GYF (2011). *Phys Ther Sport*, 12(2), 100-106. Kim H-B, Stebbins CL, Chai J-H, Song J-K (2011). *J Sports Sci*, 29(2), 133-138.

COMPARATIVE STUDY OF ISOMETRIC AND ISOTONIC TRAINING PROTOCOLS ON HEALTH RELATED FITNESS COMPONENTS AMONG YOUNG UNIVERSITY MALES

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Introduction: The purpose of this investigation was to compare the isometric and isotonic training protocols on health related fitness components among young university males. **Method:** A group of (N=100)

subjects was selected randomly to participate in this study. The age of the subjects was in the range of 18-24 years, isotonic and isometric training program was employed for 12 weeks, two days in a week, 45 minutes of training per session. These participants were segregated into two groups namely Group-A (N=50, Isotonic training group), Group –B (N=50 Isometric training group). The isotonic resistance training was employed on group –A and isometric resistance training on group- B. The pre and post-test considered for the health related fitness test as follows; BMI, bench press 1RM, sit-ups test, sit & reach test, & 12 minutes run/walk test. To compare the mean differences from pre to post test, mean, S.D, and t-test was computed by the help of SPSS software and percentages were calculated with the help of calculator online. Results: The impact of isotonic and isometric resistance training protocols had shown significant performance among the participants with regard to the health related fitness components from pre to posttest. Furthermore interestingly the isotonic training group had shown greater performance in all the selected health related components compared to isometric training group. Discussion: The twelve weeks of isotonic and isometric training protocols had revealed significant performance among the subjects in all the selected fitness components and presented by percentages i.e. Isotonic training group: BMI (increased by 2.70%), bench press test 1RM (increased by 34.45 %), sit-ups test (increased by 24.13%), sit & reach test (increased by 29.12%), and 12 minutes run / walk test (increased by 19.82%). Isometric training group: BMI (increased by 1.96%), bench press test 1RM (increased by 14.23 %), sit-ups test (increased by 7.80%), sit & reach test (increased by 6.92%), and 12 minutes run / walk test (increased by 6.99%). These findings were consistent with the previous studies they are as follows; (Steinmann, 1990) resistance training has a significant effect in improvements in some lower body power. (Warburton et al., 2001) Muscle endurance has been evidently proven and enhanced quality of life. (Moran et al. 2017) found an eight weeks of resistance training to improve lower body isometric strength (mid-thigh pull) in adolescent's to a greater extent than in children. References: Moran J, Sandercock G, Ramirez-Campillo R, Wooller J, Logothetis S, Schoenmakers P, et al (2017).J Strength Cond Res. Steinmann W. Krafttraining im Sportunterricht. Sportunterricht. (1990); 39 (9): 326–339. Warburton, D.E., N.Gledhill, A.Quinney, (2001), Canadian Journal of Applied Physiology 26 (2): 217-237.

INTERNATIONAL STANDARDS AND SEX MEDIATED DIFFERENCES FOR THE 3-MINUTE BURPEE TEST AMONG UNIVERSITY STUDENTS PERFORMING HIGH-INTENSITY MOTOR PERFORMANCE

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Introduction: This study is a continuation of the research into the applicability of the 3-Minute Burpee Test (3-MBT) for measuring the strength endurance (SE). Previous studies have affirmed that the 3-MBT is a valid (Podstawski et al., 2016a) and reliable (Podstawski et al., 2016b) test for evaluating SE, across a broad age range (Podstawski et al., 2015). The aim of this study was to develop international standards for evaluating SE and sex differences in somatic features, body composition, motor fitness and physiological parameters in young women and men performing extremely strenuous exercise. **Methods:** The results scored by 3,862 women and 5,971 men from Poland, Great Britain, Hungary, Serbia (mean age of 20.36 ± 0.94 and 20.05 ± 1.25 y) were collected in 2004-2018. Additionally 45 women and 51 men took part in the study aimed to assess sex differences. SE was determined during the 3-MBT motor fitness test, and body composition with the use of InBody 720 analyzer. Data were analyzed using a Mann-Whitney U test, statistical significance ($p \leq 0.05$). **Results:** Men completed 56.69 cycles/3 min and women – 48.84/3 min on aver-

age. The majority of male and female participants (66.71% and 68.18%, respectively) were characterized by average level of SE. Very good SE was noted in the 0.52% of male and 0.26%, of female participants. The somatic features, body composition parameters, physical fitness levels (47.22 cycles/3 min) and physiological parameters measured during the 3-MBT were significantly higher in men (VO₂avg – 41.57 mL/kg/min, VO₂max – 49.67 mL/kg/min, EPOCavg – 11.02mL/kg, EPOCPeak – 27.84mL/kg). Women were characterized by significantly higher body fat mass (BFM 18.80 kg) and percent body fat (PBF 28.26%). Discussion: Male subjects are characterized by higher values of somatic features, body composition (excluding body fat), motor fitness and physiological parameters, where SE is 23.75% higher, on average, in men than women. References: Podstawski R, Markowski P, Choszcz D, Żurek P (2016a). Correlations between anthropometric indicators, heartrate and endurance-strength abilities during high-intensity exercise of young women. *Arch Budo Sci Martial Arts Extreme Sport*, 12, 17-24. Podstawski R, Markowski P, Choszcz D, Klimczak J, Romero Ramos O, Merino Marban R (2016b). Methodological aspect of evaluation of the reliability the 3-Minute Burpee Test. *Arch Budo Sci Martial Arts Extreme Sport*, 12, 137-144. Podstawski R, Honkanen A, Boraczyński T, Boraczyński M, Mańkowski S, Choszcz D (2015). Physical fitness classification standards for Polish early education teachers. *SAJRSPER*, 37(1), 113-130.

PATTERNS OF PHYSICAL ACTIVITY OF UNDERGRADUATE STUDENTS AT THE UNIVERSITY OF TRIPOLI USING INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE (IPAQ)

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Introduction: This study aims to evaluate Physical Activity among undergraduate students. Physical activity is associated with many physical and psychological health benefits, both in the prevention of ill health and the management of existing health conditions and a strong relationship between being physically active and good health (Haskell et al., 2007). Methods: The researchers used the descriptive approach to study 515 undergraduate students from the University of Tripoli in Libya. The International Physical Activity Questionnaire (IPAQ) short version (Stockholm, Karolinska Institute., 2000) was used to identify the physical activity levels among the participants. The researcher used the descriptive approach to achieve the study objectives. Results: Higher prevalence of physical activity was found in moderate intensity which reached 18.49 minutes per day during the average of 3.69 days, while the High intensity PA category was only 9.38 minutes per day during the average of 1.54 days per week, participants were reached 28.02 minutes as an average time of walking with the average of 4.05 days of the week. Discussion: The results of the study, indicated that all the students of the sample achieved moderate PA rates (18.49 minutes per day), which was higher than the rate of high intensity physical activity that was only (9.38minutes per day). These findings are compatible with the findings of (Awadalla et al., 2014) Thus these results indicate that the sample did not reach the WHO recommendations toward physical activity and health even when combining the high moderate and high physical activity levels that achieved during the week. References: Haskell, W. L., Lee, I. M., Pate, R. R., & Powell, K.E. (2007). *Medicine and Science in Sports and Exercise*, 39, 1423-1434. IPAQ Research Committee. Guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ). Short and long forms. Stockholm, Karolinska Institute, 2000 <http://www.ipaq.ki.se> accessed 2.2.2016). Awadalla N.J, Aboelyazed, A.E, Hassanein, M.A., Khalil, S.N, Aftab, R, Gaballa, I.I, and Mahfouz, A.A. (2014). *Eastern Mediterranean Health Journal*, 20, 10.

PHYSICAL ACTIVITY, BODY COMPOSITION AND ADHERENCE TO MEDITERRANEAN DIET IN PRESCHOOL CHILDREN; CROSS-SECTIONAL ANALYSIS IN SOUTHERN CROATIA

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Introduction: Physical activity and type of diet are known to have significant influence on body composition and health in general, but there is a lack of studies examining this problem among preschool children from Croatia. The aim of this research was to investigate the association among physical activity (PA), adherence to Mediterranean diet, and indices of body compositions (body mass index – BMI; waist to hip ratio, waist circumference – WC) in healthy preschool children. **Methods:** The participants were preschoolers (n = 260; 5-6 years of age; 128 girls) from south-eastern Croatia. Preschool PA questionnaire (Pre-PAQ) was used to categorize PA into five levels, from sedentary to vigorous PA-level (L1 to L5). The adherence to the Mediterranean diet was evaluated by Mediterranean Diet Quality Index (KIDMED). **Results:** The ANOVA revealed significant ($p < 0.05$) gender differences in L2 and L5 (F-test: 5.46 and 5.05, respectively) with boys being more active than girls. The correlations between observed variables were generally low, with BMI being correlated to L5 in boys (R: 0.18, $p < 0.05$), and KIDMED score being correlated to WC in girls (R: -0.19, $p < 0.05$). **Discussion:** Here reported more vigorous PA in boys is in line with previous researches where authors mostly found higher levels of PA in boys worldwide (Trost et al., 2002). The positive correlation between BMI and L5 in boys should be explained in light of BMI values in studied sample. Namely, the maximal BMI value for studied boys was 23.33 kg/m². It indicates association between vigorous PA and lean body mass in boys, which is already suggested previously (Lazaar et al., 2007). The positive influence of type of diet on obesity is well known (Kelishadi et al., 2007). Supportively, significant correlation between KIDMED score and WC in girls indicates potential influence of Mediterranean diet on body composition. **References:** Kelishadi R, Ardalan G, Gheiratmand R, Gouya MM, Razaghi EM, Delavari A, Mahmoud-Arabi, MS (2007). Bull World Health Organ, 85, 19-26. Lazaar N, Aucouturier J, Ratel S, Rance M, Meyer M, Duche P (2007). Acta Paediatr, 96(9), 1321-1325. Trost SG, Pate RR, Sallis JF, Freedson PS, Taylor WC, Dowda M, Sirard J (2002). Med Sci Sports Exerc, 34(2), 350-355.

THE ASSOCIATIONS OF PHYSICAL ACTIVITY, SCREEN TIME AND SLEEP WITH HIGH BLOOD PRESSURE IN ADOLESCENTS

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Introduction: the aim of this study was to explore associations of physical activity (PA), screen time (ST) and sleep duration with high blood pressure (BP) in 15-year old adolescents. **Methods:** This investigation is a part of the CRO-PALS study, an observational longitudinal study conducted in a representative sample of urban youth in Zagreb (Croatia). CRO-PALS involves 903 adolescents and for the purpose of this study data from 819 participants (mean age [SD]=15.6[0.3] years) with information on PA, ST, sleep and BP were analysed. Data on the weekly duration of PA and average daily time spent in front of screens

were collected using a computerised version of the SHAPES questionnaire (Wong et al., 2006), while BP was measured following ESH guidelines (O'Brien et al., 2003). Average sleep duration was self-reported separately for school week and weekends. Participants were divided in quartiles of PA, ST and sleep, and high BP was defined as systolic BP and/or diastolic BP exceeding 95th percentile for age, sex and height (National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents, 2004). Associations of PA, ST and sleep with elevated BP were explored using multiple logistic regression adjusting for school type, maturation and smoking. All analyses were stratified by sex. Results: The prevalence of high blood pressure amounted to 27.0 % (CI=22.8-31.1%) in boys and 21.6 % (CI=17.6-25.6%) in girls. Physical activity duration and screen time were unrelated to abnormal BP in either boys or girls. Odds for having high blood pressure did not differ between children across quartiles of weekly quantity of PA ($p=0.50-0.60$ in boys, and $p=0.67-0.75$ in girls) or quartiles of screen time ($p=0.16-0.50$ in boys, and $p=0.44-0.70$ in girls). Conversely, while sleep duration was not associated with high BP in girls, in boys short sleep duration ($<7:15h$) was linked with 120% higher odds of having elevated BP compared with $>8:45h$ of sleep (OR=2.2, 95%CI=1.2-4.2, $p=0.016$). Discussion: High BP was highly prevalent in Croatian urban youth. Neither high self-reported PA nor low ST proved to be protective of high BP. Still, inadequate sleep duration was linked with 2.2 higher odds for raised BP, although this association was noted only in boys. Other factors, such as excess weight, sodium intake or psychological stress, might have a more important role in elevated blood pressure in adolescents. Acknowledgements: This investigation is a part of the Croatian Physical Activity in Adolescence Longitudinal Study (CRO-PALS), funded by the Croatian Science Foundation under the number IP-06-2016-9926. References: Wong SL, Leatherdale ST, Manske SR. *Med Sci Sports Exerc.* 2006; 38(9):1593-600. O'Brien E, Asmar R, Beilin L et al. *J Hypertens.* 2003; 21:821-848. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. *Pediatrics.* 2004; 114(2 Suppl 4th Report):555-76.

INVESTIGATING EFFECTIVENESS OF 12-WEEK WORKPLACE AEROBIC DANCE PROGRAM ON SELECTED HEALTH AND FITNESS VARIABLES OF EMPLOYEES

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Introduction: The purpose of this study was to investigate the effectiveness of the workplace aerobic dance program on selected health and fitness components (lipid profile, body composition and cardiovascular endurance) of Ministry of Education & Skills Development employees at the Gaborone headquarters. Methods: Data was collected from thirty employees (27 females, 3 Males) at the beginning and at the end of the 12 weeks. The purposive sampling technique was employed and the research design was a pre-test post-test quasi experimental. Data were analysed using descriptive statistics including means and standard deviations. Paired t-test was used to determine statistical differences between the means. Statistical significance was set at $p < .05$. Results: The results revealed that there were significant differences in high density lipoprotein cholesterol, low density lipoprotein cholesterol, triglycerides, blood glucose, VO₂max and percentage body fat. No significant differences were observed between pre- and post-test measurements in resting heart rate, systolic Blood Pressure, diastolic Blood Pressure, weight, waist circumference, hip circumference, and Body Mass Index after 12 weeks of aerobic dance program ($p \leq .05$). Discussion: The current findings on the lipid profile are consistent to the studies by Azeem & Varghese (2015) and Onagbiye et al (2016). On the other hand the findings on the body composition pa-

rameters were similar to those of Melam et al (2016) and Bastug et al (2016). It is very important to note that the intensity, time or period of exercise, duration of the aerobic dance program and many more factor have a greater influence in the outcomes of each variable. Cardiovascular endurance in the current study had shown a great improvement after 12 weeks, this is supported by the findings by Suminar et al (2018) and Rossmeiss et al (2016). Based on the findings of the study, employees and the population at large can be advised to participate in aerobic dance program in order to improve their health and fitness levels. References: Azeem, K., & Varghese, C. A. (2015). *Indian J. Sci Technol*, 8(8), 720-728. Onagbiye, S. O., Moss, S. J., & Cameron, M. (2016). *IQCH*. Bastug, G., Ozcan, R., Gultekin, D., & Gunay, O. (2016). *Int J Sport Exerc Train Sci*, 2(1), 22-29. Rossmeiss, A., Lenk, S., Hanssen, H., Donath, L., Schmidt-Trucksass, A., & Schafer, J. (2016). *Sports*, 4(5). Suminar, J., Kusnanik, N. W., & Wirawan, O. (2018). *JPCS*, 1-5

LUNG FUNCTION, MUSCULAR STRENGTH AND RESTING METABOLIC RATE OF YOGIS COMPARED TO ATHLETES

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Introduction: Physical activity is an important aspect of health contributing to its preservation and prevention of many chronic diseases. The influence of yoga can be manifested on the locomotor, nervous, endocrine and cardiopulmonary system which can lead to its use as a preventive method. Aim: The aim of the study was to compare the effect of yoga training on the values of resting metabolic rate, muscle strength and lung function with athletes. Material and methods: The study was conducted on 30 healthy participants, age 21,9±2,43. They were divided into 3 groups: yogis (practiced yoga for at least 6 months, twice a week), athletes (trained actively for at least 6 months, three times a week) and non-athletes (had no physical activity). Upon the arrival to the laboratory, several parameters were measured: anthropometric, resting metabolic rate, pulmonary function and muscular strength. Results: A statistically significant difference was observed between athletes (2308,8±491,79) and non-athletes (1691,0 ±267,2), (p<0,05), as well as between athletes (2308,8±491,79) and yogis (1798,2±227,32), (p<0,05) regarding resting metabolic rate. There was no significant difference when it comes to pulmonary function among all three groups of subjects. Dynamometric parameters were higher in athletes compared to both non-athletes (p<0,05) and yogis (p<0,05). Discussion: A survey conducted on the territory of the USA (Byrne et al., 2001) has shown the existence of a statistically significant difference in RMR values before and after five months of training. This corresponds to the highest RMR values for athletes in our study. Unlike our results in the research carried out in India, the highest values of pulmonary parameters in yogis are recorded, which is the result of possible positive effect of specific breathing exercises (Pranayama). (Prakash et al., 2007) The inclusion criterion in that study was that respondents be non-smokers. However, our group of yogis consumed tobacco. These values could be due to smoking. (Sharma et al., 2018) Different types of weight training exercises in the gym led to an increase in muscle strength in athletes (Ignjatović et al., 2007). The training of our athletes consisted of weight training exercises. References: Byrne HK, Wilmore JH. *Int J Sport Nutr Exerc Metab*. 2001;11(1):15-31. Prakash S, Meshram S, Ramtekkar U. *Indian J Physiol Pharmacol*. 2007;51(1):76. Sharma M, Acharya A. *international journal of scientific research*. 2018;7(1). Ignjatović A, Radovanović D, Stanković R. *Acta Medica Medianae*. 2007;46(3):16-20.

Motor Learning

THE DEVELOPMENT OF NEW SPORT-SPECIFIC RESPONSE TIME TESTS: VALIDITY, RELIABILITY, AND FUNCTIONALITY

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Introduction: Response time (RT) has been defined as the time needed for a person to perceive and respond to some external stimulus (Schmidt et al., 2018). Defined in such a way, we can say that RT is critical characteristic in athlete performance, especially in rapid-action sports where athletes need to react quickly and accurately in various sporting situations in response to game-specific clues (e.g., movement of the ball, opponent player, etc.) (Pojskic et al., 2018; Sekulic et al., 2014). However, there is an evident lack of reliable and valid sport-specific measurement tools applicable in the evaluation of RT in trained athletes. Therefore, this study aimed to identify the validity, reliability, and functionality of four newly developed RT testing protocols among athletes from agility-saturated (AG) and non-agility-saturated (NAG) sports. **Methods:** Thirty-seven AG and ten NAG athletes (age: 20.1 ± 2.8 ; eleven females) volunteered to undergo three randomized simple response time (SRT) protocols that included a single limb movement and one complex response time (CRT) protocol that included multi joint movements and whole body transition over a short distance (1.5 and 1.8m). Each RT test involved 3 trials with 5 randomized attempts per trial. Two sensors were placed at the left- and right-hand side for SRT-1 and SRT-2. Three sensors were positioned (left, middle, right) in SRT-3 and CRT. **Results:** The results showed the newly developed tests were more reliable and functional in the AG athletes. The RT of AG athletes was faster than that of NAG athletes in the CRT test from the left ($p = 0.00$, $d = 2.40$), center ($p = 0.00$, $d = 1.57$), and right sensor ($p = 0.00$, $d = 1.93$) locations. In contrast, there were no differences between the groups in the SRT tests, which indicated that they can be used independently of the sport affiliation. **Discussion:** The weak correlation between the SRT and CRT tests suggests that response time of the single limb and multipoint limb movements should not be considered as a single motor capacity. This study determined that AG athletes were more capable of dealing with complex response tasks than their NAG peers. Such enhanced ability to rapidly and accurately reprogram complex motor tasks can be considered one of the essential qualities required for advanced performance in agility-based sports. Therefore, coaches who work with field-sports athletes should be aware that development of rapid response time in complex motor tasks is mostly dependent on the training of neuromotor coordination (i.e., specific motor proficiency). This means that, in designing training programs, special attention should be focused on proper learning of various sport-related motor programs (i.e., playing technique) that once learned can be rapidly retrieved from neuromotor memory and formatted as an efficient motor response. **References:** Pojskic et al. (2018). *Front Physiol* 9. Schmidt et al. (2018). *Motor Control and Learning, Human Kinetics*. Sekulic et al. (2014). *J Strength Cond Res* 28.

ASYMMETRY IN HAND GRIP FORCE AND RATE OF FORCE DEVELOPMENT IN CHILDREN ATHLETES BETWEEN BASKETBALL AND SWIMMING

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Introduction: Among the athletes, muscle force is one of the most important physical fitness elements (Aoki & Demura, 2009). Hand grip force is representative of upper-limb strength in both athletes and sedentary (Ikemoto et al., 2006). Rate of force development (RFD) is also vital to produce a maximum force as fast as possible to catch the change of the games. RFD is basically defined as how fast an athlete can develop force. It is obvious that athletes who have more explosive force can improve their performance in general. Less asymmetry between hands is a sign to be a professional athlete (Loffing et al., 2010). Thus, the aim of the study was to make comparison in asymmetry in hand grip force and maximum RFD of the athletes who play basketball and swimming. **Methods:** For this purpose, 19 Basketball players (Mage = 12.4 ± 0.4 years old) and 19 swimmers (Mage = 11.6 ± 1.1 years old) voluntarily participated to this study. Basketball players had 5.2 ± 1.9 years of experience and swimmers had 5.6 ± 2.1 . Maximum hand grip force and RFD were measured with an apparatus, force transducer (Interface Model SML-900N). For the statistical analysis, mixed model ANOVA (Group between factor, basketball x swimming; Hand within factor, right x left) was used and significant level was set to $p < .05$. **Results:** The results of the statistical analyses for the maximum grip force displayed only a significant main effect for group. That is, basketball players had greater max grip force compared to swimmers. The results of the statistical analyses for the maximum RFD displayed significant main effects for group and hand. Similar to grip force, basketball players had greater max RFD compared to swimmers. Moreover, right hand RFD was found to be greater compared to left hand. **Discussion:** As in many sports, decreased asymmetry is preferable in basketball and swimming. Aoki and Demura (2009) stated a larger peak power in favor of dominant hand in healthy non-athletes. In this study, young athletes did not show an asymmetry in max grip force but we have observed an asymmetry in max FRD. Moreover, different sports types needs distinctive force requirements. As force is a key component in the performance of many sports, trying to improve max force production in a short time is very important. Thus, the trainers should be aware of this phenomenon and apply it in the training sessions. **References:** Aoki H & Demura S. Laterality of hand grip and elbow flexion power in right-hand dominant individuals. *International Journal of Sports Physiology and Performance*, 2009, 4, 355-366. Ikemoto Y, Demura S, Yamaji S, Nakada M, Kitabayashi T, Nagasawa Y. The characteristics of simple muscle power by gripping: gender differences and reliability of parameters using various loads. *J Sports Med Phys Fitness*. 2006;46:62–70. Loffing F, Hagemann N, & Strauss B (2010). Automated processes in tennis: Do left-handed players benefit from the tactical preferences of their opponents? *Journal of Sports Sciences*, 28(4), 435–443.

NEURAL MECHANISMS OF CYCLIC AND ACYCLIC MOVEMENTS LEARNING

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Introduction: Aging is a challenge for the society because senior people are experiencing a functional decline, a functional limitation which can lead to the disability. Physical activity considered an excellent

tool for healthy and active aging. In this regards different interventions has been done. Some researcher propose walking, endurance training or strength training (Chang, Yang, Yang, & Chern, 2016), while some proposed dance activity (Hwang & Braun, 2015) because it also helps to improve cognitive abilities. This study aims to find out the neural mechanisms behind the cycling and acyclic movements and the effects on learning. Method: 12 young university students aged 19.92 ± 0.76 performed new cyclic and acyclic movements for 120 sec meanwhile kinematic data was recorded with VICON motion system and 32 wireless channel MOVE EEG 10/20 system was used to measure the EEG activity during pre and post-test. The participants had two days to get familiar with the moments.. IIR filter low cutoff: 0.1 Hz, time constant 1.6, 24 dB/oct high cutoff: 120 Hz, 24 dB/oct were applied to the EEG data along with the semiautomatic artifact rejection method. The ocular correction with independent component analysis was applied to blink marker channel. The average of segments in each trail was used to apply Fast Fourier Transformation (FFT), and data were exported to SPSS. Results: Acyclic activity post-test showed high theta activity in frontal, temporal, parietal and occipital lobe ($p < 0.05$). Cycling activity post showed the same theta trend but alpha increased in the temporal and frontal lobe and gamma activity get higher in the frontal and temporal lobe of the cortex. Discussion and conclusion: The participants got quickly familiar with the cycling activity and showed relax state of temporal and central lobe during post-test along with increase the error detecting ability of the cortex and acyclic activity. Post-test results showed that the error detecting ability get improved but there was no other change was noticed. References: Chang, C. J., Yang, T. F., Yang, S. W., & Chern, J. S. (2016). Cortical modulation of motor control biofeedback among the elderly with high fall risk during a posture perturbation task with augmented reality. *Frontiers in Aging Neuroscience*, 8(APR), 1–13. Hwang, P. W.-N., & Braun, K. L. (2015). The Effectiveness of Dance Interventions to Improve Older Adults' Health: A Systematic Literature Review. *Alternative Therapies in Health and Medicine*, 21(5), 64–70.

MOTOR AND COGNITIVE DEVELOPMENT IN EARLY CHILDHOOD: THE IMPORTANCE OF BEING PHYSICAL ACTIVE

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Introduction: The assumption that there is a relationship between motor and cognitive development exist more than 5 decades. Piaget (1953) proposed that activity and sensorimotor experience are important for the development of cognitive ability. But the debate about a possible relationship between motor abilities with cognitive development has re-emerged, because of an increasing media-consume and a decrease in physical activity in childhood. Especially in pre-schoolers working memory and attention seem to be important predictors of later academic achievement (Alloway & Alloway, 2010). Hence, it is necessary to assess the cognitive and motor competence of pre-schoolers in context of the increasing media-consume. Methods: We recruited 36 children of a communal kindergarten in Magdeburg at the age ranging from 4 years until 6 years. We used the German Motoriktest 4-6 by Zimmer (2015) to accesses gross motor and fine motor skills. To access visual working memory performance and perception speed we used the Matrix Film Battery Test (MFBT) by Pittorf, Lehmann and Huckauf (2013). For attention and memory we used an interactive movie called Teddy Tom Test (Pittorf, Huckauf and Lehmann, 2010). Results: Our results reveal positive correlations between increasing age and motor as well as cognitive functions ($r = .80$; $p > .001$). Second, there is a correlation between visual memory and motor competence ($r = .43$;

$p > .001$). Furthermore the level of education of the mother seems to be an important predictor for the media-consume of children and cognitive competence, whereas the educational level of the father plays an important role for motor development. Conclusions: A physical active lifestyle is not only important to be healthy, but also to emerge important cognitive and motor competence for later life achievements. A lack of a sensorimotor enriched environment and missing stimuli have an irreversible impact on the cognitive development of children. References: Alloway, T.P. & Alloway, R.G. (2010). Investigating the predictive roles of working memory and IQ in academic attainment. *J Exp Child Psychol*, 106 (1): 20-29. Pittorf, M.L., Huckauf, A., & Lehmann, W. (2010). Zum kindlichen Verständnis der typischen technischen Filmelemente Schwenk und Umschnitt [The understanding in children of the typical technical film elements PAN and CUT]. *Medien CErziehung*, 54(6), 94–105. Pittorf, M. L., Lehmann, W., & Huckauf, A. (2014). Visual working memory and perception speed of 3- to 6-year-old children tested with a matrix film battery test. *Early Child Development and Care*, 184, 843–854.

Nutrition

THE EFFECT OF COUNTER-ADVERTISING CAMPAIGNS ON KNOWLEDGE, ATTITUDE AND BEHAVIOURS RELATED TO SUGARY DRINKS

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Introduction: The Ministry of Health and Prevention in the United Arab Emirates launched a counter-advertising campaign. The campaign aimed to raise awareness about the amount of added sugar in the SSBs, the health risks associated with overconsumption of such drinks, and to prompt behavioral change intended to reduce SSBs consumption. Methods: A quantitative survey was conducted with a sample of 2,000 respondents selected randomly across the UAE (male: 1000; female: 1000). A structured questionnaire was developed to assess respondents' awareness of the ads and its messages, their attitude towards the SSBs highlighted in the ads, and their behavior in relation to the consumption of such drinks before and after the campaign was aired. A descriptive statistics was employed to explain the basic features of the data. Results: The respondents in both pre and post campaign were aware of the high sugar content in the carbonated soft drinks, energy drinks, packaged fruit nectars and drinks, and flavored milks. Despite this fact, pre campaign results showed that people continue to consume sugary drinks on a regular basis. Nevertheless, the sugary drinks counter-advertising campaign proved effective in increasing the respondents' awareness with regards to the health facts and risks associated to the consumption of such drinks. In terms of behavior, the results showed lower consumption of energy drinks, fruit nectars and drinks amongst those exposed to the campaign ads. The majority of respondents had positive attitude about the campaign and believed that reduction in SSBs consumption is crucial for people's overall health. Discussion: The current results supports several counter sugary drinks implemented elsewhere in terms of having positive attitude about the campaign messages, and starting to reduce sugary drinks consumption (Boles et al., 2014; Farley et al., 2017; Wye G et al., 2011). However, although the SSB counter advertising campaign was followed by slight changes in respondents' awareness and behaviour, additional intensive campaigns are required to ensure the persistence of behaviour change on larger scale. References: Myde Boles, Adelle Adams, Amy Gredler, Sonia Manhas. Ability of a mass media campaign to influence knowledge, attitudes, and behaviors about sugary drinks and obesity. *Preventive Medicine*, Volume 67, Supplement 1, 2014, Pages S40-S45, ISSN 0091-7435, <https://doi.org/10.1016/j.ypmed.2014.07.023>. A. Farley, Thomas

& S. Halper, Hayli & M. Carlin, Anne & M. Emmerson, Karen & N. Foster, Kelly & R. Fertig, Angela. (2017). Mass Media Campaign to Reduce Consumption of Sugar-Sweetened Beverages in a Rural Area of the United States. *American Journal of Public Health*. 107. e1-e7. 10.2105/AJPH.2017.303750. Van Wye G, Wallace C, Kilgore EA, et al. NYC CPPW-Obesity Media. Paper presented at the American Public Health Association Annual Meeting; October 29 to November 2, 2011; Washington, DC.

KNOWLEDGE AND USE OF NUTRITIONAL SUPPLEMENTS AMONG HIP-HOP DANCERS

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Introduction: Hip-hop is a cultural movement, it captures different dance styles. The complexity of choreographies is increasing and at the same time the requirements for physical condition are higher, which leads to a greater number and greater intensity of training. In order to reduce the risk of muscle and joint injuries, at the expense of exhaustion and fatigue, it is essential that dancers understand the importance of diet and dietary supplements. The purpose of our study was to analyse the use and also knowledge about food supplements in the daily diet of hip-hop dancers. We also wanted to highlight the problem in lack of nutritional knowledge and to determine if this affects the body composition of dancers. **Methods:** The sample consisted of 114 hip-hop dancers from seven leading Slovenian dance schools, average age 17.2 ± 2.2 years, participating in adult categories, all members of Slovenian Dance Association and the International Dance Organization (IDO). An anonymous questionnaire was used, containing basic information about the dancer, followed by questions on food supplements, general nutrition and doping. Body composition was analyzed by bioelectrical impedance InBody 720 (Biospace Co., Ltd). The data was statistically processed using the SPSS statistical software, 23.0.0 for Mac OS X. **Results:** We found out that 42% of the surveyed dancers consume nutritional supplements, of which only 10% regularly. The use of food supplements and better nutrition knowledge is prevalent among more successful dancers. There is still a high percentage of those who do not consume dietary supplements – probably due to ignorance and insufficient information (48%). Results showed also poor knowledge on doping, however, 13.2% of potential doping users are among the surveyed hip hop dancers. Better body composition in more successful dancers does not influence the knowledge and/or use of dietary supplements. **Discussion:** Many studies showed that the use of dietary supplements in sports is already widespread worldwide (46-91%) (Diehl et al., 2011), while in dancing the percentage of regular use is much lower (Burckhardt et al., 2011). The knowledge on nutritional supplements of hip-hop dancers, regardless of performance ranking, is still lower compared to other sports disciplines (Kondrič et al., 2013). We conclude, that some interventional programs about substance use and misuse might help to educate dancers and choreographers. **References:** Burckhardt P, Wynn E, Krieg MA, Bagutti C, Faouzi M (2011). *J of Dance Med & Sc*, 15(2), 51–60. Diehl K, Thiel A, Zipfel S, Mayer J, Schnell A, Schneider S (2012). *Int J of Sport Nutrition and Exercise Metabolism*, 22(3), 165-174. Kondrič M, Sekulić D, Uljević O, Gabrilo G, Žvan M (2013). *J of Sports Science and Med*, 12(2), 290-297.

DIETARY SUPPLEMENTATION IN CROSSFIT; AN ANALYSIS OF PREVALENCE AND SOME CORRELATES

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Introduction: Nutrition and dietary supplementation (DS) are known to be significant part of Crossfit training, but there is an evident lack of studies which examined these problems in this highly popular mode of physical exercising. The aim of this study was to evidence the prevalence and background of DS consumption, knowledge on nutrition and dietary supplementation (KNDS) and possible association between DS and KNDS in Crossfit athletes. **Methods:** In this study we included 62 athletes (age: 28.3 ± 5.6 years) involved in Crossfit training at recreational/competitive level. Previously validated questionnaire aimed at evaluation of prevalence and background of DS consumption and KNDS was used (Kondric et al, 2013, Sajber et al. 2013). **Results:** The 93.5% of athletes reported DS consumption, while proteins/amino-acids were most commonly used DS (65.5% users). Most of the consumers initiated with consumption without any consultation with educated professionals (i.e. nutritionist, coach). Most of the participants (37.1%) declared that they use DS in order to improve recovery. Independent samples t-test did not establish difference in KNDS between DS-users and DS-nonusers (t-value: 0.10, $p > 0.05$). **Discussion:** The prevalence of DS-usage is extremely high, which is evident by the fact that studied recreational athletes consume DS to the greater extent than professional athletes (Sekulic et al. 2016). Analysis showed that KNDS is not the factor correlated to prevalence of DS-use, which is explainable knowing the two facts. First, there is a certain possibility that disproportion of DS-users and non-users (96% and 4%, respectively) influenced the non-significant difference between observed groups. Second, examined athletes presented very poor level of KNDS, which clearly points to necessity of systematic education about nutrition and DS in Crossfit. **References:** Kondric M, Sekulic D, Uljevic O, Gabrilo G, Zvan M (2013) *Journal of Sports Science and Medicine*, 12(2) 290-297. Sajber D, Rodek J, Escalante Y, Olujic D, Sekulic D (2013) *Collegium Antropologicum*, 37(2) 179- 186. Sekulic D, Tahiraj E, Zvan M, Zenic N, Uljevic O, Lesnik B (2016) *Journal of Sports Science and Medicine*. 15(4) 606-615.

Other Multi- & Interdisciplinary Themes

CHANGES IN PHYSIOLOGICAL INDICATORS DURING THE FIRST BUNGEE JUMP

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Introduction: During the bungee jump, there are numerous physiological reactions happening in the jumper's body, such as changes in heart rate, increased blood pressure and stress hormone activation (Zimmerman, Loew, Wildt, 1992). The aim of this study was to examine changes in the physiological parameters of participants before, immediately before and after the first bungee jump. **Methods:** A total of 17 subjects (male: 9; female: 8), aged 20-25 and who had no prior experience with bungee jumping, participated in the research. The research was conducted at old Maslenica bridge (55 m height) in Croatia. A sample of variables was made of the heart rate values measured 10' before the jump, immediately before

the jump and 10' and 20' after the jump. The automatic blood pressure monitor was used to measure the systolic and diastolic blood pressure values 10' before the bungee jump, 2' before the jump, 2' after the jump and 10' and 20' after the bungee jump. The perception of fear was estimated 20', 10' and 1' before the bungee jump using a fear scale (Chapman, Kirby-Turner, 2002). Statistical data processing was conducted using a software package Statistica ver. 10.0 for Windows. In order to determine the significance of differences in arithmetic means, the t-test for dependent samples was used. Results: Prior to the jump, the heart rate and median arterial blood pressure values were within the limits of normal values and the perception of fear was very small. Immediately before the jump, the heart rate and median arterial blood pressure increased and the perception of fear increased significantly. After the jump, there was a normalization of the heart rate, mean arterial blood pressure, and reduced perception of fear. Discussion: Results from this research were consistent with the previous research on effects of bungee jumping (Westerloo, et al., 2011). The results confirmed that many physiological responses occur in the human body during high-adrenaline activities. Further studies have to investigate and other physiological indicators before, during and after bungee such as the hormonal reaction of the body with the goal to explain even more specific effects of extreme sports on a human body. References: Chapman, H. R., Kirby-Turner, N. (2002). Visual/verbal analogue scales: examples of brief assessment methods to aid management of child and adult patients in clinical practice. *British dental journal*, 193(8), 447-450. van Westerloo, D.J., Choi, G., Löwenberg, E.C., Truijen, J., de Vos, A.F., Endert, E., Diks, S.H. (2011). Acute stress elicited by bungee jumping suppresses human innate immunity. *Molecular Medicine*, 17(3), 180. Zimmerman, U., Loew, T., Wildt, L. (1992). "Stress hormones" and bungee-jumping. *The Lancet*, 340(8816), 428.

DEVELOPING FOOTBALL EXPERTISE: A CLOSER LOOK AT THE NATURE VS. NURTURE DEBATE

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Introduction: Soccer is the most practiced sport in the world. As such, it is natural that there has been a proliferation of investigations that seek to investigate the process of identification and development of talent. This happens in a context dependent on the ability of clubs to produce and sell their best players in order to maintain financial sustainability. Method: The objective of the present study was to discuss the most significant scientific evidence in the context of football talent identification and development. A systematic review of Web of Science Core Collection and Scopus databases was performed according to PRISMA guidelines. Results: Research addressing the acquisition and development of football expertise has focused on specific key performance characteristics related to practice and training, the performer and the environment. The available literature indicate that the most successful players present advantages (e.g., technical, tactical, anthropometric, physiological and psychological) that change non-linearly with age, maturational status and playing positions. The most common topics of analysis in this scientific area were: (1) specificity and volume of practice; (2) psychological factors; (3) technical and tactical skills; (4) anthropometric and physiological factors; (5) relative age effect; and (6) multidimensional analysis. Discussion: The reviewed literature highlighted that there is a complex relationship between

the above-mentioned factors. This complex interaction should be carefully considered by coaches and scouts involved in the process of identification and development of talented football players. Additionally, an optimal balance between specialization and diversification appears to be related to higher levels of performance at both early ages and adulthood. Reference: None.

THE IMPORTANCE OF SPORTS IN CAREGIVERS OF SCHIZOPHRENIA PATIENTS

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Introduction: Schizophrenia is a chronic mental illness that continues with relapses that affects the areas of affect, thought, perception and behavior that are alienated from the usual perception and interpretation styles of a person and lives in a unique intellectual context (Saunders 2003). Whatever the cause of schizophrenia, it affects the individual's interpersonal relationships, work and social harmony, thoughts, feelings and behaviors negatively. Individuals with schizophrenia are usually single and are looked after by their families. Considering the family as a system, there is a continuous interaction between system components and changes in the patient's individual case of illness affects the entire family. To have an individual of schizophrenia in the family, creating severe stress on family members, the family can disrupt the current balance. When the illness occurs, one of the family members has to take care of the patient. **Results:** It is stated that physical activity has positive effects on quality of life of individuals. The physical activity applied to develop healthy lifestyle behaviors may improve the quality of life of the individual. In the studies on physical activity, it is stated that exercise is accepted in psychiatry patients and their relatives and is generally considered to be one of the most valuable items of treatment (Richardson et al. 2005). In a systematic review evaluating the effect of physical activity and exercise in chronic mental illnesses, individuals with chronic mental illnesses who participate in physical activity programs feel more comfortable with their mental well-being, are more compatible with medication and therapeutic interventions, reduce anxiety, strengthen their self-perception and increase social functionality, It has been found to have positive results as it reduces sleep and makes night sleep better quality. **Discussion:** In the literature, no studies have been found to reduce the burden of caregivers of the physical activity program and to increase healthy lifestyle behaviors. The development and effectiveness of the physical activity program need to be determined. Therefore, it is thought that the study will make a significant contribution to the literature. References: None.

THE RELATIONSHIP BETWEEN POSITIVE MENTAL HEALTH LEVELS AND PHYSICAL ACTIVITY OF ELDERLY PEOPLE LIVING IN NURSING HOMES

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Introduction: This study was conducted to determine the relationship between physical activity and positive mental health levels of elderly people living in nursing homes. **Methods:** The research was carried out with descriptive relational type. In the collection of data; The questionnaire prepared by the re-

searchers who questioned the socio-demographic information of the individuals and the Positive Mental Health Scale and the International Physical Activity Questionnaire were used. The population of the study consisted of elderly people over 65 years of age who were registered to a nursing home. In order to evaluate the relationship between the number and percentage distributions, socio-demographic characteristics and the Positive Mental Health Scale and the International Physical Activity Questionnaire, Pearson et al. correlation analysis was used. Results: When the sociodemographic characteristics of the elderly were examined, the mean age was 74.7 ± 4.12 , 68.7% were female, 39.6% were primary school graduates and 62.5% were living in a nursing home for 10 years. The mean score of the elderly was 53.45 ± 7.89 and 57% of them were inactive in terms of physical activity. When the sociodemographic characteristics of the elderly and positive mental health scale and physical activity questionnaire mean scores were analyzed, it was seen that women were more positive than men who were illiterate and elementary school graduates of high school or higher school graduates, those who perceived good health perception and those who were 10 years or more in the nursing home and the difference was statistically significant ($p < 0.05$). When the relationship between the positive mental health and physical activity level of the elderly was evaluated, a positive relationship was found between positive mental health and physical activity level ($r: 0.93$, $p < 0.05$). It has been seen that individuals have more positive mental health as their physical activity level increases. Discussion: When the results of the study are evaluated, it is seen that males, illiterate and elementary school graduates in terms of positive mental health, those who perceive their health as bad and middle, and those who stay in nursing homes for less than 10 years are in the risk group. It can be said that there is a direct link between physical activity level and positive mental health. References: Teke, C., & Arabaci, L. B. (2018). Pozitif Ruh Sağlığı Ölçeğinin Türkçe geçerlilik ve güvenilirliği. *Anadolu Psikiyatri Dergisi*, 19, 21-28. 2. Karaca, A., Ergen, E., & Koruç, Z. (2000). Fiziksel aktivite değerlendirme anketi (fada) güvenilirlik ve geçerlik çalışması. *Spor Bilimleri Dergisi*, 11(1), 17-28.

THE EFFECT OF RESPIRATORY MUSCLE TRAINING ON THE VO₂MAX AND THE ANAEROBIC THRESHOLD

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Introduction: The aim of this study was to determine if respiratory muscle (RM) training, through the MRFit protocol, increases the VO₂max and the anaerobic threshold in a young professional swimmer group, so as to improve their sports performance. Methods: The sample consisted of 11 professional swimmers (7 women and 4 men) between 13 and 17 years old. Participants were randomly assigned to two groups, control (CG) and training (TG). The TG received RM training (MRFit) 20 minutes, 2 times a week for 8 weeks incorporated into their usual training, while the GC only continued their usual training. All the participants performed, before and after the training, ergospirometric tests in treadmill, to compare the results at the end of the 8 weeks. Subsequently, a parametric statistical analysis was performed through the t test. Results: No significant differences were found for VO₂max between CG and TG nor for the anaerobic threshold ($P > 0.05$). Discussion: Despite the non-significant results, we have appreciated different tendencies between both groups and clinical improvements. Concerning VO₂max, the findings of the present investigation coincide with those of Abeijon (2007), who worked with elite athletes strengthening diaphragm and accessory muscles of respiration, also coincides with William et al (2008), who performed a program of strengthening of RM in triathletes for only 4 weeks, warning that significant

results could be obtained by increasing the number of weeks, for this reason different results were expected in the present study. About the changes related to the anaerobic threshold, clinical improvements suggest that the TG improved its capacity to maintain the intensity of effort without the appearance of a progressive accumulation of lactate (Chavarren et al 1996), concordant with González et al (2012) who got results that show lower concentrations of lactate in blood after RM training, probably caused by an increase in consumption of trained RM. Which leads us to think that by decreasing the accumulation of blood lactate the anaerobic threshold also increases. References: Abeijon, B (2007). Effects of diaphragm training and accessory muscles of inspiration in elite athletes. (PhD, Autonomous University of Barcelona, Spain). Chavarren, J., Dorado, C. and López, J. (1996). Triathlon, conditioning factors and training. Red. Sports training magazine. 10 (2). 29-37. González, S., Vaz, C., Fernández, J., Arnedillo, A., Costa, J. and Gómez, R. (2012). Effects of respiratory muscle training on performance. Bibliographic review. Rev An Med Sport. 3(3). 171-178. William, E. and Dupler, T. (2002). Effects of Respiratory Muscle Training on VO2max, Ventilatory Threshold and Pulmonary Function. J Publice 5(2) 29-35

HEALTH RELATED QUALITY OF LIFE AND ITS RELATION TO MOTOR ABILITIES OF EARLY SCHOOL AGE CHILDREN

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Introduction: Given the importance of quality of life in the context of increasing hypokinesia and obesity among children and youth, a survey was conducted in order to examine the health related quality of life (HRQOL) and its relation to motor abilities of early school age children. Method: The study included 214 children (113 boys, 101 girls) aged 7-8 years from six elementary schools from Subotica (Northern Serbia). Results and Discussion: Relations between HRQOL such as dependent and independent variables were examined: physical growth and development and motor abilities. After calculating a general factor for motor abilities by genders the results show significantly correlations in four of five domains of HRQOL in boys (Physical Well-being, Psychological Well-being, Social Support & Peers, School Environment) and no one domains of HRQOL in girls of early school age. Boys who achieved better results on tests of motor development are more physically active, full of energy, feel better, spend more time with friends and enjoy the support of their peers. References: None.

Physical Education and Pedagogics

THE INTRODUCTION OF THE THEORETICAL CONCEPTS FOR THE PHYSICAL EDUCATION AND SPORTS DISCIPLINE IN THE ROMANIAN SCHOOL SYSTEM

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Introduction: The main purpose of the study was to identify the opportunity to introduce the theoretical notions in the educational process for Physical Education and Sports. A second goal was represented by the possibility of integrating this new concept into the Romanian school system. Methods: The research

was conducted between October 2017 and March 2018. 215 PE secondary school teachers were randomly included in the research (119 females and 96 males). In order to achieve the proposed goal, a SWOT analysis was carried out. We conducted discussions and interviews with specialists in the physical education domain. The questions were open and asked those who responded to identify strengths, weaknesses, threats and opportunities regarding the introduction of theoretical notions into the physical education lessons. Results: Following the application of the SWOT analysis, we found 6 strong points, 3 weaknesses, 3 opportunities of introducing theoretical notions in the pupils' training process and only 1 aspect which could be included in the category of uncertainty elements, which could be considered a threat to the evolution of the school educational process. Discussion: The document underlying our approach was the new curriculum for secondary school Physical Education (MEN 2017). For the introduction of the theoretical notions, a textbook for fifth grade students was written (Oprea et al., 2017). The implementation of the new curricular content for Physical Education is going to be achieved gradually in the next few years (MEN 2017). In education, the pedagogical component emphasizes the theoretical notions that underpin the formative aspects of the practical activities (O'Sullivan, 2013). The Physical Education lesson should also focus on shaping an appropriate behaviour in society (Mocanu, 2015; Badau, 2017) or on improving communication activities (Rus, 2013). The main conclusion, resulting from this SWOT analysis, was that the introduction of theoretical notions would generate favourable support for the practical activities carried out during secondary school PE lessons. References: Oprea L, Pîslaru VA, Calistru MG, Stoican D, Vicol E, Şuţă N, (2017) Didactica şi Pedagogica Publishing house, Bucureşti, p 142. O'Sullivan M, (2013) Sport Education and Society, 18(1), 1-5. Rus CM, (2013) Sport science 6(2), 82-84. Badau D, (2017) Physical education of students, 21(3), 108–115. Mocanu GD, (2015) The Didactics of Physical Education and Sport, Galaţi, The "Dunărea de Jos" University Foundation Publ., p. 278. The Ministry of National Education, (2017) School Curricula for Physical Education and Sport, 5th to 8th grades, Bucureşti.

DIFFERENCES IN THE BODY COMPOSITION OF STUDENTS ACTIVE AND INACTIVE IN PHYSICAL EXERCISES

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Introduction: Human body is very complex, and apart from genetic factor, body composition is influenced by many other factors. Goal of this research is to demonstrate if there are differences in body composition of students who are active and the ones who are not active in physical activities (sports). Methods: Population/sample in this research were 288 male students of College AAB from three different campuses placed in three different cities through Kosova. For the assessment of body composition the measure instrument Tanita BC-601 was used to measure 9 variables and one variable of height which is entered into the measurement devices before measuring as well as some other data. For the assessment of life style, i.e. presence of physical activity (sports) in active or recreational sense we used questionnaire with 20 questions of different type to determine life style. Results: Based on statistical processing of the data we came to conclusion that there is a difference between students who are active and the ones that are not active in physical activities and these differences are visible in three variables: spending of calories (KCAL) - DCI, body vitality - BMR and visceral fat – AVF. Out of 288 respondents 220 were active in physical activities while 68 of respondents were not physically active. Discussion: It was determined that there is statistical significant between two tested groups in body composition and in presence or lack of physical activities. Results obtained in the variable of daily consumption of calories (DCI) demonstrate that students who

are physically active have increased need for calories since they need calories for burning when doing physical activities. In addition, even though most of the sample was considered to be active, according to the IPAQ, it can be seen that practically half the students (49.5%) were irregularly active or sedentary. Students that are active physically demonstrate better body vitality (BMR) which in simple terms means that the ones who are physically active are metabolically younger. (Saha, 2013) It may be concluded that in most of the parameter there were significant differences between physical activities and lack of physical activities of students and physically active students showed better somatotype and body composition variables than students who are not physically active. Vibrant physical activities enable possession of less visceral fat (AVF). References: Bubanj S (2013). *Physical Education and Sport* Vol. 11, No 3, 2013, pp. 197 – 208. Ghane M, Aghayari A, Mazreno AB (2014). *International Journal of Pediatrics*, Vol.2, N.4-3, Serial No.12. Mak, KK., Cerin, E., McManus, A.M. et al. *Eur J Pediatr* (2016). 175: 31. doi:10.1007/s00431-015-2586-5. Mialich MS, Covolo N, Vettori JC, Jordao AA (2014). *Junior Revista chilena de nutrición*, vol.41 no.1. Sukanta Saha (2013). *Annals of Biological Research*, 4 (3):95-100.

ACHIEVEMENT MOTIVATION OF PHYSICAL EDUCATION TEACHERS

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Introduction: The objective of this study is to identify the differences in achievement motivation of the physical education teachers divided by gender and results compared with national standards. We expect significant higher achievement motivation by male in comparison with female. Study identifies the stronger and weaker dimension of achievement motivation of physical education teachers compared to national standards. **Methods:** We collected data from 52 physical education teachers (male: n=22, 41.59±9.95 years old, female: n=30, 39.33±10.67 years old). As research tools, we used a standardized achievement motivation questionnaire. The Kolmogorov-Smirnov test was used to assess the normality of the data. The Mann-Whitney was used to test the significance of the differences between individual independent samples. The degree of dependence between two groups was expressed by using the r coefficient. **Results:** Male physical education teachers have significant higher (p=0.043, r=0.28) achievement motivation compared to physical education female teachers. When comparing dimensions of achievement motivation of male physical education teachers, they achieved significant higher score in dimension: persistence (p=0.024, r=0.31), fearlessness (p=0.011, r=0.35) and competitiveness (p=0.002, r=0.42). Comparing them with national standards, achievement motivation by male teachers of physical education, correspond with 58th percentile and by female teachers of physical education with 46th percentile. **Discussion:** Our findings, that male teacher of physical education achieved significant higher achievement motivation than female teachers which are supported by the results of previous studies (Ružić, Matešić, Štefanec, 2016; Schuler, Prochaska, 2011; Adsul & Kamble, 2008; Pašková, 2007). The low social status of the teachers can be one of the reasons of the result of ranking physical education teachers according to achievement motivation compared to the standards. References: Adsul R.K, Kamble, V. (2008). Achievement Motivation as a Function of Gender, Economic Background and Caste Differences in College Student. In: *Journal of the Indian Academy of Applied Psychology*, 34 (2), 323-327. Ružić V, Matešić K, Štefanec A (2016). Gender differences in achievement motivation of employed adults. *Suvremena psihologija*. 19(1), 81-89. Pašková, L. (2007). Gender differences in achievement motivation. *The new educational review*, 13, 245-252. Schuler H, Prochaska M (2011). *Dotazník motivace k výkonu – LMI*. Praha: Hogrefe Testcentrum.

ACUTE EFFECTS OF PHYSICAL ACTIVITY ON COGNITIVE PERFORMANCE IN ELEMENTARY SCHOOL-AGED CHILDREN DURING THE SCHOOL DAY

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Introduction: Several previous studies showed a relationship between acute exercise and cognition in children (Best, 2010; Chang, et al., 2012). The purpose of this study was to evaluate the acute effects of physical activity on cognitive performance in elementary school-aged children. **Methods:** A total of 430 children aged 6 to 15 years participated in this study. Students were randomly assigned to the experimental group (EG) or the control group (CG). The EG performed an aerobic games session lasting 45 minutes, whilst the CG had not performed in a physical education class on this school day. Memory, selective attention and creativity were analyzed by several tests. **Results:** The EGs experienced significant improvements in memory, creativity and selective attention. Conversely, the CG does not improve any creativity variables; even, the CG displayed a worsening in total graphic creativity, moreover, displayed a worsening in learning curve. **Discussion:** The main finding of this study was that cognitive processes might be influenced by aerobics exercises and might be already visible after acute bouts of exercise, which could be importantly for academic achievement. This findings are according to the previous research, which suggested that vigorous-intensity exercise improves cognitive function (Peruyero et al., 2017). The basis for the results found is the fact that physical exercise produces physiological changes in the brain, causing an immediate neurochemical response that may enhance cognitive performance (Best, 2010). Accordingly, Lupu (2012) recommend Physical Education to be taught even since kindergarten, since people who constantly participate at Physical Education lessons have a more developed creative capacity. The results indicate the importance of using physical activity as a means of regulating cognitive processes in the classroom among children. **References:** Best JR (2010). *Dev Rev*, 30(4), 331–351. Chang YK, LabbanJ D, Gapin J, Etnier JL (2012). *Brain Res*, 1453(250), 87–101. Lupu E. (2012) *Procedia - Soc Behav Sci*, 46, 1893–1898. Peruyero F, Zapata J, Pastor D, Cervelló E (2017). *Front Psychol*, 8, 921.

COMPETENCES OF THE STUDENTS OF THE FACULTY OF SPORT IN LJUBLJANA AT THE PRACTICAL PEDAGOGICAL TRAINING IN THE ELEMENTARY SCHOOLS FOR THE USE OF ICT AT THE PHYSICAL EDUCATION

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Introduction: The purpose of the study was to present the research of the pilot project “Information and Communication Technology (ICT) in Physical Education (PE) in the Practical Pedagogical Training (PPT) of the Students of the Faculty of Sport in the Elementary Schools”, which refers to the analysis of the change of students’ attitudes towards the use of ICT in PE during the PPT. We have been examined the competences of the students of the Faculty of sport in Ljubljana at the PPT in the elementary schools for the use of ICT at the PE. **Methods:** The research was done during the academic year 2017-18 on the sample of 50 students (21 women, 29 men), who were regularly enrolled in the first year of the master’s

degree of The Program Physical Education at the Faculty of sport in Ljubljana and attended subjects Didactics of Physical Education 3 and Teaching Practice in elementary PPT of the Students of the Faculty of Sport in Elementary Schools”. We interviewed the students before and after the PPT. We used the questionnaire ICT in Physical Education in elementary school (Majerič, 2017). In this study, we analyzed the competences (9 variables) of the students of the Faculty of sport in Ljubljana at the PPT in the elementary schools for the use of ICT at the PE. Respondents had to choose, by each variable, one answer on five-Likert scale. The data of variables were analyzed with SPSS for Windows. We calculated the basic statistics parameters and t-test for equality of means to calculate the differences between the initial and final interviewing (before and after PPT). Results: Analyze showed us, that before the implementation of the pilot project, students estimated that they were average ICT competent. After the implementation of the PPT (and the project), their marks about their ICT competences significantly increased. The findings of the survey showed us, that during the project implementation, students made a statistically significant ($p \leq 0.05$) improvement of their ICT competences. Discussion: Given that, the knowledge of students for the use of ICT in the PE before the implementation of the pilot project were average, it is essential that their ICT literacy training for its use should be the part of the regular study programmes and not only the pilot projects, such it was the “ICT in PE at the PPT of the Students of the Faculty of Sport in the Elementary Schools”. References: Purificación, M. (2018). Multivariate characterization of university students using the ICT for learning. *Computers & Education*, (121) 1, 124–130. Rafique, G. M. (2014). Information literacy skills among faculty of the University of Lahore. *Library Philosophy & Practice*, paper 1072. Redecker, C. (2017). European framework for the digital competence of educators: DigCompEdu (No. JRC107466). Joint Research Centre (Seville site). Wilson, M., Scalise, K., Gochyyev, P. (2015). Rethinking ICT literacy: From computer skills to social network settings. *Thinking Skills and Creativity*, 18, 65–80.

PREVALENCE OF SCOLIOSIS IN PRESCHOOL CHILDREN LIVING IN SOS CHILDREN'S VILLAGE IN SARAJEVO

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Introduction: Scoliosis can be defined as a curvature of the thoracolumbar spine that is greater than 10° in the coronal plane (Sharma et al., 2015). It is the most common paediatric musculoskeletal disorder and the prevalence is approximately 3% (Koniczny, Senyurt, & Krauspe, 2012). The goal of the present study was to determine the prevalence of scoliosis in a sample of children living in SOS children's village in Sarajevo. Method: The sample consisted of 92 preschool age children aged 4-6 years who were living in the SOS children's village in Sarajevo. A number of antropometric measures was collected including children's weight, height, body posture and presence of scoliosis (spine curvature larger than 10°). Body posture was evaluated by Wolansky criteria (Wolansky, 1975). Results: The total number of children who had scoliosis was 14 (or 15,2%). The number of children who had very good posture was 4 (4.3%), good posture had 58 children (63%), and number of children who had bad posture was 30 (32,6%). There was no significant correlation between body posture and scoliosis status ($p=0,58$). Discussion: The prevalence of scoliosis in this sample was much higher than that reported in the current literature. It is obvious that certain categories of children are at higher risk for these musculoskeletal disorders. Bad body posture was also frequent in this sample. Evidently, early social factors play an important role in the motor development of children growing up without parents. This finding points to the need for early

intensive intervention aimed at these children. References: Sharma, S., Londono, D., Eckalbar, W. L., Gao, X., Zhang, D., Mauldin, K., ... & Murphy, K. K. (2015). *Nat Commun*, 6(6452), 1-10. Konieczny, M. R., Senyurt, H., & Krauspe, R. (2012). *J Child Orthop.*, 7(1), 3-9. Wolansky N. (1975). *Tjelesni rast i razvoj s praćenjem držanja tijela. Priručnik za nastavnike*, Varšava.

Physiotherapy

EFFECTS OF ANTAGONIST-CONTRACTION STRETCHING DURING INTERFERENTIAL CURRENT ON BIOMECHANICAL PROPERTIES OF PASSIVE RESTING TENSION TORQUE DETERMINED BY BIOMECHANICS MEASUREMENT TOOLS

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Introduction: Sufficient joint mobility is a prerequisite for exercising in sports and everyday life [1]. Joint mobility is influenced by the musculo-articular complex that spans the joint [2]. Stretching is generally used to increase joint flexibility and to improve sports performance [3]. However, the relationship between articular angle and passive torque developed in resistance to motion should take into account for flexibility exercises [4]. The two structures of the musculo-articular complex cannot be easily determined. Recently, a new stretching method was investigated. During interferential current (IC) the hamstrings were stretched by the method antagonist-contrast (AC) [5]. Interferential current induces pain inhibition and probably raises tolerance to stretching pain. The primary aim of this single case study was to evaluate the feasibility of the study methodology. The secondary goal was to examine the effectiveness of antagonist-contrast (AC) stretching during IC i) on passive resting tension torque (Nm) at 50-degree and at 55-degree hip angle flexion and ii) on the maximum hip joint mobility. Method: This single case study performed a maximum passive hip flexion on day one. On the second day, the intervention was conducted. The right leg was flexed in the hip joint at 100°. This angle was adjusted with a goniometer. To reach a sub maximal sense of stretching of the right leg, the participants extended the right knee joint actively via the quadriceps muscle. During this position the IC was increased to a noticeable tingling, to superimpose the stretching pain. This process was repeated for a total of three minutes. The passive resting tension torque and the hip maximum range of hip flexion were recorded before (T0), after three, 15', 45' and 90 minutes. The passive resting tension torque was measured with a dynamometer (Nm) and the maximum hip range with a protractor. Results: The study methodology is feasible, and no side effects was determined. In comparison to passive hip flexion, the intervention AC stretching during IC showed an average of 10% lower passive resting tension torque (Nm) values at 50-degree hip angle flexion and at 55-degree hip angle flexion at all times of post-measurements. Conclusion: This study showed evidence on the feasibility and efficacy of stretching contraction of an antagonist muscle group during IC for decreasing passive resting tension torque of the hamstring muscle. Further studies should be conducted with larger sample size. Reference: None.

THE RELATIONSHIP BETWEEN POSTURAL COMPONENTS AND MUSCLE BALANCE AMONG 9-14-YEAR-OLD CHILDREN

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Introduction: Poor posture is a common problem among schoolchildren. Several studies have examined relationship between the spine posture and muscle strength or endurance (Barsczyk-Pawelec et al., 2017; Dejanovic et al., 2013). But we cannot find studies describing the ratios of muscle strength and grouping that assess the size of differences between the agonist and antagonist according to the impact that causes deviations in the posture. With the aim of answering the above issue, purpose of the study was to examine differences between the related agonist and antagonist muscle strength according to their location in the postural role. **Methods:** Cross-sectional study included 102 schoolchildren: age 11.28 ± 1.55 ($\bar{x} \pm SD$); BMI 18.87 ± 3.71 . Body posture was assessed visually in the sagittal plane (neck, chest, shoulders, upper back, trunk, abdomen and lower back position) and in the frontal plane (head, shoulders, spine, hips, feet and arches position) using the New York State Posture Rating Chart. Each posture component was rated on a scale from five to one: 5 was normal position, 3 – slightly deviated, 1 – markedly deviated. Maximal isometric muscle strength was measured with manual dynamometer on the following muscles: neck flexors and extensors, upper and lower part of pectoralis major, middle and lower part of trapezius, trunk flexors and extensors, hip flexors and extensors, hip adductors and abductors. **Results:** Children were divided into two groups according to the results of the posture assessment: normal posture and deviated posture. Comparing the strength ratios between antagonistic muscles of the postural muscle groups, we found significant differences that was more frequent among 9-14-year-old who had deviations in the posture. However, the impact on the posture was dependent of the muscle group location. **Discussion:** We expected significant differences in strength ratios comparing normal and deviated posture. However, we did not know the magnitude of the difference and the resulting impact on the posture. We found that the detrimental effect on the posture of the divergence in strength between opposing muscles was dependent on their location. There were cases of pronounced strength imbalance among children with normal posture, for example in comparison of hip flexors to hip extensors, while deviated posture group showed negligent imbalance. On the other hand, in postural deviation appears to be related to imbalances in other locations, for example in comparison of the pectoralis group to the trapezius etc. Likely explanation is that there are normal differences between anterior and posterior muscle groups, but problems arise based on the location. **References:** Barsczyk-Pawelec K, Dzijubek W, Piechura JR, Rozek K (2017). *Acta Bioeng Biomech*, 19(1), 133-139. Dejanovic A, Cambridge EDJ, McGill S (2013) *Advances in Physical Education* 3(3), 111-115.

ASSESSING YOUNG GYMNASTS' DYNAMIC POSTURE: A COMPARISON OF METHODS

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Introduction: Functional Movement Screen is an established method of assessing dynamic posture of athletes. In theory, it should be able to provide some insight in individual athlete's injury potential. Validity and reliability of FMS as screening tool is debated and one of foremost criticism is its subjectivity. To the authors' knowledge, there is no previous research using Kinovea to precisely asses FMS scores.

Methods: 10 young competitive gymnasts (4 female and 6 male) were included in this study. Mean age of sample is 11.52, mean height 138.3 cm, mean weight 33.69 kg and mean BMI score of 17.6. The participants were measured using FMS test. FMS measures assesses dynamic posture and mobility and is used as a screening tool to help prevent potential injuries by identifying athletes with higher likelihood of sustaining a sports injury. Kinovea is a video-analysis software used to measure various kinematic properties of locomotion such as joint angles, velocity and acceleration of movement of body segments. The participants were scored by an experienced FMS assessor on site as per standard FMS protocol by Cook et al. (2010). Afterwards, same participants were scored again using Kinovea to achieve more objective measurement. The kinematic protocol was described by Whiteside et al. (2016) and modified by Kiseljak et al. (2018). Results: Wilcoxon Signed Rank Test for FMS scores versus FMS-Kinovea scores identified FMS test no. 1 (Deep Squat) as significantly different. Median score of Deep Squat assessed on site was 2 (mean value: 2.1), while that same test, scored with Kinovea, had median score of 1 (mean value: 1.2). Paired Pitman-Morgan test for equality of variances was used to test the dispersion of scores. None were shown to be statistically significant, however overall FMS score was near significance threshold implying that there is a difference although our power of study was too low probably due to low sample size. Discussion: We detected significant difference in scores of Deep Squat test which is not surprising since it is the most complicated test to assess due to large number of variables assessor must evaluate. Also, variance of overall FMS score using Kinovea assisted protocol was smaller (although not significantly so), suggesting more objective assessment. References: Cook, G. (2010). *Movement: Functional movement systems: Screening, assessment, corrective strategies*. Santa Cruz, CA: On Target Publications. Kiseljak D, Jurak I, Rađenović O (2018). Objective assessment of gymnasts' dynamic posture using the functional movement screen. 14th International Scientific Conference of Sport Kinetics. Whiteside, D., Deneweth, J.M., Pohorence, M.A., Sandoval, B., Russell, J.R., McLean, S.G. & Goulet, G.C. (2016). Grading the functional movement screen: A comparison of manual (real-time) and objective methods. *The Journal of Strength & Conditioning Research*, 30(4), 924-933.

Psychology

PERSONAL WELL-BEING AS A PART OF THE QUALITY OF LIFE: IS THERE ANY DIFFERENCE IN THE MALE'S WELL-BEING LEVEL AND THE LEVEL OF THEIR ANXIETY TRAIT REGARDING THEIR SPORT ACTIVITY LEVEL?

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Introduction: In recreational sport it is important not only a victory or achievement of a record, but healthy lifestyle as well. Elite athletes are often forced to mutual hostility and a high level of competition (Sekot, 2008). The aim of the paper is to identify the level of male's well-being and anxiety trait regarding their level of sport activity. Methods: The research group consisted of 86 males (20.40 ± 1.08 years; n: 29 recreational athletes, 21 elite athletes, 36 non-athletes). We used the BDP questionnaire to determine the level of male's well-being and STAI questionnaire to determine the level of anxiety trait. We used the Kolmogorov-Smirnov test to test the normality of the data and Kruskal-Wallis test, with post-hoc Mann-Whitney U-test to test the differences between the samples. Results: We have noticed the difference in the level of well-being and the anxiety trait as well. Pair comparison of groups have showed a significant difference in the level of physical problems between recreational and elite athletes. We have also noticed

the difference in the level of positive attitude towards life, self-evaluation, and depressive mood between recreational athletes and non-athletes. The differences were also observed between elite athletes and non-athletes – in the level of both positive dimensions of well-being and in the level of physical problems and depressive mood as well. The difference in the level of anxiety trait was noticed only between recreational athletes and non-athletes. Discussion: Between recreational and elite athletes, we noticed the difference only in one dimension of well-being – physical problems. We consider that this difference may be due to the fact that elite athletes have better care options and also by fact that excessive load and lack of regeneration also appear in a group of recreational athletes (as well as perfectionism, power-orientation and inadequate goals setting) (Hall et al., 2009; Hamer & Vlachopoulos, 2002; Cockerill & Riddington, 1996). An important conclusion of our study is that sport activity, (regardless of its level) using any suitable instrument helps to increase male's well-being. Our findings about anxiety trait correspond with several meta-analyses (e. g. Wipfli et al., 2008; Petruzzello et al., 1991). References: Cockerill IM, Riddington ME (1996). *Counselling Psych Quart*, 9(2), 119-129. Hall HK, Hill AP, Appleton PR, Kozub SA (2009). *Psych Sport and Exercise*, 10(1), 35-44. Hamer M, Vlachopoulos SP (2002). *J Sports Med and Phys Fitness*, 42(2), 233. Petruzzello SJ, Landers DM, Hatfield BD, Kubitz KA, Salazar W (1991). *Sport Med*, 11, 143-182. Sekot, A (2008). *Sociologické problémy sportu*. Praha: Grada Publishing. Wipfli BM, Rethorst CD, Landers DM (2008). *J Sport & Exer Psych*. 30(4), 392-410.

Rehabilitation

DOES TECAR THERAPY AFFECT THE PERFUSION OF THE MICROCIRCULATION? A PILOT FEASIBILITY STUDY ON HEALTHY PARTICIPANTS

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Introduction: In sports physiotherapy, TECAR therapy (TT) is frequently used in the treatment of athletes with acute and chronic musculoskeletal disorders. TT is an endogenous thermotherapy used to generate warming-up of superficial and the deep tissues. The aim of this quantitative pilot study was to determinate if TT delivered in two modalities (resistive and capacitive) affect the perfusion of the skin microcirculation (PSMC) and Intramuscular blood flow (IMBF). Methods: Ten healthy volunteers (n=4 females, n=6 males; mean age 35.9 ± 10.7 y) were recruited and completed the study. All participants were delivered with three different TT applications (resistive, capacitive and placebo) for a period of 8 minutes. PSMC, IMBF and the Skin temperature (ST) were measured pre- and post- TT application using Power Doppler Sonography, Laser Speckle Contrast Imaging and Infrared Thermography. Descriptive statistics and non-parametric inferential statistic (Friedman's 2-way ANOVA by ranks, Wilcoxon matched-pair signed-rank ($P < 0.05$)) were used to analyze data and determine whether there was a statistically significant median difference between pre- and post- measurements within the three TT modalities. Results: Statistically significant differences in PSMC were found for placebo versus resistive TT ($p < 0.0001$) and the placebo versus the capacitive TT ($p < 0.0001$). Only between the resistive TT and the placebo application a significant

change in IMBF ($p=0.005$) and ST ($p<0.001$) was found. Discussion: The changes in PSMC and IMBF seem not to be related to any systemic cardiovascular responses, since both heart rate and mean arterial pressure didn't varied between pre- and post- measurements, suggesting TT to affect blood flow only at a local level Perfusion of the microcirculation can be affected by the application of TT. To optimize its clinical use further studies on physiological responses and clinical efficacy are needed. References: Kumaran, B. (2017). *European Journal of Physiotherapy*, 19(3): 137-146. Costantino C. (2005). *Acta Biomed*, Apr;76(1):37-41. Dori A. Abbasi H. Zaidman CM. (2016) *Muscle Nerve*, Nov;54(5):872-878.

Sociology

MY HANDICAP, MY CAPITAL! THE CASE OF PARALYMPIC CHAMPION

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Introduction: The purpose of this article is the promotion of self-determination and the creativity of the disabled in a hostile environment according to a sports career of a Tunisian disabled athlete. Methods: In order to meet the requirements of a sporting career, the athlete goes through different stages of perception of his disability. Perceptions that develop a set of representations, or even representations made as and when his sporting career and the support of his environment and his self-determination. Self-determination takes shape according to these 4 steps: [1] The autonomy, [2] Self-regulation, [3] Psychology power and [4] Self-realization. Results and discussion The transition from a fragile and precarious mental state to active and even enterprising state defying a home-made sporting course runs through life. Expectations, dreams, seeds and a reward or even a destiny. The analysis of life stories of the Paralympic champion with a spinal cord injury in 1997 illustrates, on the one hand, despite her late disability (age 19), her ability to take risk of late engagement in a sporting practice, its capacity to act according to its decision and to assume the consequences of its actions and even to anticipate its acts, on the other hand, it testifies its capacity to promote its physical and mental environment. The handicap therefore and indeed is a capital. The interview with our athlete was about three dimensions: the marital status, the sporting state and the social state. The developed results of a journey to preserve fighter confronts a set of obstacles and obstructions, a difficult choice to characterize the existence of sporting career. Passing through these three stages representations of "cursed" disability to "exploited" disability to "revered" disability, our respondent lives an entrenched and ambivalent journey between self-determination and resistance, its goal was the recognition of the general public, social success and physical well-being. This success is explained by learning the tools on how to favor the construction of a representation of the disabled sports career terms. References: None.

ON THE WAY TO RECOGNIZE AND PREVENT PEER VIOLENCE IN GRASS ROOT SPORTS CLUBS

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Introduction: The research is a part of project Sport against violence and exclusion (SAVE) funded un-

der the EU programme Erasmus+, with specific aim of defining competencies needed to predict, avoid and cease violence, exclusion and intolerance through sport, using sport as conflict resolution tool. This research address the question of recognition and prevention of peer violence in grass roots sports clubs, which is seen as starting point in that process. Methods: The data was collected using qualitative and quantitative methodology. The focus-group discussion was conducted with coaches (individual and team sports) who work with children age 6 – 16 in grass root sport clubs in Vojvodina, as well as with parents. The second phase of research was conducted using questionnaire among primary school children (N=118) who train some sports and children who do not train any sport. Results: The coaches spoke about forms of peer violence in their sport clubs, the frequency of violence, terms and places where violence takes place. The participants described the examples of violence, even though they have stressed that violence is rather exception and not everyday occurrence in sports. The frequency of aggressive behavior among children is 32% in the sample of 118 respondents, with the average age of 12.3. Children experienced violence in some degree (38/118), with no significant gender differences: 34.5% of boys and 31% of girls. Parents stressed that violence is not everyday occurrence in sports. However, they believe that coaches need to pay more intensive attention on children behavior before, during and after training sessions in order to prevent peer violence. Discussion: The findings show the need of more intensive desk and field researches to the issue of peer violence in sport clubs and society in general. The outcome of researches should be a comprehensive strategy which would include coaches, parents, teachers and children. This research shows that only inclusion of all stakeholders could make positive change in the field of peer violence in society. References: Bačanac LJ, Petrović N, Manojlović N. (2009). Priručnik za roditelje mladih sportista. Beograd: Republički zavod za soirt. Bailey R. (2006). Journal of School Health, 76, 397-401. Koo JE., Lee KU. (2014). Journal of Exercise Rehabilitation, 10, 111-117. Richman E., Schaffer D. (2000). Psychology of Women Quarterly, 24, 189-199.

Sport Management and Law

SATISFACTION SURVEY FOR CONSUMERS OF SHIN-KUANG PRIMARY SCHOOL'S SWIMMING POOL IN KAOHSIUNG CITY

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Introduction: This study is to understand whether there are correlations between the basic information variables and satisfaction of, Kaohsiung City, and the understanding of whether there are significant differences in the satisfaction of different basic data characteristics. In this study, the new members of the swimming pool of Shin Kong National Park were invited to study the senior and incoming members. This study was conducted using research methods such as questionnaires and surveys. The questionnaire contains three parts, first, the customer's basic information, second, the customer spending habits, third, the customer's satisfaction. Methods: After the data collection, omitting the invalid questionnaire, the effective questionnaires were given to SPSS 22.0 software package for analysis and assessment. This paper analyzed the background motive, the number of times of distribution, the percentage, the average and the standard deviation of the swimming club customers, and then analyzed the swimming club and the satisfaction degree with the t test and the single factor variance. Results: In the basic information section, the proportion of men accounted for 58%; age average 34.74 ± 15.13 years; with student occupation up to 23%, followed by

services industry, accounting for 22%. The number of consumption, 2 to 4 times the most, accounting for 34%, followed by the first consumption, accounting for 27%; the reasons for consumption, the number of consumers, the number of consumers, the number of consumers, accounting for 51%, accompanied by family and friends came first, accounting for 29%; fees accounted for the proportion of reasonable majority; consumer companions, the largest single, accounting for 39%, friends, followed by 38% The ($P < .05$). Discussion: From the results of further analysis, it was found that the satisfaction degree of the consumption rate was more than that of the past, and the results showed that the number of different consumption times was different affect consumer satisfaction. Loyalty, the highest correlation with the equipment planning, followed by the cleanliness of the environment, followed by the sanitation of the lavatory, and finally the professionalism of its staffs. The results showed that the equipment planning and environmental cleanliness played a larger role to affect customer loyalty. The proposed industry can be targeted this sector to elevate and improve upon. Reference: Wang, T.Y. (2002) Research on the relationship between service quality, relationship quality and customer loyalty of international tourist hotels - taking Taipei, Taichung and Kaohsiung as examples. Unpublished master thesis, Nanhua University, Chiayi County.

MANAGERIAL BARRIERS SAUDI ARABIAN SQUASH FACES IN MEETING INTERNATIONAL STANDARDS

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Introduction: Sports play a role in improving social development in a country, thus, many countries aim to achieve high standards in sports. Despite the great progress that has taken place in the world in achieving international standards, sports in the Arab world are still facing many difficulties and obstacles. The aim of this study was to determine the managerial barriers that Saudi Arabian Squash faces in reaching international standards. Methods: A pre-designed questionnaire was provided to four groups of the Saudi Arabian Squash Federation: players, referees, coaches, and managers. The participants assessed the management and financial barriers. The Cronbach's Alpha and Test-Retest were used to test the reliability of the questionnaire. Both the management and financial barriers had seven and six items, respectively, that were answered with agree, undecided, or disagree. Results: Based on the responses of 39 participants, the Test-Retest reliability score for the management and financial barriers were 0.917 and 0.899, respectively. Moreover, the Cronbach's Alpha scores for the management and financial barriers were 0.764 and 0.749, respectively. From the 355 participants who completed the questionnaire, the range of people in agreement with each item in the management barrier ranged from 49.86% to 60.66%. Meanwhile, 41.78% to 56.15% of the participants agreed with each item in the financial barriers. For the management aspect, most of the participants agreed with the item "The management does not accompany the squash team regularly." For the financial aspect, the item "There are complex financial procedures when participating in foreign or international squash competitions" had the highest percentage of agreement. Discussion: The results show that the participants perceived that they did not receive sufficient managerial support to reach international standards, which agrees with a previous study by Al-Halayek and Khasawneh (2005). Moreover, the participants perceived that they did not have satisfactory financial incentives when compared to other sports, such as football. This is in agreement with a study from Sobhi (2005). Thus, it is recommended that managerial and financial supports be improved. References: Al-Halayek M, Khasawneh A (2005). *Dirasat Aleulum Altarbawia*, 32(2). Issa S (2005). *Majalat Jamieat Alnajah lil'abhath*, 19(2).

WHY WOMEN ARE NOT LEADERS OF RUNNING EVENT ORGANIZING TEAMS?

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Introduction: Running is one of the most popular methods of spending time in active form in the world. It is estimated that in Europe over 50 million people regularly practice running. In Poland live 37.8 million people and above 4 million are amateur runners, and every year over 3 000 running events are organized. According to statistics data, from many countries, not only from Poland, 25-30% of participants of mass running events are women. The vast majority of managers organizing runs are former or actual runners, so it is very interesting why only men are leaders of the teams which organize running event, but women as leaders are very rare? In this article we can find answers why women aren't top leaders of running events organizing teams and, if they were, how it could be chance for the organizing process of the run. The main purpose of the research was finding influence of sex of leader on style of leadership, decision process and atmosphere in team. **Method:** Author carried out quality research using individual deep interview method. The data was collected from 26 individual deep interviews with managers of big running events organized in Poland, and 40 individual deep interviews with members of their teams. **Results:** Currently effective leaders should have different competences than 20-30 years before. More important are for example emotional intelligence, empathy, interpersonal skills. Organizations operating in amateur sport market have to build networking with many partners from public and business sector, so leader should be concentrated on cooperating with stakeholders representing different expectations. Competences that women have more than men are needed. Unlike other industries, on running market there are very few women as a leaders. Several reasons explain this situation, some of them are economic, some of them have sociological ground. **Discussion:** Results of research partly confirm the current state of knowledge about the subject of women as leaders. But on the running amateur market there are still very few women who are top leaders and organize mass sport events. **References:** Chandler D. What Women Bring to the Exercise of Leadership *Journal of Strategic Leadership*, Vol. 3 Iss. 2, Winter 2011, pp. 1-12. Supporting Women in Leadership, New Neuveau, 2011. Kessler M. Female leaders in the 21st century in a masculine world, *Koers Journal*, 2017. Lantara NF. The Roles of Woman as Leader and Housewife. *J Def Manag* 5: 125, 2015 p. 2-5. Young G. Women, Naturally Better Leaders for the 21st Century, *Routledge, Taylor and Francis Group, Transpersonal Leadership Series: White Paper Two*, 2015.

THE EFFECT OF SOCIAL CAPITAL DIMENSIONS ON KNOWLEDGE SHARING INTENTION AMONG PHYSICAL EDUCATION TEACHERS

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Introduction: Today, social capital and knowledge sharing can be defined as the most important assets of sport organizations. The purpose of the current study was to assess the effect of social capital dimensions on knowledge sharing intention among physical education teachers in Fars province. **Methods:** To fulfil this research a field study was conducted. The research was a descriptive and correlative survey. The research tool was a combination of researcher developed questionnaire (social capital questionnaire) as well as Taylor and Todd (1995) knowledge sharing standard questionnaire, that was designed based

on Likert scales (from 1 to 7). The research population was physical education teachers in Fars province and based on a formula a sample ($n=268$) was selected through random sampling. The reliability of questionnaire was found to be 0.83 according to Chronbach's alpha and the validity of questionnaire was verified by using point of views of sport management and organizational behavior management experts. AMOS18 and SPSS18 were used for data analysis. To measure the validity and fitness of the model, Structural Equations Modeling (SEM) has been applied. Results: Based on path analysis all relationships in proposed model were verified. Findings indicated that all dimensions of social capital had a positive and significant effect on knowledge sharing intention among physical education teachers in Fars province. Discussion: This study provides a model that examine the effects of social capital dimensions (Reliability, Social cohesion, Social Network and Participation, Capacity to accept criticisms, social interaction) on the knowledge sharing of physical education teachers. The results of the research are consistent with the findings of Adler and Kwon (2002). Nahapiet and Ghoshal (1998) also consider social capital necessary for the development and distribution of knowledge in organizations. Social capital can be strengthened by encouraging communication skills among physical education teachers. Social capital is one of the important assets of any organization that can help organizations create and share knowledge and create a sustainable competitive advantage. References: Adler, P.S. and Kwon, S.W., 2002. Social capital: Prospects for a new concept. *Academy of management review*, 27(1), pp.17-40. Nahapiet, J., Ghoshal, S. (1998). Social capital, intellectual capital and the organizational advantage. *Academy of management review*, 23(2):242-260.

THE RELATION BETWEEN LEADERSHIP STYLE AND ORGANIZATIONAL CULTURE IN MONTENEGRIN SPORTS ORGANIZATIONS

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Introduction: The subject of this research is to determine which leadership style do sports managers in Montenegro use, and what kind of organizational culture does a certain leadership style create. The goal is to recognize which one is the proper leadership style that will improve the quality of sports organizations, and affect their improvement and achievement of the goals they set. Methods: The research was done on 300 respondents that are active members of sports organizations. The data was collected through a specially designed questionnaire, adjusted to the Leadership network. Every statement in the questionnaire, designed to measure whether the respondent is oriented on task performance or building relationships, is followed by a Likert scale. The research was done on in the period from June to November 2018th. Results: The results of this research have given us a basis for analyzing leadership styles and organizational cultures in sports organizations in Montenegro. They give us an answer to the question whether sport managers are more task oriented, or are they rather people-oriented. Also, the results will help to determine which leadership style corresponds with a certain organizational culture as well as, how can a leadership style affect and improve performances of sports organizations. Discussion: Leadership style, with time, affects organizational culture and causes it to change, considering that in order for the manager to be accepted as a leader, he has to adjust his leadership style to the organizational culture that those before him created. Based on this research, we can come to the conclusion that the set hypothesis has been proved right: leadership style and improving the relationship between sports management and the organization's members does affect organizational culture, its quality and task performances, which

finally affects organization's members and their motivation and loyalty towards the sports organization they belong to. References: Bartoluci, M., Škorić, S., (2009.), Menadžment u sportu, Zagreb, Kineziološki fakultet. Erhardt, N., Carlos, M. R., Heckscher, C., (2016) Am I doing the right thing? Unpacking workplace rituals as mechanisms for strong organizational culture, International Journal of Hospitality Management Vol.59, pp.31-41. Janićijević N. (2013) Organizaciona kultura i menadžment, CID, Ekonomski fakultet, Beograd. Kastratović, E. (2004), Osnove menadžmenta sa menadžmentom u sportu, Beograd, Institut za razvoj malih i srednjih preduzeća. Northouse G. P., (2008) Liderstvo: teorija i praksa, Data Status, Beograd.

PUTTING IN PLACE THE FIRST GOVERNMENT'S NATIONAL STRATEGIC PLAN FOR SPORT IN KOSOVO 2017-2021

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Introduction: The purpose of project was to build the 2017-2021 Strategic Plan for Sport in the Republic of Kosovo (first ever Government's Sport Strategic Plan). To support the vision and Sport system, enhancing the inspiration by Gold Medals in Judo for all. Methods: Cooperation with KOS NOC Strategic Plan 2015-2020, was synergic for the methodology and the outcomes of the Strategic Plan methodology paving implementations steps, with the overall information from the meetings organized with sport stakeholders. Results: One of the main objectives of the sports development strategy 2017 -2021 is for the Sport department to change its form of management and to help in organizing the financing of the Sport federations on an annual basis and not anymore on an ad-hoc, project-oriented basis. The current results are: [1] As per 2017-2021 Strategic Plan, Legal Framework completed with several laws, rules and regulations on sponsorship, against violence, sports categorisation, etc. [2] Infrastructure concrete investments in sport stadiums meeting international standards, etc. Discussion: The new strategy of sports in Kosovo should be oriented towards the athletes and citizens that are dealing with physical activity. The period for the implementation of the strategy (Alaj, 2016) for sport will include a wide range of changes in legislative and financial system of sport in the Republic of Kosovo. References: Aćimović, D., Špirtović, O., Jonić, Z. & Projević, A. (2013). Act.in Phy.Ed.and, 3(2): 251-253. Alaj, I. (2016). Université catholique de Louvain, Belgique.bn (Unpublished master degree). Kiriemadis, Th. & Theakou, E. (2007).SMIJ, 3(2), 27-37.

Sport Statistics and Analyses

DIFFERENCES IN METABOLIC AND ANTHROPOMETRIC PARAMETERS BETWEEN ATHLETES ON DIFFERENT TYPES OF TRAININGS

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Introduction: Resting metabolic rate (RMR) is a rate of energy which body needs in order to perform the basic functions such as breathing, circulation of the blood, brain functions and others, while it is in complete resting. It is approximately equal to basal metabolism. RMR is influenced by many factors, and

one of the greatest influences are body composition and hormonal influences. The goal of the study was to determine anthropometric and metabolic parameters of athletes engaged in different types of training, to compare obtained results and to examine whether there are statistically significant differences among them. Material and methods: The study included 42 male athletes divided into two groups. The first group consisted of 21 athletes who were predominantly performing aerobic type of training, and the other group consisted of 21 athletes performing anaerobic type of training. Anthropometric test (body weight, body height, skinfold thicknesses and circumferences) and RMR (using the indirect calorimetry method) were performed. The results were statistically analyzed and the differences in parameters between the two groups of athletes were compared. Results: There were statistically significant differences in body weight, amount of fat free mass (FFM) and muscle mass, body mass index, as well as in the relative metabolic parameters between two groups of subjects. Discussion: The greatest impact on RMR has a percentage of body weight that does not contain fat, i.e. FFM. The rate of metabolic activity of this body compartment is higher in athletes in aerobic than athletes in anaerobic type of training. References: Guyton A, Hall J. Textbook of medical physiology, eleventh edition. University of Mississippi; 2011. Harris JA, Benedict FG. A biometric study of human basal metabolism. Proc Natl Acad Sci U S A. 1918; 4(12):370-3. Illner K, Brinkmann G, Heller M, Bosy-Westphal A, Muller JM. Metabolically active components of fat free mass and resting energy expenditure in nonobese adults. Am J Physiol Endocrinol Metab. 2000; 278(2):E308-15. Grujic N. Fiziologija sporta. Novi Sad:Futura; 2004. Srdic B, Stokic E, Polzovic A. Odnos parametara koji definišu velicinu i raspored masnog tkiva. Med Pregl. 2003; 5:232-6.

Sport Tourism

SUSTAINABLE SPORT HUNTING TOURISM IN NEWFOUNDLAND & LABRADOR: FOCUS ON THE MOOSE

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Introduction: The purpose of this paper is to highlight the impacts of sport hunting tourism with a focus on the moose in Newfoundland and Labrador Province in Canada. The study looks into the history of the moose, highlights economic impacts of hunting moose, the community impacts as well sustainability issues with regards to sport hunting. Methods: In this study, a case study approach was adopted to understand the sustainability of moose hunting as well as the economic impact in the Province. Competitive analysis of hunting tourism is considered. A case study approach enabled me to explore the issues emerging from moose hunting as a conservation tool and how it can contribute to community tourism development. Results: The results show there are economic benefits as well as some negative impact with regards to moose management. Various strategies can be utilized however, to manage any potential negative impacts in the future as well as manage moose populations sustainably, further resources need to be put in place. Discussion: The current literature highlights the much needed information on moose hunting as a sport in Newfoundland and Labrador. The benefits of sport hunting are also explored as well as community involvement in sustainable hunting practices. References: Bauer, H., Chapron, G., Nowell, K., Henschel, P., Funston, P. J., Hunter, L.T. B., & Packer, C. (2015). Lion (*Panthera leo*) populations are declining rapidly across Africa, except in intensively managed areas. Proceedings of the National Academy of Sciences United States of America, 112, 14894–14899. Begg, C.M., Miller, J.R.B., & Begg, K.S. (2017) Effective implementation of age restrictions increases selectivity of sport hunting of the African

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THE ADVANTAGES AND DISADVANTAGES OF SPORTS TOURISM IN MONTENEGRO

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Introduction: The aim of this study is to define key advantages and disadvantages of Montenegrin sports tourism from the perspective of tourists - domestic as well as international, to identify their attitudes and beliefs about the quality of sports tourism in Montenegro. Defined advantages and disadvantages, combined with measures and activities proposed in strategic documents defined on national level, will be used as a theoretical and practical framework for future improvement of quality of this segment of tourist offer. **Methods:** The research was, according to the original questionnaire designed for this purpose, conducted in the period from June to September 2018. Methodological method used for collection of data was survey. The questionnaire contains a total of fourteen questions. The first part relates to biological, social and economic characteristics, while the second part contains questions that relate to the subject of the research itself. The questionnaire contains open-ended questions in which respondents independently present their opinions and attitudes, closed questions as well as pivot questions. **Results:** The results of the survey have shown that tourists are generally satisfied with the quality of sports tourism offer in Montenegro, but that there is still a lot of space for future improvement especially regarding infrastructure, facilities, quality of services, promotion, etc. **Discussion:** By analyzing the results of the research and main advantages and disadvantages of sports tourists offer in Montenegro identified by tourists as well as main strategic documents on national level, theoretical and practical framework for future development of sports tourism in Montenegro was defined, as well as main measures and activities that should be carried out in order to reach the main strategic goals and improve the quality of this segment of tourist offer. The findings of theoretical research and the survey that was carried out represent the cornerstone for future development of sports tourism in Montenegro and all its segments, as well as for its positioning as high quality sports destination. **References:** Bakić, O. (2010). *Marketing u turizmu*. Univezitet Singidunum. Fakultet za turistički i hotelski menadžment: Beograd. Kotler, Ph., Keller, L. (2016). *Marketing management*. London: Prentice Hall. Radović, M. (2010). *Tourism Geography of Montenegro*. Faculty of Tourism Bar & Faculty of Tourism: Kotor. Unković, S., Zečević, B. (2009). *Ekonomika turizma*. Centar za izdavačku djelatnost Ekonomskog fakulteta u Beogradu: Beograd.

ANALYSIS OF PROGRAMME CONTENTS AT A SAILING CENTRE

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Introduction: The main purpose of this study was to identify the most commonly used programme contents at a sailing centre and if there are differences between them from one year to the next. Another aim of this study was to determine if there are gender differences in choosing the mentioned contents, or a dominant age group, level of education or national structure among the users. **Methods:** The sample was represented by 924 users from year 2003 to 2007 between June and September. The data was collected using a questionnaire which included basic anthropological, sociological and demographical data. The Chi-squared test was used for determining if there was a statistically significant difference between analysed and anticipated frequencies among the contents from one year to the next. **Results:** Upon applying the Chi-squared test, no statistically significant differences among programme contents from one year to the next were determined. The results presented in percentages from one year to the next indicate that there was a difference between the contents in favour of windsurfing. In terms of gender differences in the use of different sailing contents, there is an advantage of male users. **Discussion:** The most used programme contents are kayak, windsurf and sail boat rental. The second category are windsurfing contents. Gender differences indicate an advantage of male users, which could be understood as a result of the traditional view that sailing is too demanding for women. The domination of the under-15 age group in using windsurfing contents can be attributed to the attractiveness. Enlightenments, tradition and financial conditions are noticed in the second large group of highly educated users. The national structure features a high proportion of European guests, mostly Croats then British, Germans, Slovenians, Italians, French and Austrians. Such results can be interpreted by the proximity and beauty of the destination, range of programme contents, affordable prices, development level and cultivation of the maritime culture among the nations. The results dictate guidelines for more successful planning and programming of contents, which allow economic, tourist and sports-recreational effects and they simultaneously contribute to an increase and improvement of Croatian tourism. **References:** Bartoluci M et al. (2004). *Management in sports and tourism*. Zagreb: Faculty of Physical Culture, Faculty of Economics and Business University of Zagreb. Dobrila I, Vlašić J, Andrijašević M (2004). *Diving in a tourist offer programme*, in Paleka M (2008). *Marketing aspects of nautical tourism (Diploma thesis)*. Zagreb: Faculty of Physical Culture University of Zagreb. Institute of Tourism (2008). *Attitudes and expenditures of tourists in Croatia*/online/downloaded on September 10 2008 at: <http://www.iztztg.hr/hr/institut/projekti/istrazivanja/>

SPORTS TOURISM AS AN ECONOMIC FACTOR OF THE DEVELOPMENT OF THE MUNICIPALITY OF HERCEG NOVI

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Introduction: The intent of this study was to elaborate on the existing situation in sport and tourism areas in the municipality of Herceg Novi, as well as to analyze the existing condition of its sports and tourist facilities. **Method:** The data were collected in the Municipal Secretariat for Sports, Sports Clubs,

Municipalities and Municipal Institutions, as well as in hotel and tourist enterprises. The targeted issues required the precise answers from institutions, sports and tourism that are involved in the organization of preparatory, recreational and competitive events at all levels. What are the sources of funding for sports collectives and what are they on an annual basis? Which institutions and to what extent organize the stay of competitors the competition itself, as well as recreation in the municipality of Herceg Novi? Results: Municipality of Herceg Novi, Ministry of Sports and Businesses are mostly financiers of sports teams and sports competitions in Herceg Novi. Hotel and tourist facilities are providers of accommodation services while municipal institutions and sports facilities host sports competitions. It was undoubtedly confirmed that the sport is not recognized as one of the priority branches of Herceg Novi's economic development, despite the favorable geographical (climate, relief, geographical position...) characteristics. Via methods of comparison and analysis, we have reached the conclusion that Herceg Novi needs hotel capacities, sports fields and facilities in order to be able to use the natural resources at its disposal in the future. Sports and tourism regions such as Antalya in Turkey, Medulin in Croatia, Ayia Napa in Cyprus were the starting point for research and destinations for comparison. Discussion: The results achieved by this research unambiguously suggest that the city of Herceg Novi has exceptional preconditions for the development of sports tourism, which is a branch of economy that could completely change the image, not only of the city but the entire region of the Bay of Boka Kotorska, and contribute to the recognition and accelerated development of Montenegro as the state. References: None.

STRUCTURE AND SPECIFICS OF SPORT AND RECREATIONAL OFFER IN RURAL TOURISM: CASE OF MONTENEGRO

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Introduction: The aim of this paper is to analyse the structure and specifics of sport and recreation offer in rural tourism in Montenegro. Although contemporary rural tourism definition and development focuses mainly on cultural elements of offer, it is obvious that recreational components in integral tourism product have its importance, especially in sense of provision conditions for active relaxation, rehabilitation, recreation, sport, adventure and entertainment. Methods: The data is extracted from the survey conducted and organized by author as part of the PhD thesis research about rural tourism operators in Montenegro during 2013. After deleting observations that do not provide all necessary information for this research, we work with a sample of 77 rural tourism operators. Key descriptive statistics are obtained using STATA. Results: The integral rural tourism offer in Montenegro mostly is characterized by simpler forms of recreational services and programmes such as: farm visits, degustations of local food, excursions to local attractions, camping etc. Over 60% of surveyed operators offer mentioned services. More complex programmes (e.g. educational programs, sport and recreational facilities, flora and fauna watching) are present in less than 40% of total number of operators. Renting of equipment for sport and recreation is underdeveloped, due to general underdevelopment of rural tourism. For example, only 19% of operators offer biking and renting bikes service, while only 12% of operators offer other kinds of recreational equipment renting. Discussion: Key findings indicate the necessity for further development of rural tourism as well as individual sport, leisure and recreational facilities and services in rural Montenegro. Consumers in contemporary rural tourism have needs for active relaxation, rehabilitation, recreation, sport, adventure and entertainment (Butler et al., 1998; Roberts and Hall, 2001; Long and Lane, 2003). Due to mentioned, further strategic and operational measures have to be developed and implemented in order to

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THE ANALYSIS OF ANIMATION PROGRAMS IN MONTENEGRO

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Introduction: Today, hotels have to offer much more than quality accommodation and food, due to the great competition in tourism sector. Therefore, the implementation of animation programs in the hotel industry represents the way to new clients. Actually, animation program aims to fulfill the time of tourists and contribute to their satisfaction. Therefore, taking into account the importance of animation programs, the aim of this paper is to analyze the current state of the animation programs offered in Montenegro, as well as to provide suggestions for further development in order to enhance tourist experience. Methods: Based on information collected from tourists during their stay in Montenegro, the paper provides empirical analysis regarding the current state of the animation programs in Montenegro. More precisely, using Tobit model, the paper offers analysis whether different aspects of animation programs drive tourist satisfaction. Findings: The obtained findings indicate that animation programs play important role for tourist satisfaction. Discussion: Well-designed and realized animation programs improve the leisure time of tourists during their holidays as well as their overall satisfaction what could be also reflected on economic results of the hotel or destination (Milohnic and Betic, 2010; Mikulic and Prebezec, 2011). References: Milohnić, I. and Betić, M. (2010). Education for experts in tourism entertainment. *Hrvatski znanstveno-stručni skup o menadžmentu u turizmu i sportu*, Čakovec: Printex, 42-49. Mikulic, J. and Prebezac, D. (2011). Evaluating hotel animation programs at Mediterranean sun and sea resorts: an impact-asymmetry analysis. *Tourism Management*, 32, 688-696.

Sports Medicine and Orthopaedics

THE EFFECT OF CRYOTHERAPY AFTER MUSCLE-DAMAGE IN A FEMALE POPULATION: A RANDOMIZED-CONTROLLED TRIAL

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Introduction: The aim of this study was to compare the physiological response and effects on recovery between partial-body cryotherapy (PBC), cold-water immersion (CWI) and a control group (CON) after

exercise-induced muscle damage (EIMD) in a female population. Methods: A total of $n=28$ females were randomly allocated into the PBC, CWI and CON group. EIMD was induced using a 5 x 20 drop-jump protocol. Muscle oxygen saturation (SmO_2), cutaneous vascular conductance (CVC) and skin temperatures were used as physiological markers and assessed up to 60 min, while delayed-onset of muscle soreness (DOMS), muscle swelling, maximum-voluntary isometric contraction (MVIC) and vertical jump performance (VJP) were used as recovery markers and assessed up to 72 hrs. Results: Mean skin temperature was significantly lower in the CWI vs. the PBC group up to 40 min ($p=0.049$). SmO_2 and CVC were not significantly affected by the cold treatments. DOMS does not return to baseline in the CON group after 72 hrs ($p=0.02$). MVIC recovers in the PBC group after 24 hrs ($p=0.52$) vs. 72 hrs in the CWI group ($p=0.11$), whereas no difference between groups can be observed for muscle swelling and VJP. Discussion: The magnitude and positive effect of cooling might be present in superficial tissue and pain ratings. However, other factors such as body composition and oestrogen levels might influence the amount of EIMD and effectiveness of cooling methods in females. Consequently, coaches and athletes should consider this when using cold as a recovery enhancing method in females. References: Costello JT, Bieuzen F, Bleakley CM. (2014) *Eur J Sport Sci.* 14(8):847-851. Ferreira-Junior JB, Bottaro M, Vieira A, et. al. (2015) *Scand J Med Sci Sports* 25 (5):e524-530. White GE, Wells GD. (2013). *Extrem Physiol Med.* 2(1):26.

THE RELATIONSHIP BETWEEN PERSONALITY TRAITS AND MUSCLE INJURIES IN SWEDISH ELITE MALE FOOTBALL PLAYERS

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Introduction: Football is a powerful contact sport, often resulting in a broad range of injuries. The physical and mental demands on an elite football player are complex, which may explain why injuries are common in football. At elite level, muscle injuries of the lower extremity are the most common among male football players, and the research hitherto is limited. Objective: To investigate whether personality traits affect the incidence of muscle injuries among male football players from the first league in Sweden. Method: Prospective cohort study. Participants: A male football team from the first league in Sweden was prospectively followed, in terms of muscle injuries of the lower extremity during eight seasons, between 2007 and 2015. Intervention: All muscle injuries included in this study were evaluated and diagnosed with ultrasonography. Players from the team filled out the Swedish Universities Scales of Personality (SSP) questionnaire. SSP consists of 91 items and is divided into 13 categories. Main outcome measures: The raw values of each scale were linearly transformed to T-scores, which have a mean of 50 and standard deviation of 10. All variables were summarised with standard descriptive statistics such as frequency, mean and standard deviation. No variable distribution was severely skewed. One-way analysis of variance with post-hoc tests using Tukey's Honest Significant Difference test was used. Results: No significant difference in personality traits were seen between non-injured players (NIP), rarely injured players (RIP) and frequently injured players (FIP) regarding number of muscle injuries ($p > 0.05$). However, a trend ($p = 0.07$) was seen, where FIP scored higher on stress susceptibility than RIP. Discussion: A player's stress susceptibility should be taken into consideration by the player, coaches and medical staff

when assessing the risk of a muscle injury. Also, preventive actions available for these players may need to be considered. References: None.

FACTORS ASSOCIATED WITH POTENTIAL DOPING BEHAVIOUR IN OLYMPIC SAILING; GENDER SPECIFIC ANALYSIS

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Introduction: Consumption of doping has many negative consequences and one of the approaches of anti-doping campaigns is to investigate which of these consequences are important for each specific group of athletes so specific and targeted campaigns against doping behaviour can be created (Plagemann et al., 2009). The aim of this study was to evaluate factors associated with potential doping behaviour (PDB) in competitive Olympic sailors. **Methods:** In this study, we tested competitors in Olympic Laser class (n = 80, 39 females; all >18 years). Variables were collected by previously validated questionnaires (Rodek et al. 2012, Devcic et al 2018), with PDB as criterion. To establish the relationships between variables and the criterion, multinomial logistic regression models were calculated. **Results:** Majority of tested athletes observed doping as mainly a fair play issue, and not health threatening behaviour. The significant correlations between factors of hesitation against doping behaviour and PDB were evidenced for all social consequences among men. Meanwhile, for women, the significant correlation with criterion was evidenced solely for one social consequence (e.g. condemnation of the family), and all negative health related consequences. **Discussion:** Until few years ago, athletes considered doping mostly as health-related problem, but recent studies evidenced change in general perception over the past years as athletes started to look it as mainly fair-play issue (Sekulic et al 2016). The results of this study provided another confirmation that negative social consequences should be prioritized in anti-doping campaigns. Results for women can be explained with regard to specifics of sailing as a sport. Sailing is sport where familiar support is of crucial importance from the very beginning of one's career and it is particularly important for female athletes. Also, specific sailing conditions are particularly demanding for women due to physiological specificities of the female body, and therefore women are much responsive to health in general (Zaletel et al 20115). **References:** Rodek J., Sekulic D, Kondric, M. (2012). *Journal of the International Society of Sports Nutrition*, 9(1), 51. Plagemann A, Harder T, Brunn M, Harder A, Roepke K, Wittrock-Staar M, ..., Dudenhausen JW (2009). *The Journal of physiology*, 587(20), 4963-4976. Devcic S, Bednarik J, Maric D, Versic S, Sekulic D, Kutlesa Z, ... Liposek S, (2018). *Int J Environ Res Public Health*, 15(8), 1720. Zaletel P, Versic S, Perić M, Zenic N, Sekulic D, Kondric M, (2015). *Medicina dello sport*, 68(3), 447-460. Sekulic D, Tahiraj E, Zvan M, Zenic N, Uljevic O, Lesnik B, (2016). *J Sports Sci Med*, 15(4), 606-615.

INJURY INCIDENCE IN VOLLEYBALL PLAYERS OF SERBIAN NATIONAL VOLLEYBALL TEAM THAT COMPETED AT THE OLYMPIC GAMES

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Introduction: Volleyball is characterized by fast and explosive movements, high jumps and ball play. It has high popularity in Serbia where in last 20 years is among top 7 teams in both men and women categories

with both silver medal at Olympic Games and gold medal at world championship. Even though limits of human possibilities in last decade are constantly improving, with it technology and methodology of training are following. With that in mind training procedures have never been at higher level. All that having in mind, sports injuries are also unavoidable factor that influence life of every athlete. Injuries in elite sport are frequent and most likely caused by increased frequency, intensity and duration of training. Even slightest injury could from functional point of view influence athletes result. This research aims to analyze and provide data regarding cause of injuries of elite volleyball players of Serbia and has goal to with gathered information to provide and help coaches and sports medicine experts, as well as future generations in planning of training and sports preventive procedures. Methods: Injury incidence data were collected using a questionnaire that was given to 15 players of Serbian national female volleyball team. 20 questions both open and closed type were used, and questionnaire was split into 3 blocks, 1st social-demographic, 2nd related to training, and 3rd related to injuries. Variables taken into consideration were towards preventive exercise modalities, and activities not related to exercise. Data was analyzed via descriptive statistics. From descriptive statistic parameters, SUM and percentage were presented. Results and Discussion: Average age of players was 25,53 years with volleyball experience of 14 years. Of all the injuries that happened most frequent were the ankle injuries (33%) followed by shoulder (20%) then rest, with 40% of the time it happened resulted 2-4 weeks off the court. Data gathered and compared to other researches shows similar results and thus we can conclude our hypotheses that shoulder injuries are most often chronic and from overusing. Over 70% of injuries that happened were during some point of jumping phase in attack or defense we can also conclude our second hypotheses that most injuries happen during some point of jumping phase. Results show that amount of hours spent on exercising could also led to injuries that happened gradually. Even though most injuries were minor ones 80% of the time injury occurred, player could not finish session or match. References: Aagard H, Jorgensen U (1996). *Scand J Med Sports*, 6(4), 228-32. Aido R, Massada M, Leitao N, Magalhaes C, Puga N (2011). *Br J Sports Med*, 45, 533-549. Bere T, Kruczynski J, Veintimilla N, Hamu Y, Bahr R (2015). *Br J Sports Med*, 49, 1132-1137. Nestic G, Ilic V, Sikimic M, Dopsaj M (2011). *Br J Sport Med*, 45(6), 546. Pimenta R, Hespanhol L, Grangeiro J, Lopes A (2017). *Br J Sports Med* 51, 375. Schafle M, Requa K, Patton WL, Garrick JG (1990). *Am J Sports Med*, 18(6), 624-631.

USE OF DIETARY SUPPLEMENTS AMONG STUDENTS WITH DIFFERENT LEVELS OF PHYSICAL ACTIVITY

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Introduction: Dietary supplements (DS) are products intended to supplement normal nutrition and represent concentrated sources of vitamins, minerals and other substances with nutritive and physiological effects. Often, these products are used irrationally, without clear indications and recommendations by health professionals. The aim of this study was to determine the frequency of DS use by students of the University of Novi Sad, as well as to assess their knowledge and attitudes towards DS. The specific aim of the study was to determine the use, attitudes and information about the DS among students with different levels of physical activity. Methods: A descriptive epidemiological investigation included a total number of 153 students of the University of Novi Sad. In order to obtain these data, a specially designed questionnaire was applied. The sample was stratified according to the level of students' physical activity. Results: Dietary supplements were used by 62.5% of the respondents. Physically active students were significantly more likely to use these products compared to physically inactive students (96.1%

vs. 28.9%, $p < 0,01$). The most frequently used DS were DS of vitamins, used by 50.7% of the subjects, proteins (34.2%) and caffeine-containing drinks (26.3%). More than half of the students stated that they were not properly informed about DS. Professional advice from a medical doctor on the use of the DS was received by 25.7% of participants. The preferred source of information about DS for most of the subjects was physician, as reported by 73.7% of investigated students. Physically inactive subjects reported that the most frequent source of information about DS are media (39.5%), while physically active students were most often advised to use DS by a coach (42.1%). Discussion: The results obtained in this study are in line with the available literature data, which also indicate excessive and uncontrolled use of dietary supplements without clear medical indications. Niper et al. obtained similar results investigating DS use in athletes. The students in our investigation do not have reliable sources of information about DS, since the main source they have enlisted are media and coaches, which match the results of other studies (Petroczi et al., 2008 and Manore et al., 2017). References: Petroczi A, Naughton DP, Pearce G, Bailey R, Bloodworth A, & McNamee (2008). *J Int Soc Sports Nutr*, 5, 22. Manore M, Patton-Lopez M, Sun Wong S. (2017). *Nutrients*, 9(4), 350. Niper A. (2005). *British Journal of Sport Med*, 39, 645-649.

Training and Testing

MUSCLE OXIGENATION IN WORLD-CLASS KAYAK ROWERS DURING DIFFERENT INTERVAL TRAINING SESSIONS

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Introduction: Aerobic metabolism processes in muscles play essential role in 1000 m. distance for kayak rowers' work. Interval training method is used as one of the means of training methods, applied for kayak rowers training. Therefore, the aim of the study was to explore an effect of high intensity and short sections interval training workouts for world-class kayak rowers' muscle oxygenation. Methods: Case study was carried out during preparatory cycle in 1917- 2018. Two world-class kayak rowers (VO_{2max} – 62.5 and 64.3 ml/min/kg) participated in this study (K2). Muscle oxygenation was measured using MOXY Oxygen Monitor device while athletes worked on kayak ergometer DANSPRINT. There were three different high intensity interval training sessions: (0-10 sec – 300 W, 11-30 sec 80 W) training load repeated 6 times with 6 min rest; (0-15 sec. – 300 W, 16-30 sec 80 W) training load repeated 6 times with 6 min rest; and repeated 6 min duration work of 80 pct. intensity, which was followed by 6 min sitting at rest. Sensors were fixed on athletes' Quadriceps and Pectoralis Major Muscles. Results: After 6 times repeated high intensity interval 10 sec training load, muscle oxygen consumption decreased to 45 pct. in Quadriceps and to 20 pct. in Pectoralis Major Muscle. During light workload (11-30 sec 80W) oxygen consumption recovery in both muscles reached 70-80 pct. After 6 min in rest position, oxygen consumption in the muscles recovered to 85 pct. It was found that general O₂ consumption of kayak rowers during interval workouts is less comparing to the same work of the same duration by less intensity. Discussion: This study revealed that high intensity interval training load provokes big changes in muscles oxygenation while the muscles are working in aerobic metabolism zone. Level of aerobic metabolism has a significant impact on results (Paquette et al., 2017). Cipryan et al. (2017) also mention significance of high intensity interval training for elite athletes. Paulsen et al. (2012) points out, that amount of myoglobin increase in muscles fibres after high intensity interval training. References: Cipryan L, Tshakert G, Hofmann P (2017). Acute and post-exercise physiological responses to high-intensity interval training in endurance

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COMPARISON OF PHYSICAL PERFORMANCE OF CHILDREN LIVING IN DIFFERENT ENVIRONMENTS

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Introduction: The purpose of this study was to compare physical performance between rural children and urban children. It is naturally expected that children living in rural areas perform much more physical activity than children living in the urban areas, and therefore motor skills will be more developed. In this study, we compare the basic motor performance of primary school students living in the urban areas have a total of two hours physical activity per week including physical education classes, and in the rural areas have at least seven hours of physical activity. **Methods:** The research was carried out in the city center of Aydin and in the rural areas of Balta village's primary schools with 10 and 11 years old boys (N=88). We carried out two separate sessions; one in the morning and the other in the afternoon session. In the morning session, students did vertical-jump and ball throwing (120 grams) tests; in the afternoon session, firstly, a 60m sprint then after half an hour rest, a 1000m endurance running test. In order to find out whether the differences between the score and time averages are meaningful; rural and urban students were tested with the t-test variation analysis. **Discussion:** The development of myelination in children is important for features such as movement's coordination and economy, muscular power, speed, quickness and strength. This provides infrastructure for stronger muscular contractions and better mobility coordination. Stimulation of nerve cell axons (Demerens et al., 1996; Fields, 2005; Zalc and Fields, 2000) and increases in release levels of neuroactive hormones such as progesterone, testosterone (Roglio et al., 2008) increase myelination. The release of these hormones increases during puberty. The level of physical activity itself also affects these hormone release levels. **Results:** Level of physical activity in the period before puberty and during puberty, affects the development of sportive performance. In order to achieve high sportive success during youth periods, scheduled physical activities should be started before puberty. However, it should be kept in mind that branching before the age of 10 in early specialization branches such as football, athletics may lead to premature closure of adaptation reserves and premature stopping of performance development, boredom and early withdrawal of sports. The development stages of children must be considered. Early physical activity is very important for sportive performance, but early branching is inconvenient. It needs 6-8 more years for this. **References:** Fields RD (2005). Myelination: An Overlooked Mechanism of Synaptic Plasticity? *Neuroscientist* Dec, 11(6), 528-31. Zalc B, Fields RD (2000). Do Action Potentials Regulate Myelination? *Neuroscientist* Dec, 6(1), 5-13.

ANTHROPOMETRIC, PHYSICAL FITNESS PARAMETERS AND HANDBALL SKILLS IN FUNCTION AGE AND SEX

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Introduction: Handball performance is a combination of many factors: constitution-disposition, coordination, strength, endurance, nutrition, cognition, tactics, and social and external influences (Wagner et al., 2014). The purpose of this study was to analyse anthropometric (constitution-disposition), physical fitness, and handball skills (coordination, strength, endurance) in club handball players according to age and sex. **Methods:** Two hundred and twenty six handball players (age 17±4 years old, 122 males, 104 females) participated in the study. The players belonged to national under-14, under-16, under-19, and A teams. They were evaluated with a full battery tests covering kinanthropometry, physical fitness, and handball skills: stature, weight, arm span, and hand length and width, arm span index, body mass index, counter movement jump, medicine ball throw, hand dynamometry, 20 m sprint, T test, and yo-yo intermittent recovery level 2 test, throwing speed at 7 m standing, 9 m after three steps, 9 m after three steps and a jump, and pass-to-wall test. A one-way ANOVA with a Bonferroni post-hoc test was used to investigate differences between teams and a t-test for differences between the sexes. **Results:** The results showed there to be little difference between the U19 and A teams in any of the variables studied in either men or women and that the lowest values corresponded to the U14 team. The differences according to sex were clear in the kinanthropometric and physical condition variables, but much less so in handball skills. **Discussion:** The results were agreed partially with previous studies that only found differences in sprint and squat jump (Ingebrigtsen et al., 2013) or counter movement jump (Saavedra et al., 2018). It seems to indicate that, in the A team case, there is a need for training that is more specialized. While there were clear differences by sex, this was not the case for all the handball skills variables between the U19 and A teams, suggesting that, by adulthood, technical action does not differ much between men and women players. **Acknowledgement:** We would like to acknowledge the collaboration of Handknattleiksfélag Kópavogs (HK club) their coaches and players. Also the authors thank to Phillipp Behncke for his collaboration in the data collection. **References:** Ingebrigtsen J, Jeffreys I, Rodahl S. (2013). *J Strength Cond Res*, 27(2), 302–309. Saavedra JM, Kristjansdóttir H, Einarsson IP, Guðmundsdóttir ML, Þorgeirsson S, Stefansson A. (2018). *J Strength Cond Res*, 32(8), 2294-2301. Wagner H, Finkenzeller T, Würth S, von Duvillard, SP. (2014). *J Sports Sci Med*, 13, 808-816.

APNEA WORKOUTS FOR SCUBA DIVERS TO ESTABLISH UNDERWATER FITNESS

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Introduction: The aim of the study was to assess the effects of Apnea underwater training on physiological characteristics, Scuba diving Skills, fins swimming endurance, and breath hold time for scuba divers to can establish underwater fitness with scuba diving equipment. The combination of Apnea exercise, static apnea, dynamic apnea affect SCUBA diving, free diving sport, synchrony swimming, in underwater rugby and the diving phase of competitive swimming disciplines. (U.Hoffman2005). **Methods:** The

data was collected from randomly selected (20 mal) sport healthy divers in Egypt in summer of 2018. The variables consist of 15 items; physiological variables during tow Apnea methods Subject were tested on two separate times with spirometer and E.C.G, and Scuba diving skills consist of CESA, respiratory Consumption, Swimming endurance tests. Control value for each parameter was calculated as an average value mean and standard deviation \pm SD from apnea. Results: The relative changes were calculated for each subject, an individual mean value from the three last apneas in each condition was calculated for all parameters. The improvement of apneic time values were compared between, before and after, underwater Apnea program. The Scuba Diving and swimming Skills variables were also compared between Apnea methods using paired t-test. The level used for accepting significance was *P < 0.05., heart rate , systolic blood pressure, diastolic blood pressure, cardiac output , heart stork volume, oxygen volume , carbon dioxide volume, Data are means \pm SD, Static apnea. Discussion: The ventilator and cardiology parameters observed after Apnea workouts better lung volume, vital capacity and heart rat valuables, the apnea performance, SCUBA diving and Swimming skills. These results became more significant, indicating the positive effect of Apnea method on performance. Using underwater Apnea exercise with SCUBA diving equipment can improve breath holding, SCUBA diving skills and improve apnea time for divers in case of the cut of air. Health benefits of fitness are balance of strength and flexibility, improved Organ function, better circulation, and relaxation. This study is considered an innovation special under water fitness exercises for scuba divers and non-divers. References: FA Fernández, JM González-Ravé, D Juárez, (2017) - rua.ua.es. Breath-hold diving performance factor. TF Whyne - Current vascular pharmacology, (2018) - ingentaconnect.com, Medical Management and Risk Reduction of the Cardiovascular Effects of Underwater Diving U. Hoffmann, M. Smerecnik D. Leyk D. Essfeld, (2005). Cardiovascular Responses to Apnea during Dynamic Exercise”. Int J Sports Med; 26: 426–431. Ralph Potkin, Victor Cheng, and Robert Siegel., (2007). “Effects of glossopharyngeal insufflation on cardiac function: an echocardiography study in elite breath-hold divers” Appl Physiol 103: 823-82; doi: 10.1152/jappphysiol.

RELATIONSHIPS BETWEEN SOME ANTHROPOMETRIC MEASUREMENTS AND THE BODY MASS INDEX AND THE DISTANCE ACHIEVED IN SHOT PUT

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Introduction: The purpose of this study was to identify the relationships between some anthropometric measurements and the body mass index and the distance achieved in shot put, mostly due to the reason that it was expected that the anthropometric measurements play a major role in superiority in the sport field, and that the skilful performance of any sport requires specific anthropometric characteristics. Methods: The sample of this study consisted of twenty one male students from Department of Physical Education at Sultan Qaboos University who studied athletics course which includes shot put skill. Anthropometric measurements namely body height, legs length, arms length, and trunk length were measured to the nearest 0.1 cm and body weight was measured to the nearest 0.1 kg. Body mass index (BMI) was calculated as body weight in kilograms divided by height in meters squared (kg/m²). Distance achieved in shot put was measured to the nearest 0.1 cm. The collected data were analyzed using the statistical package SPSS version 22.0 and the descriptive statistics were expressed as mean (SD) for each variable, while the simple correlation was carried out to detect the relationships between the anthropometric measurements and the body mass index and the distance achieved in shot put. Results: The analysis of the data indicates that the distance achieved in shot put was significantly correlated with

body height, with legs length, with arms length and with trunk length, while the distance achieved in shot put was not significantly correlated with body weight and with body mass index. Discussion: The results obtained showed that there is a significantly correlation between the distance achieved in shot put and the anthropometric measurements namely body height, legs length, arms length, and trunk length, while the distance achieved in shot put was not a significantly correlated with body weight and body mass index. These results confirm that the greater the player's height, arms length, legs length and trunk length, the greater the distance achieved in shot put. These results are consistent with (Khater and Elbeik 1996) who point out that the anthropometric measurements play a major role in superiority in the sport field, and that the skillful performance of any sport requires specific anthropometric characteristics. These results are also consistent with (Tešanović et al., 2010) results which indicate that there was a statistically significant importance between body height and arm length and results achieved in shot put. References: Bartonietz, K. and Borgstrom, A. (1995). The throwing events at the World Championships in Athletics 1995, G'teborg: Technique of the world's best athletes. Part 1: Shot put and hammer throw. *New Studies in Athletics*, 10(4), 43- 63. Bastouisse, A. (1997) *Track and field events, Teaching, technique and training*. 1st Edition. Arab thought house. Cairo. EGYPT.

RELATING AGILITY WITH OTHER PERFORMANCE VARIABLES IN MALE A-DIVISION RUGBY PLAYERS

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Introduction: The purpose of this study was to identify the relationship of height, static balance, hip joint flexibility, muscle mass, anaerobic power with agility performance in male A-division rugby players based in Gaborone, Botswana. Methods: Simple random sampling technique was used to select eighty participants from the estimated population of one hundred A-division league rugby players in Botswana. Testing took place over a three-day period in the morning for each of the 4 teams. On the first day, height, body mass, agility and flexibility were measured. Measurements taken on the second day included balance and skinfolds. Wingate anaerobic test was assessed on the third day. All measurements were taken at the University of Botswana Exercise Physiology Laboratory, the University of Botswana stadium and Botswana Defence Force gymnasium. Pearson Product-Moment Correlation coefficients were computed to examine the relationships between agility and the physical variables. Results: The players' agility was not significantly related to their body height, hip flexibility, fatigue index ($p>0.05$). While on the other hand, agility was found significantly related to static balance, fat free muscle mass, anaerobic peak power, and average anaerobic power. Discussion: The findings of this study indicate that there is a significant correlation between static balance and agility. The significant relationship between balance and agility found in this study indicates that it is important for athletes to change the running direction rapidly without the loss of balance (Chatzopoulos et al., 2014). The findings of this study indicated that there was a significant relationship between fat free muscle mass and agility. The findings are consistent with those of Peñailillo et al. (2016) who found significant relationship between agility and muscle mass. This result shows that muscle mass is an important correlate of agility in male rugby players as it is a sports code which depends on high muscle strength and power in other skills and techniques. Hence, achieving and maintaining increases in lean body mass is an important goal for rugby players (Garthe et al., 2011). The findings implicate that there is need for emphasis to physical trainers and coaches, to encourage their players to increase static balance, fat free muscle mass, anaerobic peak power and average anaerobic

power in order to improve their performances in skills requiring agility. References: Chatzopoulos, D., Galazoulas, C., Patikas, D., & Kotzamanidis, C. (2014). Acute effects of static and dynamic stretching on balance, agility, reaction time and movement time. *Journal of Sports Science & Medicine*, 13(2), 403-409. Peñailillo, L., Espíldora, F., Jannas-Vela, S., Mujika, I., & Zbinden-Foncea, H. (2016). Muscle strength and speed performance in youth soccer players. *Journal of Human Kinetics*, 50(1), 203-210. doi: 10.1515/hukin-2015-0157.

PUTTING ACCURACY OF AMATEUR GOLFERS

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Introduction: Driving, iron shots, pitch shots, chips around the green and putting are golf skills that determine the outcome performance in golf. High performance with driver, wedges and putter are the most important factor for long-term achievement of low scores (McLean, 2005). In elite golf, 43% of shots made in round are with putter (Pelz, 2000). Wiseman and Chatterjee (2006) found out a strong correlation ($r = .68$) between putting performance and scoring average. The aim of this study was to determine the success of amateur golf players from different distances and directions and to find out the relationship between success rate of putts and the performance level of the player. Methods: We tested 34 amateur golfers who had the task of playing 2 putts from different distances (gradually 1m, 3m, 5m) and from each direction (downhill, uphill, right-to-left, left-to-right), total of 24 putts. The goal of each player was to make as many putts as possible, but in the case of unsuccessful putts, keep the ball as close as possible to the hole. To determine the relationship between handicap, game experience and success of putts, resulting distance from the hole we used Spearman's correlation coefficient ($p < 0.05$) in statistical software program ORIGINE and the two ways ANOVA. Results and discussion: The players reached the highest success rate on the downhill putts, but also the largest resultant distance from the hole in the unsuccessful putts. The two ways ANOVA showed shortest resulting distance from putt uphill ($p = .00001$). When putting uphill, the ball has a lower speed than from downhill, and is more influenced by the slope and inconsistencies of the surface. When putting from downhill, it is easier to keep putt in the right direction than the putt uphill, but it is much more vulnerable to the distance from the hole in the unsuccessful attempts. Thus, it is clear that the most advantageous strategy for successful putting (to avoid the triple putt) is to place the ball below the hole with short game and be aggressive with first putt to keep the ball behind the hole. We found a significant relationship between handicap and golf experience ($r = -0.460$, $p < 0.01$). ANOVA showed a higher success rate of 1m and 3m putts, where players with higher performance level were more successful ($p = .027$). We can say that to increase the performance level of amateur golfers it is necessary to increase the success of putt from 1m and 3m. References: McLean, J. (2005). *The 3 scoring clubs*. New York: GothamBooks, PenguinBooks. Pelz, D. (2000). *Dave Pelz's putting bible*. New York: Doubleday. Wiseman, F., & Chatterjee, S. (2006). Comprehensive analysis of golf performance on the PGA tour: 1990-2004. [Article]. *Perceptual and Motor Skills*, 102(1), 109-117. doi: 10.2466/pms.102.1.109-117

PREDICTORS OF REACTIVE- AND NON-REACTIVE AGILITY PERFORMANCES IN FEMALE ATHLETES INVOLVED IN AGILITY-SATURATED AND AGILITY-NON-SATURATED SPORTS

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Introduction: There is an evident increase of interest for the evaluation of background for different agility performances, including non-reactive agility (change of direction speed – CODS), and reactive agility (RAG). Meanwhile, little is known on predictors of CODS and RAG in athletes involved in different type of sports. This study aimed to evaluate the associations which may exist between certain anthropometric- and motor-indices, with different RAG and CODS in female athletes with respect to their sport-background (i.e. involvement in agility-saturated-sports [AG-S] vs. agility-non-saturated-sports [AG-NON]). **Methods:** The sample of participants comprised 59 female athletes involved in AG-S (n = 32), and AG-NON (n = 27). The variables included four predictors (body height, body mass [BM], sprint over 5-m distance [S5M], and broad jump), and criteria (CODS and RAG). The criteria were measured by previously validated protocols (Spasic et al., 2015). The univariate correlations and multiple regressions were calculated for the total sample of participants, and separately for AG-S and AG-NON. **Results:** Predictors explained 68% of the CODS variance for AG-NON, with significant partial influence of S5M (Beta: 0.96, $p < 0.01$). The 82% of RAG variance was explained in AG-S, with significant partial influence of BM (Beta: 0.42, $p < 0.05$). **Discussion:** This study highlights the necessity of differential approach in training and conditioning of the RAG and CODS, as it was previously suggested (Sekulic et al., 2014). Although sprinting-performance was found to be important predictor of CODS in athletes involved in AG-NON, the predictors of CODS in AG-S should be found in other variables than those studied herein. The complexity and specificity of RAG-performance resulted in lack of association between studied predictors and RAG among AG-NON. Meanwhile, because of the test-characteristics (i.e. repeated stop-and-go movement scenario), BM negatively influenced RAG in AG-S (Sattler et al., 2015). **References:** Sattler, T., Sekulic, D., Spasic, M., Peric, M., Krolo, A., Uljevic, O., & Kondric, M. (2015). *J Hum Kinet*, 47, 137-145. doi: 10.1515/hukin-2015-0069. Sekulic, D., Krolo, A., Spasic, M., Uljevic, O., & Peric, M. (2014). *J Strength Cond Res*, 28(11), 3306-3312. doi: 10.1519/JSC.0000000000000515. Spasic, M., Krolo, A., Zenic, N., Delextrat, A., & Sekulic, D. (2015). *J Sports Sci Med*, 14(3), 501-506.

IDENTIFYING DIFFERENCES IN ANTHROPOMETRIC AND CONDITIONING VARIABLES BETWEEN PERFORMANCE-LEVELS IN TOP-LEVEL WATER POLO

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Introduction: The proper identification (selection) of talented athletes is one of the crucial duties in competitive sport. Appropriate selection allows the application of the meaningful and effective training and conditioning, with consequent final achievement – competition at senior level. In majority of sports, the most rigid selection is the one which occurs in transition between junior and senior level. Therefore, the aim of this investigation was to identify possible differences between high-level junior and senior

water polo players in basic anthropometric variables and sport specific tests of conditioning capacities. Methods: The sample of participants were 50 water polo players involved at senior- ($n = 21$), and junior-level ($n = 29$). The sample of variables consisted of anthropometric indices (body height, body mass and arm span), and sport-specific conditioning tests: sprint-swimming over 20m distance (S20M), on-water vertical jump, shooting speed (SHOOT), and maximal dynamometric force in eggbeater kick (DYN), measured by protocols suggested previously (Platanou, 2005, Uljevic et al 2014). Results: All variables were normally distributed as evaluated by Kolmogorov-Smirnov's test. The analysis of variance indicated significant difference between performance levels in SHOOT (F-test: 19.34, $p < 0.05$), and DYN (F test: 25.48; $p < 0.05$), with no significant difference in anthropometric indices. Discussion: The non-significant differences in anthropometric status indicated morphological similarity between junior and senior water polo players, which is at least partially influenced by selection in earlier age (Kondric et al 2013). Namely, water polo sport favors taller and heavier athletes and therefore only those who meet such requirements are identified as potentially successful in earlier age (i.e. in transition between "younger junior level" and "junior level"). Therefore, our results indicate that junior-level players probably reached the level of body-build which is necessary for senior-level-performance. The performance-level differences in SHOOT and DYN indicates either (i) necessity of further development of force-related conditioning capacities, or (ii) the fact that successful senior players are generally selected on a basis of such performances. Further studies which will include younger athletes and additional tests of conditioning capacities are necessary. References: Platanou T (2005). *J Sports Med Phys Fitness*, 45(1) 26-31. Uljevic O, Esco MR, Sekulic D (2014). *J Strength Cond Res*. 28(6), 1595-1605. Kondric M, Uljevic O, Gabrilo G, Kotic D, Sekulic D (2012). *J Hum Kinet*, 32, 157-165.

REACTIVE AGILITY PERFORMANCE IN ASSISTANT REFEREES IN FOOTBALL - RELIABILITY OF A SPORT-SPECIFIC MEASUREMENT PROTOCOL

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Introduction: There is an evident lack of research investigating the factors associated with the performance of football referees with regard to their agility performance. The objective of this study was to evaluate the reliability of the newly designed test aimed at evaluation of reactive agility in assistant football referees. Methods: The participants in this study were top league assistant referees in Croatia ($N = 21$, age $35,8 \pm 5,2$ years). The data was collected during summer camp for elite Croatian football referees. Assistant referees were evaluated in a newly designed test for reactive agility. Testing consisted of three repeated measurements of specific reactive agility. Four variables were used for every measurement: time to change direction (t-0), time to reach 5m (t-5), time to reach 10m (t-10), time to reach 15m (t-15). For the reliability of the test Cronbach alpha was used. To determine the differences among the measurements the repeated measures ANOVA was conducted. Results: The results of Cronbach alpha for reactive agility test were 0.67 (t-0), 0.69 (t-5), 0,71 (t-10) and 0.73 (t-15), indicating a good reliability of the newly designed test. Statistical differences were established by ANOVA were significant ($p < 0.05$). Discussion: In this study, good reliability is reported for reactive agility test aimed at evaluation of this capacity in assistant referees. The results are consistent with previous findings regarding reactive agility in sport-specific conditions (Sattler et al., 2015; Spasic, Krolo, Zenic, Delextrat, & Sekulic, 2015; Uljevic, Esco, & Sekulic, 2014). Analysis of the differences among measurements indicated the best achievement for 1st measurement. Several factors can influence the reaction time in later trials, such as:

fatigue, complexity of the activity, motor learning, motivation, etc. (Schmidt & Lee, 1999; Spasic et al., 2015). Notwithstanding, the test is applicable in practice for assessing reactive agility in assistant referees. The author's recommendation is that the reference value is taken as the best result rather than the mean value. References: Sattler, T., Sekulic, D., Spasic, M., Peric, M., Krolo, A., Uljevic, O., & Kondric, M. (2015). *Journal of human kinetics*, 47(1), 137-145. Schmidt, R., & Lee, T. (1999). *Motor control and learning* (Human Kinetics, Champaign, IL). Spasic, M., Krolo, A., Zenic, N., Delextrat, A., & Sekulic, D. (2015). *Journal of sports science & medicine*, 14(3), 501. Uljevic, O., Esco, M. R., & Sekulic, D. (2014). *The Journal of Strength & Conditioning Research*, 28(6), 1595-1605.

MORPHOLOGICAL AND MOTOR PREDICTORS OF PLANNED AGILITY MANIFESTATIONS AMONG UNTRAINED PUBERTAL GIRLS

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Introduction: The aim of this study was to determine the multivariate relationship of some motor and anthropometric measures on planned (non-reactive) agility of untrained pubertal girls. **Methods:** The participants were 63 girls aged 13-14 years. They were selected in such a way that, until then, they had not been involved within the activities that could develop movement structures required during agility testing. A sample of predictors consisted of different anthropometric and motor variables. The criteria were five non-reactive agility variables, which were chosen in a way to access different manifestations of agility (i.e. non-stop, stop-and-go, rotational) (Metikos et al., 2003). The forward-stepwise regression analysis were calculated. **Results:** The results of this study indicate a relatively high percentage of the explained variance of the criterion variables (32% to 65% of explained variance) which is higher than in some similar previous studies (Markovic et al., 2007; Sekulic et al., 2013). Anthropometric variables, especially body weight and body fat, are found to be significant predictors of agile manifestations in girls. **Discussion:** As expected, different influence of predictor variables on different criterion variables was evidenced, since agility tests used in this study require various manifestations of agility-performances. Test "side-jumps in 15 seconds" was recognized as important predictor of various types of agility in girls. Further, obtained results also show the negative effect of body fat on the results of the applied agility tests. Such a finding could suggest that reduction of body fat could have a positive influence on the results of tested agility manifestations in tested girls. In future studies, it would be useful to design and conduct a training process, targeting fat reduction and see if there was a positive shift in the agility test results. The way in which the respondents were selected to homogenize the sample proved to be correct since predictors explained a large proportion of the variance of the criteria. References: Markovic G, Sekulic D, Markovic M (2007). *Collegium Antropologicum*, 31(3), 787-793. Metikos D, Markovic G, Prot F, Jukic I (2003). *Kinesiology*, 35(1) 14-29. Sekulic D, Spasic M, Mirkov D, Cavar M, Sattler T (2013). *Journal of Strength and Conditioning Research*, 27(3), 802-811.

DIFFERENCES IN TRANSFER FACTOR OF LUNG BETWEEN REST AND AFTER MAKSIMAL EXERCISE IN CROATIAN JUNIOR AND SENIOR ROWERS

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Introduction: Aerobic capacity depends on age, sex, genetic factors and, what is of particular importance, professionally guided training. The test of maximal possible reception of oxygen is considered to be the best test giving the relatively reliable information about maximal aerobic capacity. The aim of this paper is to determine the change of diffusing lung capacity for carbon monoxide (DLCO) of Croatian rowers at progressive exercise on rower's ergometer. Methods: The research included 91 rowers (45 seniors; 46 juniors). Ergometric tests were performed on rowing ergometer "Concept II" model C (Morrisville, Vermont, U.S.A.). Diffusing lung capacity for CO (DLco) and unit diffusion (DLco/va) were measured at rest as well as after maximal exercise using the multifunctional apparatus "Master Lab" of the Jaeger Company. Diffusing lung capacity was measured by the "single breath method". Correction of diffusing capacity to alveolar volume has been suggested, and is termed unit diffusion or Krogh constant (KCO). Values after Cotes (Cotes et al., 2006) have been taken as normal values for diffusing capacity. The results were statistically processed by analyze of variance with the level of significance $p < 0.05$. Results: The two samples were statistically significantly different in the three variables: age, body height and body weight which was expected. The values of diffusing lung capacity at rest were 21.93 ± 3.23 mmol.min⁻¹.kPa⁻¹ for juniors and 23.56 ± 4.73 mmol.min⁻¹.kPa⁻¹ for seniors ($p > .05$). Unit diffusion at rest were 2.41 ± 0.30 mmol.min⁻¹.kPa⁻¹.L⁻¹ for juniors and 2.27 ± 0.43 for seniors ($p > .05$). At the end of the testing, after maximal effort, the values increased significantly by 1.2 times in both rowing patterns. Diffusing lung capacity for juniors was 26.04 ± 3.31 ($194.45 \pm 27.19\%$ predicted) and for seniors 28.43 ± 5.43 mmol.min⁻¹.kPa⁻¹ ($208.54 \pm 39.14\%$ predicted). Seniors have statistically significantly higher diffusing capacity ($p < .01$) as well as predicted value ($p < .05$). However, when the values of diffusion capacity are corrected for alveolar volume, no statistically significantly difference between two samples were found. Discussion: Authors consider that this research confirms that the degree of training is closely related to the increase of DLco after maximal effort speaks of the utilization of pulmonary reserves already at rest (Secher & Volianitis, 2007). In top athletes at rest DLco as well as DLco/va is increased compared to standard norms after Cotes. Differences in diffusion capacity among rowers of different ages can be partially explained by considerably higher body height as well as on the associated larger alveolar surface (Marinović, 2011). References: Cotes JL, Chinn DJ, Miller MR (2006). Lung function. Blackwell Publishing. Marinović M (2011). (Unpublished doctoral dissertation). Secher NH, Volianitis S (2007). Blackwell Publishing

DIFFERENCES IN ISOKINETIC MUSCLE POWER BETWEEN ATHLETES FROM VARIOUS SPORTS

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Introduction: Isokinetic dynamometry is widely used in sport and medicine as a method for the assessment of muscle strength, power and other muscle contractile properties (Abernethy et al., 2005). So far,

very few studies investigated differences in isokinetic muscle power between athletes from structurally different sport groups, which results could lead to information about some discriminative values of isokinetic dynamometry and could contribute to the development of sports training technology, selection process in sport, physical therapy and rehabilitation. Accordingly, the aim of this study is to examine the differences in muscle power measured by the method of isokinetic dynamometry between athletes from various sports. Methods: The sample of participants consisted of 42 top level athletes from football, long distance running, and karate. Each group consisted of 7 men and 7 women (age = 22.6 ± 4.1 year; body height = 175.2 ± 11.4 cm; body weight = 68.3 ± 12.1 kg, on average). Measurements of average isokinetic muscle power (W) were done on the knee flexor and extensor muscles of right (dominant) leg in concentric mode at movement velocities of 60 and 180°/s (Toskić et al., 2018). Of statistical analysis, descriptive statistics, ANOVA and MANOVA were used. Results: There is no statistically significant differences in isokinetic muscle power of the knee flexor and extensor muscles between athletes from various sports on the general level ($F = 0.239$; $p = 0.981$) as well as on the level of individual variables ($F = 0.523$; $p = 0.678$, on average). Discussion: The results obtained in this study indicate that there is no significant differences in muscle power measured by the method of isokinetic dynamometry between top level men and women football players, long distance runners, and karatekas. This finding is somewhat unexpected as it is assumed that football players and karatekas, who are involved in sports which to a large extent depends on muscle power manifestation (Reilly et al., 2000; Chaabene et al., 2012), have higher level of isokinetic muscle power that long distance runners, and can be attributed to specific movement conditions in isokinetic dynamometry testing which is different regarding to other movement and sport activities. Obtained results indicate that muscle power measured by the method of isokinetic dynamometry have low discriminative values, and it is not suitable for detecting differences between athletes of the three structurally different sports, that is, football, long distance running, and karate. References: Abernethy P, Wilson G, Logan P (1995). *Sports Med*, 19(6), 401-417. Chaabene H, Hachana Y, Franchini E, Mkaouer B, Chamari K (2012). *Sports Med*, 42(10), 829-843. Reilly T, Bangsbo J, Franks A (2000). *J Sport Sci*, 18(9), 669-683. Toskić L, Dopsaj M., Stanković V, Marković M (2018). *Isokinet Exerc Sci*, (Preprint), 1-10.

CHANGE OF DIRECTION SPEED OF FEMALE VOLLEYBALL PLAYERS

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Introduction: The ability to change direction while sprinting is considered essential for successful participation in most team and individual sports (Brughelli et al., 2008). Volleyball is a sport comprised of many explosive efforts, characterized by multiple short bouts of high-intensity exercise, interspersed with brief rest. Considerable demands are placed on the neuromuscular system during the multidirectional court movements that occur repeatedly during competition periods (Sheppard et al., 2009). The purpose of this study was to examine change of direction speed (CODS) of young female club volleyball players in terms of age categories. Methods: Thirty four players were assessed for CODS (T – test, Sprint 93639 m fb and Sprint 93639 m with 1800 turns. MANOVA with LSD post hoc test was applied in order to examine wheter there were statistically significant differences between Team A, B and C (17.93 ± 1.33 , 8.58 ± 2.84 ; 16.59 ± 0.93 , 5.29 ± 2.06 ; 14.41 ± 0.61 , 3.87 ± 1.30 age and training years respectively), in CODS. Results: The MANOVA revealed a significant difference for age, training years and technical – tactical knowledge – on behalf of criteria for selection to team was made ($F=2.37$; $P=0.04$; $Part\eta^2=0.20$).

Results of Team A volleyball players were better than Team B and Team C volleyball players in T test (11.78 ± 0.59 , 12.77 ± 1.03 , 12.83 ± 0.92 sec, $f=5.67$, $p=0.01$, $\text{part}\eta^2=0.27$) and test Sprint 93639 m with 1800 turns (8.90 ± 0.40 , 9.71 ± 0.88 , 9.45 ± 0.64 sec, $f=4.29$, $p=0.02$, $\text{part}\eta^2=0.22$). Statistically significant differences were observed between Team A and B $p=0.02$ and Team A and C $p=0.00$ (T test) and Team A and B $p=0.01$ and Team A and C $p=0.03$ (Sprint 93639 m with 1800 turns). Discussion: Time spent in strength and conditioning programs, the quality of strength and conditioning programs, physical maturation, and increased time playing volleyball as a result of age results in advanced level of motor abilities. This may be because of an increased emphasis in sprinting, and speed and power development in Team A strength and conditioning programs or to the previously mentioned effect of older age, training years involvement and enhanced muscle mass. Similar findings were found in the work of Gabbett & Georgieff (2007), in which authors detected significant differences ($p < 0.05$) among junior national, state, and novice volleyball players with the physiological and anthropometric characteristics of players typically improving with increases with playing level. This may also be attributed to the Team A volleyball athletes being older, heavier, and taller, which may translate into more muscle mass and greater power which is in accordance with recent findings of Schaal et al., 2013. References: Brughelli M, Cronin, J, Levin, G, Chaouachi, A (2008). *Sport med*, 38(12), 1045-1063. Gabbett, T, Georgieff, B (2007). *JSCR*, 21(3), 902. Schaal, M, Ransdell, LB, Simonson, SR, Gao, Y (2013). *JSCR*, 27(7), 1841-1850. Sheppard, JM, Gabbett, TJ, Stanganelli, LCR (2009). *JSCR*, 23(6), 1858-1866.

Poster Presentations

Adapted Physical Activity

META-ANALYSIS OF SCIENTIFIC PAPERS ON PHYSICAL ACTIVITY IMPORTANCE IN DIFFERENT AGE PUBLISHED IN THE MAGAZINE SPORT MONT FROM 2007 TO 2014

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Introduction: The main goal of this research is to do meta-analysis of published original scientific papers in the fields related to importance of physical activity in different age in the magazine "Sport Mont" from 2007 to 2014. **Methods:** Content analysis is a method commonly present in researches which qualitatively and quantitatively systematize published papers on certain topics, and in the more simple form, collection and description of the above mentioned papers are used. Unit of the content analysis in this revised paper are the titles of original scientific researches published in the magazine "Sport Mont" from 2007 to 2014. In this paper, meta-analysis has been done and there are five selected papers classified according to a simple criteria, and that is doing the research on importance and effects of physical activity in different age groups. **Results:** Given results refer to the fact that with all of five published papers classified in three categories: students, high school students and children, there is an established trend of decrease in physical activity, being decreased in age. It is for sure that contemporary life styles and expansion in digital technology have given a lot of contribution to passive spending of free time with different age. Physical development of an individual is best achieved through activities that are intensive, well planned and versatile (Bjelica & Krivokapić, 2011). **Discussion:** Well-known positive effect of physical activity on the health has been scientifically confirmed nowadays. Numerous researches have confirmed that physical activity is connected to reduced risk of, first of all obesity, as well as its complications (coronary) disease, cerebrovascular disease, hypertension, insulin dependent diabetes mellitus, some forms of cancer, osteoporosis etc. Statistic data refer to the fact that physical activity is very little present not only with adults, but also with children in the world and our country as well. Therefore, it is necessary to promote physical activity in general, but first of all at all levels of health protection, especially in primary protection. It is necessary to do national programs intended to health improvement through physical activities and proper nutrition, and it should become the priority. Physical activity has multiple importance for growth and development of a young person. **References:** Joksimović M., Joksimović V, Vujović D (2010). Sport Mont, 7(23-34), 437-441. Joksimović M., Joksimović V (2007). Sport Mont, 5(12-13-14), 273-75. Krivokapić D, Bjelica D (2014). Sport Mont, 12(40,41,42), 200-8. Lepeš J (2012). Sport Mont, 10(34-35-36), 521-28. Tatar N, Mulešković M, Ćupić, R (2011). Sport Mont, 8(25-26-27), 48-54.

EVALUATION OF THE UNITED ARAB EMIRATES MASS MEDIA CAMPAIGN TO PROMOTE PHYSICAL ACTIVITY, “MOVE IT, UAE”

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Introduction: Physical inactivity may have detrimental effect on people’s health as it increases the risk of obesity and its associated non-communicable diseases (World Health Organization, 2018). To address this, the Ministry of Health and Prevention in the United Arab Emirates launched “Move it UAE” media campaign. The campaign aimed to raise awareness that physical activity is not restricted to structured exercises, 30 minutes of physical activity can be divided into bouts of 3, and that all barriers to physical activity can be overcome. **Methods:** A quantitative survey was conducted with a sample of 2000 UAE adults. The questionnaire was developed to assess respondents’ awareness of the campaign ads, understanding of the messages, physical activity related behaviours and their intention to be active. SPSS-24(IBM) was used for analysis with descriptive and logistic models used to describe campaign impact and correlates. **Results:** The results showed slight increase in campaign awareness. However, there was significant increase in knowledge related to campaign messages, and physical activity related behaviours. The respondents agreed that the messages were new, different and relevant to them. **Discussion:** The effect of the campaign was modest on awareness. The awareness levels usually varies when evaluating mass media campaigns and some shows modest affect (Berry et al., 2009). However, the results showed some changes with increases in facilitators to being active, and some changes in physical activity behaviours and total physical activity achieved. The increase in physical activity motivators and engaging behaviours can be attributed to higher proportion of males amongst participants, as various studies showed sex differences in sports or physical activity (Lunn, 2010; Stamatakis and Chaudhury, 2008; Mabry et al., 2010). **References:** Berry TR, Spence JC, Plotnikoff RC, et al. A mixed methods evaluation of televised health promotion advertisements targeted at older adults, *Eval Program Planning*, 2009, vol. 32 (pg. 278-88). Lunn, P. D. (2010). The sports and exercise lifecourse: A survival analysis of recall data from Ireland. *Social Science & Medicine*, 70, 711–719. <http://dx.doi.org/10.1016/j.socscimed.2009.11.006>. Mabry, R. M., Reeves, M. M., Eakin, E. G. and Owen, N. (2010), Evidence of physical activity participation among men and women in the countries of the Gulf Cooperation Council: a review. *Obesity Reviews*, 11: 457-464. doi:10.1111/j.1467-789X.2009.00655.x. Stamatakis, E., & Chaudhury, M. (2008). Temporal trends in adults’ sports participation patterns in England between 1997 and 2006: The Health Survey for England. *British Journal of Sports Medicine*, 42, 901–908. <http://dx.doi.org/10.1136/bjism.2008.048082>. World Health Organization. (2018). Physical inactivity a leading cause of disease and disability, warns WHO. Retrieved from <https://www.who.int/mediacentre/news/releases/release23/en/>.

SPORT FIELDS AT SCHOOL INCREASE STUDENTS’ PHYSICAL ACTIVITY LEVEL BUT MAY CAUSE UNHEALTHY SUN EXPOSURE

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Introduction: Research reveals that long outdoor stay is a strong predictor of primary school children’s free mobility involving moderate to vigorous physical activity (MVPA)¹. On the other hand long outdoor

stay may cause hazardous exposure to ultraviolet radiation (UVR) from the sun even at high latitudes as in Sweden². In this study we investigated the concurrent impact of different school outdoor play settings upon students' physical activity level and sun exposure across different ages, genders and seasons of the year. Methods: Individually MVPA and UVR exposure were measured one week each in September, March and May in 7-11-year-old students. Activity monitors (Actigraph GT3X+) measured MVPA, and polysulphone film dosimeters assessed erythemally effective UVR exposure. Schoolyard play was recorded on maps, and used areas defined as four play settings (fixed play equipment, paved surfaces, sport fields, green settings), categorized by season, age and gender. Results: In September and March sport fields raised students' MVPA and UVR exposures were suberythemal. Boys used sport fields more than girls. MVPA and outdoor stay dropped in March. In May green settings and fixed play equipment close to greenery promoted MVPA and protected from solar overexposure during long outdoor stays. Discussion: Sport fields which boys used significantly more than girls, generated the highest amount of MVPA in all pupils across all seasons. In May however, the outdoors, especially sport fields, not unexpectedly exposed the pupils to risky amounts of UVR. The significance of a strategic design to reduce UVR exposures during play, and to extend safe outdoor stays has been stressed in a recent study⁴. Grassy sport fields in green surroundings could lower the risk for hazardous UVR exposure in May, as would opportunities to recess or scheduled physical activity in mornings and late afternoons. Further, as we know that the presence of trees and other greenery increase the play-value and overall attraction of outdoor settings to children³ this is another argument for the greening of sport fields, as well as other paved areas and areas with play equipment. References: Dessing D, Pierik FH, Sterkenburg RP, et al. Schoolyard physical activity of 6-11 year old children assessed by GPS and accelerometry. *The international journal of behavioral nutrition and physical activity*. 2013;10:97. Pagels P, Wester U, Soderstrom M, et al. Suberythemal Sun Exposures at Swedish Schools Depend on Sky Views of the Outdoor Environments - Possible Implications for Pupils' Health. *Photochemistry and photobiology*. 2016;92(1):201-207. Mårtensson F, Jansson M, Johansson M, et al. The role of greenery for physical activity play at several grounds. *Urban Forestry & Urban Greening*. 2014;13(1):103-113. Vanos JK, McKercher GR, Naughton K, et al. Schoolyard Shade and Sun Exposure: Assessment of Personal Monitoring During Children's Physical Activity. *Photochemistry and photobiology*. 2017.

Anthropology

BODY COMPOSITION AND ANTHROPOMETRIC MEASURES OF SOCCER PLAYERS, CHAMPIONS OF MONTENEGRO AND BOSNIA AND HERZEGOVINA

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Introduction: The aim of this research was to determine the differences among the top soccer players of the Montenegrin club FC Buducnost and Bosnia and Herzegovina club HSC Zrinjski Mostar, the champions in their countries, in the anthropometric measures and body composition. Methods: A sample of 58 examinees is divided into two sub-samples. The first sub-sample of the examinees consisted of 30 players of FC Buducnost of the average age of 22.73 ± 4.33 , the champions of the Montenegrin Championship in the season 2016/17, while the other sub-sample consisted of 28 players of HSC Zrinjski Mostar of the average age of 24.36 ± 4.14 , the champions of Bosnia and Herzegovina in the season 2016/17. Soccer players were tested immediately after the end of the competition season 2016/17. Anthropometric

measures in the body composition were evaluated by a battery of 10 variables: body height, body weight, body mass index, fat percentage, muscle mass, waist size, triceps skinfold, biceps skinfold, back skinfold and abdominal skinfold (Bjelica et al., 2018; Corluka et al., 2018; Gardasevic et al., 2018). The significance of the differences between the players of the two soccer clubs in the anthropometric measures and variables for assessing body composition was determined by a t-test for independent samples. Results: It was found that the soccer players of the two mentioned clubs have statistically significant differences by the three variables that estimate the waist size, biceps skinfold and biceps skinfold, in a favor of HSC Zrinjski Mostar. Discussion: The values obtained in this research can be useful for coaches of these clubs for making a comparison of their players with others and formulate their work in a way that enables reduction of those parameters that are not good, and raise those that are good to a higher level. The results obtained in this research can serve as model parameters for the estimated variables for players of all other soccer clubs in Montenegro and in Bosnia and Herzegovina. References: Bjelica, D., Gardasevic, J., & Vasiljevic, I. (2018). Differences in the morphological characteristics and body composition of football players FC Sutjeska and FC Mladost in Montenegro. *Journal of Anthropology of Sport and Physical Education*, 2(2), 31-35. doi: 10.26773/jaspe.180406. Corluka, M., Bjelica, D., Vasiljevic, I., Bubanja, M., Georgiev, G., & Zeljko, I. (2018). Differences in the morphological characteristics and body composition of football players of hsc zrinjski mostar and fc siroki brijeg in bosnia and herzegovina. *Sport Mont*, 16(2), 77-81. doi: 10.26773/smj.180614. Gardasevic, J., Bjelica, D., Popovic, S., Vasiljevic, I., & Milosevic, Z. (2018). Differences in the morphological characteristics and body composition of football players FC Buducnost and FC Mladost in Montenegro. *Journal of Anthropology of Sport and Physical Education*, 2(1), 51-55. doi: 10.26773/jaspe.180109

BODY COMPOSITION AND ANTHROPOMETRIC MEASURES OF SOCCER PLAYERS, CHAMPIONS OF BOSNIA AND HERZEGOVINA AND KOSOVO

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Introduction: The aim of this research was to determine the differences among the top soccer players of the Bosnia and Herzegovina club HSC Zrinjski Mostar and Kosovo club FC Trepca '89, the champions in their countries, in the anthropometric measures and body composition. Methods: A sample of 43 examinees is divided into two sub-samples. The first sub-sample of the examinees consisted of 28 players of HSC Zrinjski Mostar of the average age of 24.36 ± 4.14 , the champions of Bosnia and Herzegovina Championship in the season 2016/17, while the other sub-sample consisted of 15 players of FC Trepca '89 of the average age 21.80 ± 3.57 , the champions of the Kosovo Championship in the season 2016/17. Soccer players were tested immediately after the end of the competition season 2016/17. Anthropometric measures in the body composition were evaluated by a battery of 10 variables: body height, body weight, body mass index, fat percentage, muscle mass, waist size, triceps skinfold, biceps skinfold, back skinfold and abdominal skinfold (Bjelica et al., 2018a; Bjelica et al., 2018b; Gardasevic et al., 2018). The significance of the differences between the players of the two soccer clubs in the anthropometric measures and variables for assessing body composition was determined by a t-test for independent samples. Results: It was found that the soccer players of the two mentioned clubs don't have statistically significant differences by the variables. Discussion: The values obtained in this research can be useful for coaches of these clubs for making a comparison of their players with others and formulate their work in a way that enables reduction of those parameters that are not good, and raise those that are good to a higher level. The re-

sults obtained in this research can serve as model parameters for the estimated variables for players of all other soccer clubs in Bosnia and Herzegovina and in Kosovo. References: Bjelica, D., Gardasevic, J., & Vasiljevic, I. (2018a). Differences in the morphological characteristics and body composition of football players FC Sutjeska and FC Mladost in Montenegro. *Journal of Anthropology of Sport and Physical Education*, 2(2), 31-35. doi: 10.26773/jaspe.180406. Bjelica, D., Gardasevic, J., Vasiljevic, I., & Corluka, M. (2018b). Body composition and anthropometric measures of footballers, cup winners of Montenegro and Bosnia and Herzegovina. *Journal of Anthropology of Sport and Physical Education*, 2(4), 3-7. doi: 10.26773/jaspe.181001. Gardasevic, J., Bjelica, D., Popovic, S., Vasiljevic, I., & Milosevic, Z. (2018). Differences in the morphological characteristics and body composition of football players FC Buducnost and FC Mladost in Montenegro. *Journal of Anthropology of Sport and Physical Education*, 2(1), 51-55. doi: 10.26773/jaspe.180109

MORPHOLOGICAL DIFFERENCES BETWEEN KICKBOXING AND OLYMPIC COMBAT SPORTS

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Introduction: The main purpose of this study is to investigate morphological differences between highly trained kickboxers and Olympic combat sports except fencing. Study consisted of two parts, general comparison and comparison by universal weight categories. Many review and original papers have investigated physiological profiles of combat sport athletes, and anthropological parameter within sports as well as younger athletes (Lulzim, 2011; Vecchio, Matsushigue and Franchini, 2011; James et al., 2016). **Methods:** 135 healthy male, national and international competitors voluntarily participated in this study. All participants were introduced with the procedures and signed written consent to be a part of the study. Sports that were included in this study were boxing (N=16), wrestling (N=23), judo (N=23), karate (N=20), taekwondo (N=30) and kickboxing (N=23). Procedure of measurement was defined by International biological programme (IBP). One way ANOVA, and Bonferroni post hoc method were used for determining statistical significance. **Results:** General analysis of longitudinal and transversal dimensions showed that Olympic sports have similar values than kickboxers. Only difference was between kickboxers and wrestlers. There were no significant differences between sports considering body volume and body composition. Similar findings were found when put in universal weight categories (-70kg, -80kg, -90kg, 90kg+). What was interesting to notice is that kickboxers have lower increase in longitudinal and transversal dimensions when compared through universal weight categories. This can be explained by their greater weigh cuts before fights. **Conclusion:** These findings can suggest that morphological characteristics cannot be used as discriminative factor between Olympic and non-Olympic combat sports. Kickboxing fighters appear to be less affected by weight categories in terms of longitudinal and transversal characteristics. **References:** James, L. P. et al. (2016) 'Towards a Determination of the Physiological Characteristics Distinguishing Successful Mixed Martial Arts Athletes: A Systematic Review of Combat Sport Literature', *Sports Medicine*. Springer International Publishing, 46(10), pp. 1525–1551. doi: 10.1007/s40279-016-0493-1. Lulzim, I. (2011) 'Razlike u morfološkim karakteristikama, motoričkim i funkcionalnim sposobnostima, kod dječaka džudista i nesportista', *Спортске Науке И Здравље - Апейрон*, 2(2), pp. 164–169. doi: 10.7251/SSH1102164L. Vecchio, B. Del, Matsushigue, K. A. and Franchini, E. (2011) 'Physiological Profiles of Elite Judo Athletes', 41(2), pp. 147–166. doi: 10.2165/11538580-000000000-00000.

BODY COMPOSITION OF ELITE GRECO-ROMAN WRESTLERS REGARDING WEIGHT CATEGORIES

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Introduction: The aim of this study is to determine body composition of Serbian Greco-Roman national wrestling team. This study tends to explore body composition characteristics with anticipation for differences among different categories to occur. **Methods:** In this study, a total of 11 male Greco-Roman elite wrestlers have participated. They were divided in three different weight category groups: light, middle and heavyweight. Four of these 11 athletes were European, World and Olympic medalists. The rest of the wrestlers were national medalists and were participants in European and World Championships. The body composition measures were estimated through manual bioimpedance. The differences between the groups of light, middle and heavyweight wrestlers were compared by One-Way ANOVA. **Results:** Heavyweight wrestlers have higher average height values than other two lighter groups, meaning that significant differences were observed in both cases (light weight vs. heavyweight and middleweight vs. heavy weight). There were no significant differences observed in body composition between light and middleweight category groups except for the BMI, fat free mass (kg) and muscle mass (kg). When comparing fat free mass (FFM) and muscle mass (MM) expressed in relative values (%) no significant differences appeared between light and middleweight group. As it could be anticipated, Body Mass Index (BMI) significantly differed between every group. When light weight (≤ 70 kg) and middle weight (70 - 90kg) categories were compared to heavyweight (≥ 90 kg) category, significant differences were present in every variable. Heavyweight wrestlers had higher body fat than two lighter groups with values of 23.86 ± 4.68 %, which is almost twice as high when compared to lightweight wrestlers. Light and middle weight category wrestlers showed higher values of relative fat free mass and muscle mass (%). **Discussion:** According to previous studies, off-season values for percentage of body fat range from 8 to 16% in the well-trained stage (Yoon, 2002). In this study, body fat values in light and middle weight wrestlers fit in this range. It appears that wrestlers who compete in the lower categories have leaner bodies (body composition). However, elite level wrestlers indeed, having the ideal “sport-specific” body build is only one part of a complex interaction that leads to optimal performance (Classens et al., 1999). Nevertheless, it seems that body composition assessment in elite Greco-Roman wrestlers are useful for determining factors that can lead to success. **References:** Classens AL, Lefevre L, Beunen G, Malina RM (1999). *Journal of Sports Medicine and Physical Fitness*, 39, 355-360. Yoon J (2002). *Sports Medicine*, 32(4), 225-233.

Architecture and Urbanism

NETWORK OF SPORTS FACILITIES IN THE BOKA BAY: LIMITATIONS AND POTENTIALS ON THE DEVELOPMENT OF THE SPORTS NETWORK

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Introduction: The area of the Boka Bay is recognized as a specific spatial and cultural phenomenon, with a specific geographic position on the Adriatic, a morphological uniqueness (one of the 25 most beauti-

ful bays in the world), cultural diversity and architectural richness. The research is based on the study of the existing network of sports facilities in the area of The Bay of Kotor. The urban development of Herceg-Novi, Kotor and Tivat can be traced back from prehistoric era, through all periods of spontaneous construction, to the first planned documented building during the Austro-Hungarian rule. After 1918, the size of the cities increased. The first plans that were made recognized the importance of sports and recreational areas in the city, which are necessary for the normal psycho-physical development of the inhabitants. In the period after 1918, the development of sports began to intensify, and a large number of sports clubs were established in Herceg Novi, Kotor and Tivat. Method: Data analysis will be performed using the following scientific methods: method of analysis, comparison method, inductive-deductive method and the method of synthesis. Descriptive and normative methods were also used. Results: The research covers three Montenegrin municipalities: Herceg-Novi, Kotor and Tivat. Tivat is a city in Boka Bay with the greatest potential for development of all forms of sports contents, both indoors and outdoors. Un-built areas in the city account for almost 76% of the land area of the Municipality of Tivat, which makes it a Montenegrin city with the greatest potential for development of sports and recreation. In Herceg-Novi and Kotor there are huge constraints, due to terrain morphology and high density of housing in urban historical centers, inappropriate locations for sport etc. Discussion: The aim of this paper is to identify the existing network of sports facilities in the area of The Bay of Kotor, to determine whether such a setup meets individual urban norms for the cities of HN, KO and TV, as well as generally for the bay, which can be viewed as one entity Bokapolis. Also, the goal is to determine what the possibilities of transforming the existing network of sports facilities are, and to propose a model of development of the sports network according to the needs of the population and the available resources. References: Ilić, S. (1998). Sportski objekti (Sports Facilities). Beograd: Građevinska knjiga. Monstat, Montenegro statistical Office (2015). Statistical Yearbook. Podgorica: Monstat. Popović, G.S. (2014). Urban Parameters for Planning the Network of Physical Education Facilities in Montenegro. Sport Mont no. 40-42/XII, 131-139.

SPORT CENTER “MORAČA” - A REPRESENTATIVE EXAMPLE OF THE ARCHITECTURE AND URBANISM OF SPORTS FACILITIES IN PODGORICA

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Introduction: The purpose of the paper is to recognize a sports object of architectural and urban importance in the territory of Podgorica, which won Borba award for achievements in architecture in 1981, and Liberation of Titograd award the same year. The work of the architect Predrag Mitrović, whose work on the sports hall began in 1976, with numerous sports facilities and park space, makes the urban entity with the Morača River, on an area of 4 ha. Reconstruction of the sports hall in 2015 and 2018 led to modernization and re-valorization of this area. Methods: By collecting archival material, graphic and photographic documentation about the architectural work of the Morača sports center, through the method of analysis, the inductive-deductive method and the synthesis method, the standard designs of sports objects of the seventies of the twentieth century were compared with the design standards in the twenty-first century. The abovementioned methods have also explored the capacities of open sports contents, at the time of design, as well as after the adaptation of the object in the twenty-first century. Through the architectural and urban aspect, the context of the sports and recreational center at the time of design is still being compared. Results: By comparing standards in the design of sports facilities of the second half of the twenty-first and twenty-first centuries, it was identified the lack of basic elements

of the capital city– the capacity of indoor courts, as well as the lack of activation of outdoor recreational facilities. Discussion: Sports Center “Morača” with its existing capacity relative meets the requirements of a sports facility of an indoor character at the territory of Podgorica. However, the inexorability of the maximum potential of the area of the surface of 4ha leads to a sharp segregation in the use of space along the right bank of the Moraca River. The synthesis of networks of various sports contents, while respecting the morphology of the terrain and using it for the purpose of activating sports and green areas, would greatly reduce the devastation of the subject area. Disadvantages in the capacity of indoor sports facilities result in an increase in the same, by reducing the surface of open public sports content, as well as devastation of the same. References: Ilić, S. (1998). Sportski objekti (Sports Facilities) Belgrade: Građevinska knjiga. Mitrović, M. (1981). Sportski objekti (Sports Facilities) Belgrade: Faculty of Architecture. Monstat, Montenegro statistical Office (2015) Statistical Yearbook, Podgorica: Monstat. Republički zavod za urbanizam i projektovanje RZUP (1972). General Urban Plan of Titograd, Podgorica. Urbi Montenegro (2014). “Prostorni urbanistički plan glavnog grada- Podgorice”, Spatial urban plan of capital city- Podgorica. Popović, S., Bajić Šestović, J., Mašanović Đurović, N., Vlahović, S. (2016). Planning Network of Sports Facilities in the Context of Montenegro Case Study: Herceg-Novi, Podgorica and Danilovgrad, Sport Mont 14(2), 45-51.

NETWORK PLANNING OF SPORTS FACILITIES IN THE CITY CENTER OF MUNICIPALITY MOJKOVAC

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Introduction: The aim is to identify the potential of the city center of Municipality Mojkovac in terms of sports-capacity open and closed areas for conducting sports activities, their mapping, inclusion in the spatial concept of the Municipality, distance from other city facilities and public spaces, the possibility of their being recognized as the city’s landmarks. Methods: The methods used in this paper are most commonly used and they are: the collection of archives, graphic documents, access to valid planning documents of the city center of Municipality Mojkovac, norms and standards related to the area and facilities for sports and recreation. Also, using the method of analysis, inductive-deductive methods and methods of synthesis compared to standard planning and design of these facilities in an urban city core with other public facilities. The above methods also are explored and capacity to open spaces for sport and recreation and indoor sports facilities. Results: The above methods, as well as normative regulations and standards for open and closed sports contents in the spatial concept of one municipality or urban planning of the city center, conclude their insufficient capacity for the Municipality Mojkovac. Discussion: Sports facilities of a city have always, throughout its long history of development of the city, had been recognized as important areas in the city, a place of communication and interaction between people, unwinding part of social life, the so-called urban point of assembly. Apart from the social aspect, facilities for sport are often involved in the formation of the visual identity of a city. Areas for sport and recreation are areas that have a planning document intended for the development of sports and recreational facilities, outdoors or indoors. Positions of sports facilities in the urban pattern of the city, generating significant urban processes, and therefore the urban development of the city. The aim is to determine whether the existing network of sports facilities in the Municipality Mojkovac can satisfy the needs of its inhabitants, as well as make recommendations for the further development of the network of sports facilities and facilities and their integration into the urban matrix of the city. References: Ilić, S. (1998).

Sportski objekti (Sports Facilities) Belgrade: Građevinska knjiga. Monstat, Montenegro statistical Office (2015) Statistical Yearbook, Mojkovac: Monstat. Popović, S., Bajić Šestović, J., Mašanović Đurović, N., Vlahović, S., (2016). Planning Network of Sports Facilities in the Context of Montenegro Case Study: Herceg-Novi, Podgorica and Danilovgrad, Sport Mont 14(2), 45-51. Planska dokumenta: DUP Sportska zona Mojkovac, DUP Centar sa Gornjim Mojkovcem, PUP Opštine Mojkovac do 2020. Godine.

GENESIS OF LEGISLATION AND REGULATIONS FOR CONSTRUCTION OF SPORTS FACILITIES IN MONTENEGRO

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Introduction: The concept of work is based on a chronological analysis of the adopted and applied legal regulations for the establishment and establishment of norms for the design and construction of sports infrastructure facilities, since ancient times. **Method:** The text provides the basis for the conditions to be fulfilled by specifying the normative solutions for meeting the aesthetic and functional characteristics of sports facilities: stores, stadiums, water, snow and ice surfaces, landscape objects, etc. **Results and discussion:** Using experience of legal regulative practice, regulation of sports in European countries, which point to certain advantages and disadvantages, Montenegro can help to regulate the ways and possibilities of construction, use, maintenance and management of sports facilities. In ways already tested in the practice of France, Germany and Austria. **References:** Šuput, D. (2009). Zakonsko uređivanje sporta u evropskim državama“, Strani pravni život, 3. Mićović, M. (2018). Vrhunski spor. Zbornik radova Pravnog fakulteta u Splitu, 55(2). Drobnjak, D. (2004). Zakon o sportu Republike Crne Gore. Montenegrin sport academy, „Sport Mont“, 4.

Biochemistry

DO COMPRESSION GARMENTS INFLUENCE CARDIAC BIOMARKERS DURING A 10 KM TREADMILL RUN? A CROSS-OVER STUDY IN NON-ELITE ATHLETES

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Introduction: The purpose of this study was to evaluate the effects of using compression garments (CG) on cardiac biomarkers during a 10km treadmill run. **Methods:** In 15 non-elite, healthy athletes (7 female, age 42.1 ± 9.7, range 28-67 years) cardiac biomarkers troponin T (cTnT) and N-terminal prohormone of brain natriuretic peptide (NTproBNP) were measured directly after and on the day after (22-24 hours after the run) a 10km treadmill run, with and without CG (CEP pro + run socks). A cross-over study design with a two week wash-out phase was applied with participants being their own controls. **Results:** CTnT concentration [ng/L; reference < 15] without CG was on average 4.8 ± 1.2 (before), 7.3 ± 3.2 (directly after) and 6.0 ± 2.8 (day after the run). CTnT values with CG were on average 5.0 ± 1.4 (before), 6.7 ±

2.3 (directly after) and 5.5 ± 2.2 (day after the run). The course of NTproBNP concentration [ng/L; reference < 300] without CG was on average 56 ± 15 (before), 70 ± 27 (directly after) and 63 ± 24.7 (day after the run). NTproBNP values with CG were on average 51 ± 10 (before), 60 ± 21 (directly after) and 64 ± 28 (day after the run). Although athletes exhibited a rise in cardiac biomarkers after exercise, only one participant had a cTnT higher than the upper reference of normal and none exceeded the NTproBNP upper reference. The paired samples T-test analysis including bootstrap for compensating normal distribution showed neither for cTnT nor NTproBNP any significant correlation between values with or without CG. Discussion: CG are popular among athletes despite that studies have shown contradictory results concerning their effects. It is well known that strenuous exercise leads to the rise of markers of cardiac muscle damage and stress (Danielsson et al.2017). It has been shown that CG can lead to higher filling pressure in the right atrium and ventricle in heart failure patients (Wilputte et al., 2005). The effect of compression garments on biomarkers of cardiac cell damage and filling pressure has, to our best knowledge, never been evaluated. In our cross-over study neither cTnT nor NTproBNP was affected by using CGs on a 10km treadmill run. However, further research is warranted, not at least during more strenuous forms of exercise such as marathon. References: Danielsson et al., PLoS One. 2017 Jun 13; 12(6):e0179324. Wilputte F, et al. Eur J Lymphol. 2005; 15:1-4.

Biomechanics

QUANTITATIVE ANALYSIS OF BIOMECHANICAL PARAMETERS IN CMJ AND SJ JUMP TESTS ON 10 -14 YEARS OLD PLAYERS OF TIRANA FOOTBALL CLUB

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Introduction: Vertical jumping ability is of importance for good performance in different kinds of sports, and football among them. The most effective way for a football coach is to improve the vertical jumping ability in a proprioception training program (Baker 1996). The purpose of this study is to estimate the quantitative analysis of biomechanical variables in counter movement jump (CMJ) and squat jump (SJ) tests (Leo. 2010). Methods: Subjects participating were 29 boys aged 10-14, mean (12.1 ± 0.62) years old, with these anthropometric characteristics: height (1.54 ± 0.14) m, body mass (46.55 ± 9.74) kg and body mass index (BMI) (19.3 ± 2.37) kg/m². The subjects were tested in two forms: CMJ test for maximal height, performed with arm swing, and SJ test for maximal force, jump without arm swig with arms closed to the waist. Results: t-test analysis applied at this team, emphasizes the differences between them and their statistical and practical significance. In both tests was used the multiple regression method to understand whether the main variables of vertical jump can be predicted based on anthropometric variables. In two-way ANOVA analysis within subjects, was adapted the regression model (Field A, 2009), to connect the main dependent variable of each test, with the two independent variables: training level and test. Discussion: According to the results of the t-test values, it was concluded that there was a statistical improvement of 7 cm in maximal height in CMJ test, (Mackala, 2013) and an improvement of 320 N in maximal force in SJ test. A stepwise multiple regression analysis was conducted to determine the best predictors of the main variable for each test. In CMJ test, for the measurement of Hmax, the best predictor was Vmax. In SJ test, for the measurement of Fmax, the best predictors were: body mass and Pmax/kg. Conclusions: The proprioceptive exercises have a huge effect in the variety of training, by changing the style, monotony and the difficulty which results in improving all biomechanical param-

eters, including those of the sportive technique. Future training exercises studies are needed to determine which technique should be preferred to the specific required tasks. References: Baker, D(1996). J.of St.& Cond. Res:10,131-136; Leo. Mechan. (GRFP) v4.2. St. Ed. 2010; Field A. (2009), 3rd ed.; Mackala, et al, (2013) J. of St. & Cond. Res:10, 2650-2661.

EXPERIENCE RELATED IMPACTS ON JUMP PERFORMANCE OF ELITE AND COLLEGIATE BASKETBALL PLAYERS; INVESTIGATION ON FORCE-TIME CURVATURE VARIABLES

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Introduction: The importance of vertical jump in sports fields is widely recognized. Force-Time (F-T) curve variables of the vertical jump are known as contributing factors in jumping height. A study on F-T curve variables could lead to more focus on these parameters in jumping. Furthermore, experience differences might also have impacts on kinetic and kinematic outputs of athletes. Hence, the aim of this study was to investigate the relationship between F-T curve variables of eccentric and concentric phases with jump height (JH) among elite and collegiate basketball players. Methods: With institutional ethics approval, 12 elite (24.3±5.9 years, 195.4±23.1 cm, 89.1±15.2 Kg, 13.6±2.3 years' experience) and 12 collegiate (21.6±2.5 years, 183.2±6.1 cm, 75.3±9.5 Kg, 9.1±1.8 years' experience) male basketball players participated in this study. Correlation between F-T variables-included peak force (PF), relative peak force (RPF), peak power (PP), average power (AP), relative peak power (RPP), peak velocity (PV), and modified reactive strength index (MRSI)- in the eccentric (E) and concentric (C) phases- and jump height (JH) was studied. Results: Outcomes portrayed that CRPF (r=0.71), CRPP (r=0.83), CPV (r=0.99) and MRSI (r=0.71) have a significant correlation with JH in elite players, while in collegiate athletes, CRPF (r=0.79), CAP (r= 65), CRPP (r=0.81), CPV (r=0.98) and MRSI (r=0.83) were significantly correlated with JH. Eccentric phase total time has a moderate negative correlation with JH among elite (r=-0.24) and collegiate (r=-0.47) players. Discussion: Power measures are considered as vital factors in performance, and it is brought up that CPP, CAP and CRPP have a significant correlation with JH (Pupo, et al. 2012; Riggs and Sheppard 2009), which support the outcomes of this study. In addition, it is pointed out that MRSI has a significant correlation with the JH of athletes (Suchomel, et al. 2015), which is approved by the results of this study. Given that MRSI is defined as an explosiveness measurement in athletes and named as a reliable parameter in athletes' performance measurement, it could be accounted as of jump performance criteria. In terms of phase timing, former studies claimed that reducing eccentric phase time leads in increment of jump height (Laffaye, et al. 2014), which is in line with the results of this study. Both elite and collegiate groups tried to decrease eccentric phase duration to take the most advantage of a stretch-shortening cycle in order to obtain higher jump. Focusing on selected factors described above in training programs can sharply improve athlete jump performance. References: Laffaye, Guillaume, Phillip P Wagner, and Tom IL Tombleson (2014) J. Strength Cond. Res. 28(4):1096-1105. Pupo, Juliano Dal, Daniele Detanico, and Saray Giovana dos Santos (2012) Rev. bras. cineantropom. desempenho hum 14(1):41-51. Riggs, Michael P, and Jeremy M Sheppard (2009). J Hum Sports Exerc. 4(3). Suchomel, Timothy J, et al. (2015) J. Strength Cond. Res. 29(4):899-904.

Coaching

PLYOMETRIC EXERCISES WITH LOW LOAD IN ARTISTIC GYMNASTICS TO GIRLS 15 YEARS OLD

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Introduction: This study was conducted to evaluate the outcome of complex plyometric training at low intensity load intervals among 15 year old gymnastics girls in several physical variants. Complex exercise involves completing an aerobic exercise before a plyometric exercise. A classic example is to perform vertical jumps or depth jumps after completing a back squat exercise (ups and downs with his feet). (Damian, M., Popescu, R., Oltean, A., Giurgiu, L., 2014). **Methods:** We considered twenty-four gymnasts in four Albanian sports clubs, which were classified by two groups (the experimental group twelve girls and the control group twelve girls). The experimental group trained with specific plyometric exercises twice a week, for six months, the control group attended normal training. (Potop V, 2008) Collected data started, middle and in the end of tests were under a statistical processing by IBM SPSS package, version number 22. **Results:** The overall results showed that: the experimental group had significantly higher physical skills than the control group, as well as significant improvements were observed in the power and strength to the experimental group as compare to the control group, ranging from $p \leq 0.005$. **Discussion:** Complex plyometric exercises with low load intensity are safe and enhance the quality of strength and speed. (Knudson DV, 2009) In their article (Makaruk H. & Sacewicz, T, 2010) suggests that it may be necessary to make a three to four-minute break between weight training and plyometric exercises. **References:** Damian M, Popescu R, Oltean A, Giurgiu L, (2014). Plyometric exercises to improve explosive power in artistic gymnastics, *Science, Movement and Health*, 14, (2), 183-186. Potop V (2008). Artistic Gymnastics Elements of Theory and Methods, Publ. H. Kiev, 56-58. Knudson DV, (2009). Correcting the use of the term “power” in the strength and conditioning, *Journal of Strength and Conditioning Research*, 23, (4), 105-108. Makaruk H, Sacewicz T, (2010). Effects of plyometric training on maximal power output and jumping ability, *Human movement* Vol. 11, (1), 17-22.

MODEL FOR STAMINA DEVELOPMENT IN BIATHLETES ON THE BASIS OF COMBINED APPLICATION OF RESPIRATORY EXERCISES AND ASSESSMENT OF ITS EFFICIENCY

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Introduction: The adaptation biathletes' bodies to different loads takes place gradually from stage to stage due to the development of stamina in the framework of combined use of respiratory exercises. The process of adaptation and change in functional parameters characterizing physical performance and functioning of external respiration occurs mainly due to the expansion of the range of application of the means that expand the capabilities of the cardiorespiratory system of the biathlete's body. The use of respiratory exercises with and without exercise machines in combination with aerobic exercises of moderate, medium and maximum intensity allows expanding the reserve and functional capabilities of the

biathlete's body. Methods: The device "Spirolab III" was used to study and analyze the indicators of the respiratory system of biathletes. This device allows determining forced vital capacity of the lungs, inspiratory capacity, expiratory capacity, maximum ventilation of the lungs, setting breathing pattern, and also measuring oxygen saturation in the blood and pulse. The following indicators were studied: vital capacity of the lungs VC, forced vital capacity of the lungs FVC, maximum voluntary ventilation MVV, expiratory vital capacity EVC, forced inspiratory volume in the first second FIV 1. Results: Improvement in the process of arranging and expanding the content of physical training for biathletes using multidirectional means aimed at developing stamina and the integrated use of breathing exercises creates favorable conditions for the further development of the adaptive capabilities of the functional systems of their body. This contributed to the effectiveness of competitive activity of biathletes. Discussion: Pedagogical testing was conducted to assess the overall physical fitness of biathletes. The following tests were used as indicators of general preparedness: standing long jump (cm); pull-ups (quantity); hip pull-over (quantity); shuttle run 10 * 10 (s); running 100 m (s); running over rough terrain for 5 km (s); 1 km and at 3 km run on the stadium (s) (Bakaev et al., 2015; Bolotin & Bakayev, 2017). Testing of biathletes' body reserves was carried out using the "Sources of Health" (Istoki Zdorovya) hardware-software complex, where the level of functional and adaptive reserves of their bodies was assessed (Bolotin et al., 2018). References: Bakaev, V.V., Bolotin, A.E., Vasil'eva, V.S. (2015). Factors determining sports specialization of cross country skiers. *Teoriya i Praktika Fizicheskoy Kultury*, (2), 40-41. Bolotin A., Bakayev V. (2017). The differences in response of the respiratory system of long and middle-distance runners and their influence on recovery rate. *JPES*, 17(4), 2443-2446. Bolotin, A., Bakayev, V., & You, C. (2018). Comparative analysis of myocardium repolarization abnormalities in female biathlon athletes with different fitness levels. *JHSE*, 13(2proc), S240-S244.

Health and Fitness

COMPRESSION GARMENTS DO NOT SIGNIFICANTLY AFFECT SKELETAL MUSCLE BIOMARKERS DURING A 10 KM TREADMILL RUN

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Introduction: The purpose of this study was to evaluate the effects of compression garments (CG; clave socks) on skeletal muscle biomarkers creatine kinase (CK) and myoglobin (MG) during a 10km treadmill run. Methods: In 15 non-elite, apparently healthy, well trained athletes (7 female, age 42.1± 9.7, range 28-67 years, HRR (Heart Rate Reserve) 80.5±6.4 %) skeletal biomarkers CK and MG were measured in plasma by accredited laboratory methods before, directly after and on the day after (22-24 hours after the run) a 10km treadmill run, with and without CG (CEP pro + run socks). A cross-over study design with a two week wash-out phase was applied. Thus, participants served as their own controls. Results: The course of MG concentration [$\mu\text{g/L}$; reference < 72] without CG was on average 32.3 ± 13.9 (before), 85.6 ± 50.3 (directly after) and 47.4 ± 21.8 (day after the run). MG values with CG were on average 31.3±7.9 (before), 92.9±64.7 (directly after) and 47.5 ± 20.5 (day after the run). The course of CK concentration [$\mu\text{kat/L}$; reference < 1.9] without CG was on average 2.25 ± 1.2 (before), 2.7 ± 1.3 (directly after) and 5.1 ± 4.1 (day after the run). CK values with CG were on average 2.4 ± 1.0 (before), 2.8 ± 1.1 (directly

after) and 4.8 ± 2.3 (day after the run). The paired samples T-test analysis including bootstrap for compensating normal distribution showed neither for MG nor CK any significant correlation between values with or without CG ($p > 0.05$). Discussion: There is an ongoing debate about the effects of using compression garment during strenuous exercise. Numerous studies have shown contradictory results concerning objective and subjective parameters (Duffield et al., 2008). Notwithstanding the scientific ambiguity, CG are popular among different kinds of athletes. A recent meta-analysis showed some positive effects on delayed-onset muscle soreness, muscular strength, measures of creatine kinase and mechanical stress/vibrations (Hill et al. 2014). Of the 18 studies in this meta-analysis, only 3 showed significant effects of CG on CK (Hill et al. 2014). However the effect of mechanical stress/vibrations has not, to our best knowledge, been evaluated using the biomarker myoglobin (MG). In our cross-over study neither MG nor CK was affected by using CGs on a 10km treadmill run. However, further research is warranted, not at least using different garments, controlling for the pressure exerted by the garment, training status of the athlete and type of exercise. References: Duffield R et al., *Int J Sports Physiol Perform* 2008; 3:454-68. Hill J et al., *Br J Sports Med* 2014; 48:1340-6.

WORKING EXPERIENCE AND PERCEIVED PHYSICAL ACTIVITY BARRIERS

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Introduction: The purpose of this study was to assess the relationship between physical activity (PA) and the type of barriers of PA and exercise depending on working experience years, among women who have sedentary jobs. Whereas, inactivity in working women with preservative socio-cultural norms has been defined as a risk factor of life quality in the Arab world. Methods: Participants were randomly recruited during spring 2018 from Yarmouk University female working body, who were healthy and had an 8 hours desk job. A total of 101 females (34.6 ± 6.2 years) were grouped according to years of working experience: less than five years L5 ($n = 34$), 6-9 years ($n = 32$), more than ten years M10 ($n = 35$). PA level and barriers of PA were assessed by the Arabic short form of the International Physical Activity Questionnaire IPAQ and the Barriers to Being Active Quiz (Centers for Disease Control and Prevention) respectively. Participants' responses were analyzed using multivariate analysis to indicate the most significant PA and exercise barrier among years of working experience groups. Results: Overall participants had a low PA level as calculated according to the (IPAQ). No significant differences were observed between years of experience and type of barriers. Whereas, the results of this study showed that the PA and exercise barrier among all participants where the lack of energy ($M = 6.1$, $SD = 1.7$), followed by lack of time ($M = 5.9$, $SD = 1.8$) and lack of willing power ($M = 5.6$, $SD = 1.7$). Discussion: The results of this study were consistent with earlier findings that addressed time and fatigue as the main barriers of working women despite their socio-graphic background (Moreno & Johnston, 2014; Neil-Sztramko et al., 2017; Sharara et al., 2017). The author prophesied that long years of experience might impact managing time and energy during working hour to promote PA levels. Although no differences in PA barriers were indicated, participants in the L5 group had a higher impact of time barrier and the availability of resources than participants with more working experience year's groups. These differences could be attributed to the fact that social norms and traditions affect younger women and could negatively impact their engaging in PA outside the house and the availability of gyms to late hours after work. The author recommends the establishment of interventions for overcoming barriers and enhancing PA for women's during working hours. References: Moreno, J. P., & Johnston, C. A. (2014). Barriers to physical activity in women.

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PHYSICAL ACTIVITY OF SENIORS AS A RESULT OF MEMBERSHIP IN THE UNIVERSITY OF THE THIRD AGE

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Introduction: Physical activity (PA) in the so-called third age is decisive in the prevention of serious diseases. Universities of the Third Age (U3A) play an important role in promoting PA among seniors. This article presents the results of a study investigating the impact of U3A membership on the PA of seniors. **Methods:** A diagnostic survey was performed in a group of 226 Polish seniors who were members of the U3A (194 females and 34 males). The results were processed with the use of the dominance index D expressed in percentage terms, Spearman's rank correlation coefficient and the multiple regression model to evaluate the effect of membership in the U3A on the PA of seniors. **Results:** In the studied group, 89% of the respondents were physically active, and 65% were of the opinion that membership in the U3A had encouraged them to become more physically active. The values of Spearman's rank correlation coefficient revealed a significant correlation between the duration of membership in the U3A and its declared influence on PA levels ($R_s=0.239715$, $p<0.05$). The above relationship was also confirmed by the linear regression model $A=112.53+0.1080UTW$ ($t=24.92593$, $P<0.001$; $t=-2.47448$, $p=0.014184$). The values of coefficients a and b were statistically significant, which indicates that the length of membership in the U3A significantly influences the initiation of PA. Enrollment in PA programs organized by the U3A was positively correlated with the duration of membership (Spearman's rank correlation coefficient $R_s=0.239715$, $p<0.05$; statistical significance of the linear regression model: $A=114.9743+0.1323UTW$; $t=27.44417$, $p<0.001$; $t=-3.26889$, $p=0.001273$). According to most respondents, their PA levels increased after they had joined the U3A. The results of Spearman's rank correlation analysis (at $p<0.05$) revealed a significant correlation between the duration of membership in the U3A and an increase in the respondents' PA levels ($R_s=0.159250$). **Discussion:** In the analyzed group, 89% of the respondents were physically active. Similar results were reported by other authors (Stwiot and Juśkiewicz-Swaczyna 2017, Kaczmarek 2017). Universities of the Third Age play an important role in promoting PA among seniors. The above observation was confirmed by a significant correlation between the duration of membership in the U3A and participation in sporting activities: enrollment in sports programs increased with the length of membership. **References:** Kaczmarek Ż (2017). Health-seeking behaviours of students of the University of the Third Age at Wrocław Medical University. Research results and recommendations, *Andragogy YearBook* 24, 189-200. Stwiot M, Juśkiewicz-Swaczyna B (2017). Physical activity and quality of life according to students of the University of the Third Age, *Postępy Rehabilitacji* (4), 45 – 56

DESCRIBING PHYSICAL ACTIVITY PROFILE OF YOUNG MONTENEGRIN MALES USING THE INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE (IPAQ)

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Introduction: The goal of this study was to describe the physical activity profile of young males living in Montenegro. **Methods:** The data was collected from 376 randomly selected older Montenegrin males, aged between 18 and 32 years of age (average age: 21.83±2.68). The International Physical Activity Questionnaire (IPAQ), self-administered long format, was used to describe the physical activity profile of selected population in five areas (job-related physical activity, transportation physical activity, housework, house maintenance, and caring for family, recreation, sport, and leisure-time physical activity and time spent sitting). A descriptive analysis was carried out to analyze the mentioned variables. **Results:** Among variety of very interesting results reached by the mentioned protocol, it is important to highlight that about one third of respondents currently have a job or do any unpaid work outside its home and walk more than hour within their work. Most of them use motor vehicles such as train, bus, car or the tram almost five days a week, while there is a lack of using the bicycle, just 17% of the respondents have a bicycle. However, 87% of them walked for at least 10 minutes at a time to go from place to place, and walked almost 6 days a week, about an hour a day approximately. On the other hand, 38% of respondents did hard physical activities and 55% of them light physical activities related to housework, house maintenance, and caring for family at least 10 minutes at a time, but not more than one hour a day in both activities. 14% of Montenegrin males did not walk at least one day for at least 10 minutes at a time in its leisure time, but active men did walk more than one hour and 15 minutes a day. The respondents have usually spent sitting four hours and 42 minutes during the working days, while they spent sitting 13 minutes less during the weekends. **Discussion:** The data reached in this project suggested that the prevalence of physical inactivity among young Montenegrin males was relatively high and might be an issue in the future. From this reason, the physical activity promotion has to be more implemented in the national projects for the young male people in Montenegro. **Funding:** This abstract has been done within nation project under the title “Effects of Physical Activity on Social Inclusion of Young People” that was approved by Ministry of Sport in Montenegro (No.01- 553-691/2018 from 1 March 2018). **References:** Popovic S, Bjelica D, Vukotic M, Masanovic B (2018). In Book of Abstracts of the 15th International Scientific Conference on Transformation Process in Sport “Sport Performance” (60-61). Masanovic B, Vukotic M, Bjelica D, Popovic S (2018). In Book of Abstracts of the 15th International Scientific Conference on Transformation Process in Sport “Sport Performance” (61). Popovic S, Bjelica D, Masanovic B, Vukotic M (2018). In Proceedings of the World Congress of Performance Analysis of Sport XII (344).

PHYSICAL ACTIVITY AND SATISFACTION WITH PHYSICAL APPEARANCE AS PREDICTORS OF SMOKING PREVALENCE AND SMOKING INITIATION; PROSPECTIVE ANALYSIS IN OLDER ADOLESCENTS

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Introduction: Although smoking prevalence among adolescents in south-eastern Europe is alarming, there is an evident lack of studies which prospectively examined the potential predictors of smoking

prevalence (SP) and smoking initiation (SI) in this age group. This study examined the level of physical activity (PA), personal satisfaction with own physical appearance (appearance satisfaction – AS), and satisfaction with body weight (WS) as potential predictors of cigarette smoking (CS) and smoking initiation (SI) in older adolescents. Methods: The sample comprised 303 adolescents (161 females), who were 16 years of age old at study baseline. The previously validated questionnaires were used as measurement tools (Bjelica et al., 2016). The participants were tested over two testing waves, the baseline (beginning of the 3rd grade of high-school) and 20 months later (the end of 4th grade; follow-up). Logistic regressions with binomial criteria (SP: smoking vs. non-smoking; SI: initiated over the course of the study vs. didn't initiated) additionally controlled for gender, age and parental conflict as potential covariates were calculated. Results: The predictors were not significantly related to the SP at baseline, but PA and AS were significantly correlated to SP at follow-up, with lower likelihood of smoking in those adolescents of higher PA (OR: 0.81; 95%CI: 0.44-0.98) and those who were less concerned about their physical appearance (OR: 1.23; 95%CI: 1.03-2.01). No significant correlation was found between predictors and SI. Discussion: This study highlighted specific associations between PA and personal opinion about physical appearance as potentially related to substance misuse. The association between PA and AS with smoking at the end of the high-school period should be observed emphasizing this specific age-period, and further plans for latter life (Zenic et al., 2015). Most probably, the PA and AS are interrelated and consequently the higher level of PA and personal satisfaction are both correlated to lower likelihood of smoking (Sallis et al., 2000). However, results indicate necessity of gender specific approach in further examination of the problem. References: Bjelica, D., Idrizovic, K., Popovic, S., Sisic, N., Sekulic, D., Ostojic, L., . . . Zenic, N. (2016). *Int J Environ Res Public Health*, 13(10). doi: 10.3390/ijerph13100968. Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). *Med Sci Sports Exerc*, 32(5), 963-975. Zenic, N., Ostojic, L., Sisic, N., Pojskic, H., Peric, M., Uljevic, O., & Sekulic, D. (2015). *BMJ Open*, 5(11), e009446. doi: 10.1136/bmjopen-2015-009446.

THE INFLUENCE OF A DIFFERENCE IN THE SHAPE OF A HAT ON THE TEMPERATURE INSIDE IT DURING THE PLAY OF GOLF

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Introduction: As for the past studies about the influence of wearing a hat in a hot environment, Yorimoto, et al. (1982) showed that wearing a hat not only suppresses a rise in the skin temperature but also prevents unnecessary water loss by sweating, but that there is no difference in thermal sensation on the head between wearing and not wearing a hat. Midorikawa et al. (1992) studied the influence of wearing a hat on thermo physiological responses in the presence of heat and radiant heat, and they found a rise in the tympanic temperature and rectal temperature levels as well as an acceleration in the speed of the head surface temperature rise and the sweat rate in the case of not wearing a hat. However, these past studies were conducted by artificially creating a hot environment in a laboratory, and there have not been many field experiments during the actual play of a sport. In view of this, this study examined the influence of a difference in the shape of a hat on the temperature inside it during the play of golf. Method of the experiment: The study was to examine the difference between a highly ventilated hat developed by A Company and a regular golf cap. The highly ventilated hat has a ventilation hole in the top part of the brim, a double-layer structure at the sides of the hat, and ventilation holes in the top of the hat. The summary of the experiment is as follows. The temperature inside a hat was measured at the top of the head every 15 seconds by using a thermo recorder

(manufactured by ESPEC CORP.). Results: The results of nine-hole measurement (started at 9:46, holed out at 12:02) showed that with the highly ventilated cap, the average temperature inside the hat was 35.0 °C (maximum value: 37.5 °C) while with the regular cap it was 37.9 °C (maximum value: 39.5 °C). The average temperature difference was 2.9 °C, and this difference was statistically significant ($p < 0.001$). Discussion: Regardless of the shape of a cap, the temperature inside it changes in almost the same pattern during the play of golf. It is speculated that the quick rise in temperature occurs at that time because the green tends to be the hottest place in the course and because players stay on the green for a comparatively long time. From this point too, what we need to pay attention to especially before and after putting during the play of golf in a hot environment in summer is the following two: 1) Water and salt should be supplied frequently before and after the play on the green. 2) A player should take his or her hat off and put it on again at least once before putting or on the green. References: Yorimoto.A, et al. (1982) "Experimentation study about the effect of wearing a hat during exercises" *Descente Sports Science* 3 pp. 224-231. Midorikawa.T, et al. (1992) "The influence of wearing a hat on thermo physiological responses in the presence of heat and radiant heat" *Journal of Home Economics of Japan*, Volume 43 Number 5, pp. 421-427.

DIFFERENCE IN MOTOR COORDINATION BETWEEN CHILDREN PARTICIPATING IN MULTISPORT ACTIVITIES AND CHILDREN WHO SPECIALIZE IN A SINGLE SPORT

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Introduction: The continuous monitoring of children's motor coordination levels is very important. The purpose of this study was to determine the differences in motor coordination of children engaged in single sport, multisport activities and children not involved in any organized physical activity. Methods: One hundred and seventy nine children (90 boys and 89 girls) participated in this study (7-9 years). The total sample of subject was composed of three groups: children who do not exercise additionally ($n = 66$), children engaged in multisport activities (63) and children training soccer and volleyball ($N = 50$). Motor coordination was evaluated with the Kiphard-Schilling body coordination test (KTK). Results: Anova test showed significant differences in values of total motor quotient of children in three different groups ($p < 0.05$). The total motor quotient was the highest in the multisport group ($\text{mean} \pm \text{SD} = 113.30 \pm 15.19$), the lowest results were found in children not involved in any organized physical activity ($\text{mean} \pm \text{SD} = 93.50 \pm 14.96$) while the group of children engaged in single sport had result 100.51 ± 15.07 ($\text{mean} \pm \text{SD}$). Discussion: We found that children enrolled in multisport exercise program have higher levels of motor coordination than children involved in one single sport and children who do not exercise additionally. References: None.

EFFECTS OF TWO DIFFERENT TYPES OF SWIMMING TRAINING ON THE BODY STRUCTURE RATIO CHANGE

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Introduction: Morphological characteristics of swimmer's body structure significantly affects the level of expressing a series of specific abilities. One of the commonly used procedures for evaluating physical

preparation is evaluation of body structure, according to Gastin, P.B. (2001) as the increase in muscle, and reduction in fat tissue is a consequence of regular exercising and indicator of better physical preparation. Methods: The research is designed as a longitudinal study, and it is organized in the form of an experiment with parallel groups in which effects of two different training swimming programs were followed. They were different in criteria of applied work intensity in some trainings. The first training type consisted of swimming in intensity which has always been present in the first two zones of load below anaerobic threshold, according to Janssen (1987). In the other type dominated swimming in intensity in the third and fourth zone below anaerobic threshold. Scope of work, expressed by overall duration of activities in both programs was the same. Results: In order to establish efficiency of applied experimental treatments in both experimental groups of recreational swimmers, a discriminative analysis was done among average results achieved in initial and final measuring. After comparing average results from initial and final measuring, it was established that with examinees in both groups, namely, a share of fat component in the total body structure was significantly reduced. As for the share of muscle mass, it has been established that there was a per cent increase in muscle mass only with the second experimental group, but it wasn't significantly important. Discussion: Starting from the aim of this research which, first of all, was an attempt to prove influence efficacy of two different types of swimming trainings on the above mentioned variables of recreational swimmers' body structure, on the base of the given results, it could be claimed that both experimental treatments have caused statistically significant reduction in body mass, which can be considered as health desirable effect. Although difference in efficacy of applied experimental programs has not been established, it can be stated that both types of swimming trainings are recommended as equally efficient in the sense of health recreational exercising. References: Gastin, P. B. (2001): Energy System Interaction and Relativ Contribution during maximal Exercise. *Sport. Med.*; 31(10): 725-741. Janssen, P.G.J.M. (1987): Training - Lactate - Puls rate. *Polar Electro, Oy, Finland*, pp.49.

CHANGES ON BODY COMPOSITION OF OLDER ADULTS BY EXERCISE PROGRAM AND TIME DISTRIBUTION STRATEGY

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Introduction: Currently, there are some scientific inconsistencies regarding the effect on the body composition of older adults that different physical exercise programs have (Bouaziz et al. 2016) as well as their time distribution strategies (Donnelly et al. 2013). This study compares the effect of the multicomponent program "EFAM-UV©" (2 sessions/week) or a walking interval training "WIT" (3 sessions /week), both carried out following two different time management strategies: continuous "CON" (sessions of 60 consecutive minutes) and intermittent "INT" (30 minutes in the morning and 30 minutes in the afternoon). The aim is to point out the changes generated on the body composition of sedentary older adults by each activity and strategy. Methods: A quasi-experimental and longitudinal study was carried out with a 2x2 pre-post factorial design, where factors are the type of exercise and the training application strategy. To this intervention (16 weeks) took part 46 older adults (73.95±12.98 kg and 71.30±4.30 years) who had not participated in any directed physical activity for 4 months. The body composition was evaluated by bioimpedance (TANITA, model BC-545N, Tokyo, Japan). Results: Bonferroni post-hoc comparisons reveal significant improvements to all groups (except for EFAM-UV©INT) on body fat (WITCON: 34.61±7.28 vs 29.22±8.59, WITINT: 35.03±7.33 vs 26.91±8.55, EFAM-UV©CON: 38.30±6.37 vs 35.32±5.91), on muscle mass (WITCON: 44.63±9.73 vs 47.83±11.51; WITINT: 50.38±6.79 vs 55.64±8.36; EFAM-

UV©CON: 42.66 ± 8.98 vs 44.95 ± 7.68), and on bone mass (WITCON: 2.37 ± 0.99 vs 2.55 ± 0.59 , WITINT: 2.67 ± 0.32 vs 2.94 ± 0.42 , EFAM-UV©CON: 2.27 ± 0.45 vs 2.37 ± 0.39). Weight and BMI improved significantly ($p < 0.05$) regardless the type of exercise or the training strategy. Discussion: Our results suggest that starting physical practice in sedentary older adults improves body composition regardless of the type of program performed and, in particular, EFAM-UV© gets improvements with only 2 days/week. The distribution strategy only gave positive results in the WIT group. According to Bouaziz et al. (2017), aerobic conditioning programs could be a key element in the design of weight control strategies in older adults, although multicomponent programs generally have shown greater benefits at the functional level (Cadore et al., 2013). So further studies should focus on effects of the time distribution on these variables. References: Bouaziz, W., Lang, P. O., Schmitt, E., Kaltenbach, G., Geny, B., & Vogel, T. (2016). *Int. J. Clin. Pract.*, 70(7), 520-536. Donnelly, J. E., Jacobsen, D. J., Heelan, K. S., Seip, R., & Smith, S. (2000). *Int. J. Obes.*, 24(5), 566. Bouaziz, W., Vogel, T., Schmitt, E., Kaltenbach, G., Geny, B., & Lang, P. O. (2017). *Arch. Gerontol. Geriatr.*, 69, 110-127. Cadore, E. L., Rodríguez-Mañas, L., Sinclair, A., & Izquierdo, M. (2013). *Rejuven res.*, 16(2), 105-114.

BODY COMPOSITION AND CALCANEUS QUANTITATIVE ULTRASOUND: IMPACT ON FOOT DEFORMITIES AMONG UNIVERSITY STUDENTS

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Introduction: The purpose of this cross - sectional study was to determine the impact of body composition and calcaneus bone density on foot deformities among the university students, and the second was to establish gender differences among university students. Methods: One-hundred and fifty-five university students (20.25 ± 2.12 years of age; male: 110; female: 45) were enrolled in the study. Height was measured to the nearest 0.1 cm using a fixed stadiometer. Body composition was determined by a body-fat analyzer (BF 905, Maltron, UK). Quantitative ultrasound (QUS) measurements of the heel were performed using "Sahara" sonometer ("Hologic," Bedford, MA). Assessment of foot status was performed using computerized, digitized sub-graphic imaging, with PEDIKOM. The regression analysis: optimal scaling was used to determine connection between body composition and calcaneus bone density as well as calcaneus bone density and foot posture. To evaluate gender differences a Multivariate analysis of variance (MANOVA) was used. χ^2 - square test was used to determine estimated foot posture differences. Results: The results show that there are statistically significant gender differences in all of body composition examined indicators ($F = 1166.62$; $P = 0.00$; $P \leq 0.01$), but no significant difference in foot posture and calcaneus bone density. There are no statistically significant connection between body composition and foot posture except impact of fat free mass on foot posture ($R^2 = 0.06$; $p = 0.03$). The left leg broadband ultrasound attenuation (BUA) showed statistically significant partial correlation with foot posture ($p = 0.05$) Discussion: The current findings do not support the authors' hypothesis that there are statistically significant impact of body composition and calcaneus bone density on the foot posture. The obtained results are confirmed by research by Atamturk (2009), Redmond at all (2008), who also found no significant correlation between anthropometric variables and postural foot assessment. However, the dominant leg has no effect on bone density (Obradović et al, 2010), and these assumptions should be taken with reserve, because, as in the case of a body composition, there is not enough research on the relationship with the status of the foot arch, with which we could compare the obtained results and confirm our predictions. References: Obradović B, Bubanj S, Stanković R, Dimić A, Bubanj R, Bubanj M,

Bojanić V & Perić S (2010). Mineralni denzitet kalkaneusa kod dece sportista i odskočna noga [The calcaneal mineral calcium densities in athlete's children and dominant leg]. *Acta Medica Medianae*, 49, (29), 25-28. Atamturk D (2009). Relationship of flat foot and high arch with main anthropometric variables. *Acta Orthopaedica et Traumatologica Turcica*, 43, (3), 245-259. Redmond AC, Crane YZ, & Menz HB (2008). Normal values for the foot posture index. *Journal of Foot and Ankle Research*, 1, 1:6.

Motor Learning

THE ASYMMETRICAL INFLUENCE OF DUAL-TASK INTERFERENCE ON ANTICIPATORY POSTURAL ADJUSTMENTS DURING ONE-LEG STANCE

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Introduction: The purpose of this study is to examine how dual-task interference differently influences anticipatory postural adjustments (APA) depending on lower limb dominance during one-leg stance and how the central nervous system organizes the coordination of the joint kinematics of the anticipatory postural adjustments to maintain equilibrium in APA phase. The hypotheses examined were that (1) non-dominant limb condition will require more attentional demands, (2) dual-task interference on APA will be larger in non-dominant limb compared to dominant limb condition, (3) it would be found through the coordination pattern of multiple joints as indicated by the reduced estimate of independent components in the principal components analysis (PCA). **Methods:** Thirteen healthy young adults (male: 13; 11 right-footed, 2 left footed subjects; age 25.62 ± 3.36 yr) were recruited for this study. Participants were asked to lift one leg as fast as possible following an auditory signal and perform 30 trials of a one-leg stance according to six conditions: single task (i.e., lifting one leg with non-and dominant limb) and dual task (i.e., with two levels of a concurrent working memory task). For dual-task conditions, instructions were given to perform the tasks with equal priority. Two-way repeated measures ANOVA (2 within-subject factors) was used to investigate the effects of limb dominance (ND, D), cognitive load of concurrent task (ST, DT 1/2, DT+1), and interaction to compare variables of APA. **Results:** Asymmetrical influences representing the difference in only ND condition were found in Onset and Amplitude of APA. The average of APA parameters between limb dominance as a function of the cognitive load induced by the concurrent task. The results showed that the significant interactions between limb dominance and task condition on APA onset ($F_{2,24} = 5.592$, $p = .010$, $\eta^2 = 0.318$) were observed and ND limb showed later APA onset compared to dominant limb ($p = .005$). Also, the D condition showed significantly smaller APA amplitude compared to the single-task condition in the ND limb condition on DT+1 ($p = .039$). Likewise, principal components analysis (PCA) showed that the number of principal components and corresponding loadings were altered in ND condition as a cognitive load of the concurrent task increased. **Discussion:** According to this study, cognitive-load and foot dominance influences how the central nervous system utilizes APA in a different way to maintain equilibrium during the one-leg stance. The findings of this study suggest that dual-task interference asymmetrically influences on APA according to the limb dominance, which alters the coordination strategy of joint angular motion. Thus, the results could provide new insight into the nature and mechanisms of APA. **References:** None.

Nutrition

MODE AND FOOD HABITS OF ATHLETES OF KAZAKHSTAN

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Introduction: The organization of rational nutrition of athletes implies the existence of a certain regime, including the distribution of meals throughout the day, the number of meals and must be strictly coordinated with the training process (Czaja et al., 2008). Therefore, although the flow of scientific information about nutrition is sufficiently large, the athletes do not have the right information about nutrition (Nowacka et al., 2016). The aim of the study was to evaluate the mode and the eating habits of some sports athletes as well as to find out the sources of received knowledge about nutrition athletes. **Methods:** In the evaluation of actual nutrition 60 participants took part, including 15 volleyball players, 15 judo wrestlers, 15 wrestlers of the club team and 15 triathletes of the national team. To study data on the regime and eating habits, a valid questionnaire was used, directly interviewing each researcher. The statistical analysis of the survey data was carried out, the percentage distribution of responses on the questionnaire was calculated. For the analysis of categorical data χ^2 test (chi-square) have been applied. **Results:** The results of the study have shown that Kazakhstan sportsmen diet is not optimal, not enough of the studied athletes eat 4 or more times a day. 22.7% of the respondents are snacking not enough - only once per day, and 11.7% of the respondents do not snack at all. More than half of the subjects (52%) regularly eats every day at the same time, while 48% - not always eat regularly. **Discussion:** Many authors investigating diet believe that athletes should eat 4-5 times at the same time (Dunn et al., 2007). According to our study, only 10% of respondents eat 4-5 times a day. Along with the basic eating habits it is important for athletes to snack throughout the day. As the authors point out (Rossi et al., 2009), the amount of snacking should be 2-3 times a day. These recommendations are followed by 59% of the athletes we surveyed. According to our research, 36.7% Kazakhstan athletes had a basic knowledge of nutrition is obtained from the coach. On the other hand, the results of some researchers show that the level of knowledge of coaches about nutrition is not sufficient (Torres-McGehee, 2012), and information sources (TV, radio programs, popular literature, friends, family members) do not always provide qualified nutrition information to athletes. **References:** Czaja J, Lebedzińska A, Szefer P. (2008). *Rocz Panstw Zaklad Hig*, 59(1), 67-74. Dunn D, Turner LW, Denny G. (2007) *Sport J*, 10(4), 45–53. Nowacka E et al. (2016), *Sci & Sports*, 31(4), 79. Rossi L et al. (2009). *Brazil J of Biochem*, 3(2), 159-166. Torres-McGehee TM, et al. (2012). *J of Athletic Training*, 47(2), 205–211.

INFLUENCE OF ACUTE CONSUMPTION OF CHOCOLATE ON ARTERIAL BLOOD PRESSURE

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Introduction: High blood pressure is a well-known risk factor for cardiovascular diseases. Many studies are designed in order to find nonpharmacological treatment options which could reduce blood pressure

and could be used in prevention of life threatening conditions. Chocolate and other cocoa-rich products contain polyphenols which have been shown to increase the formation of endothelial nitric oxide, which promotes vasodilatation and consequently may lower blood pressure. The aim of this study was to investigate potential reduction in blood pressure after acute consumption of a single dose of chocolate. Methods: Thirty-one normotensive individuals were involved in the study. The average age of the examinees was 21.16 ± 1.93 years, with average weight 71.61 ± 14.35 and average height 174.14 ± 8.09 . Blood pressure was manually measured with sphygmomanometer after 15 minute rest in supine position at baseline and one hour after acute consumption of a single dose (30g) of a dark or milk chocolate. In the dark chocolate group were eighteen subjects and thirteen subjects were in the milk chocolate group. Results: The results of this study show that there was a statistically significant decrease in systolic blood pressure in all subjects. (109.2 ± 8.3 mmHg vs. 103.4 ± 8.8 mmHg, $p < 0.05$). Diastolic pressure was just slightly decreased without statistical significance (70.1 ± 7.3 mmHg vs. 68.2 ± 6.7 mmHg, $p > 0.05$). Furthermore, there was no significant difference in any parameter between dark and milk chocolate group. Discussion: Despite the lack of significant decrease in diastolic pressure in this study, data suggest that chocolate consumption may be encouraged in moderation of the blood pressure. Chocolate flavanols can significantly affect especially systolic blood pressure, suggesting potential benefit associated with dietary inclusion of chocolate. References: Corti R, Flammer AJ, Hollenberg NK, Lusche TF: Cocoa and cardiovascular health. *Circulation*. 2009, 119: 1433-41. Fisher ND, Hollenberg NK: Aging and vascular responses to flavanol-rich cocoa. *J Hypertens*. 2006, 24: 1575-80. Fisher ND, Hughes M, Gerhard-Herman M, Hollenberg NK: Flavanol-rich cocoa induces nitric-oxide-dependent vasodilation in healthy humans. *J Hypertens*. 2003, 21: 2281-86.

Other Multi- & Interdisciplinary Themes

RESEARCH QUALITY EVALUATION IN SOCIAL SCIENCES: THE CASE OF CRITERIA ON THE CONDITION AND REQUIREMENTS FOR ACADEMIC PROMOTION IN SERBIA, SLOVENIA AND MONTENEGRO

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Introduction: From the reason the most critical topics in research quality evaluation in Social Sciences are choices and definitions of evaluation criteria, the main goal of this is to analyse and compare the criteria on the condition and requirements for academic promotion in three countries: Serbia, Slovenia and Montenegro. Methods: University of Novi Sad, University of Ljubljana and University of Montenegro were selected to be subjects in this study. The sources used for the analyses in this study were the following documents: [1] Minimum standards for the appointment of university teachers issued by National Council for Higher Education of the Republic of Serbia, and Minimum standards for the appointment of university teachers at University of Novi Sad issued by the Senate of the University of Novi Sad, [2] Minimum standards for the appointment of higher education teachers, researchers and faculty assistants at higher education institutions issued by the Council of the Slovenian Quality Assurance Agency for Higher Education in Slovenia and Criteria for appointment to the titles of university teacher, researcher and associate at the University of Ljubljana issued by the Senate of the University of Ljubljana, and [3] Criteria on the conditions and requirements for promotion to academic titles issued by Council for Higher Education in Montenegro. The authors used a descriptive method with consulting of competent sources.

Results: First of all, it is interesting to note that both universities, in Serbia and in Slovenia follow the official documents at two levels, one at the national level issued by higher education council/agency, and the second one, at the university level issued by the Senate of the each university that more precisely and strictly predicts the criteria. On the other hand, it is not the case in Montenegro, and Montenegrin universities just follow the national criteria in the research quality evaluation. In each country, evaluation exercises usually recognized three fields, and one of them is social sciences and humanities which concern whole range of interdisciplinary and multidisciplinary scientific areas. Discussion: Comparing the minimum standards for the appointment of university teachers, it important to highlight that Slovenian regulations are the most demanding, especially in the part of quantitative criteria, while Serbian and Montenegrin criteria is similar; however, it is important to highlight that Montenegrin regulations contain some unusual criteria such as requirement that scientific research work must be achieved through one single author paper published in an international journal, just for promotion to academic titles at all three levels (assistant, associate and full professor) in social Sciences and Humanities and it is not the case in two other fields. Acknowledgement: This abstract has been done within national project under the title “Quality of Research in Social Science and Humanities” that was approved by Ministry of Science in Montenegro (No.01- 2589/2 from 11 December 2017). References: None.

EFFECT OF MORPHOLOGICAL CHARACTERISTICS AND BODY COMPOSITION INDICATORS ON THE SKI TECHNIQUE ACQUISITION LEVEL

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Introduction: To be successful in certain sports, it is necessary to possess certain morphological characteristics in an optimal level. This rule can be applied in the Alpine skiing because the performance of ski elements depends on integration of relevant body composition indicators. (Franjko, 2017). Methods: The research was carried out on a sample of 35 students who attended regularly the course of the Basics of Skiing at the Faculty of Sport and Physical Education, Niksic. Within the morphological characteristics and body composition indicators research, a sample of 8 variables was used to obtain latent anthropometric dimensions. The criterion system of variables utilized a test for the assessment of the situational motor problem -the basic winding. A multiple regression analysis was used to determine the impact of the system of predictor variables on the criterion. Results: The results obtained by the regression analysis of the criterion variables – the basic winding in the predictor system of 8 variables for estimating morphological characteristics, indicate that there is no statistically significant influence of the predictor system on the criterion variable. Discussion: Based on the results of this study, it can be concluded that the applied predictor system of morphological characteristics and body composition indicators has no statistically significant influence on the criterion variable, the basic winding. An unverified statistical significance can be the result of some other anthropological factors that are not tested in this study. References: Franjko, I. (2007). Faktori uspjehnosti izvedbe skijaških elemenata. Magistarski rad. Kineziološki fakultet Sveučilišta u Zagrebu.

WORKING ABILITY FACTORS AS A PROTECTIVE MECHANISM AGAINST SOCIAL EXCLUSION OF OLDER PEOPLE: A SYSTEMATIC REVIEW

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Introduction: The main goal of this study is to systematically review working ability as a protective mechanism against social exclusion of older people. **Methods:** The most recognized electronic database: “Web of Science”, “Scopus”, “PubMed” and “Google Scholar” were used in this research. The field of research of the above mentioned electronic database of scientific papers is related to the working ability as a protective mechanism against social exclusion of older people. In the search of the mentioned database, the following keywords were used: “work ability”, “aging”, “elderly”, while the author reviewed and made a further selection of the papers, and rejected all that did not follow the criteria. Later on, according to the criteria authors performed the systematic analysis of the materials in accordance with the principles of “Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)”. **Results:** The initial research included 1024 quotations that made up the basic database. Then a program called “Reference Manager” was used for referencing all the quotations to be included in the program database for easier analysis. 33 papers out of the total base were included in the further analysis because they did fit into the purpose of this research, while 21 papers went into shortlist after they have been systematically analysed in detail. It is interesting to highlight that some variables showed negative correlation with the working ability, such as ages, smoking and physical demands within working time. On the other hand, some variables showed positive correlation with the working ability of older people such as life satisfaction, above average earnings, physical activities, helping others and mental activities. **Discussion:** This systematic review confirmed that there are variety of working ability factors that can improve social inclusion of older people and fight against issues related to disability, fragility, depression, cognitive function and older people autonomy. Hence, this study recommend the implementation measures that would imply investing in the public health of older people, especially in their musculoskeletal and cardiorespiratory capacity. Investment in development of daily physical activities of older people and creation of new policies in this area have to be priority of each society in the process of health promotion. **Acknowledgement:** This abstract has been done within nation project under the title “Effects of Physical Activity on Social Inclusion of Older People” that was approved by Ministry of Science in Montenegro (No.01- 2587 from 11 December 2017). **References:** Masanovic, B., Vukotic, M., Popovic, S., & Bjelica, D. (2018). Comparative study of anthropometric measurement and body composition between junior basketball and volleyball players from Serbian national league. In Proceedings of the World Congress of Performance Analysis of Sport XII (340), Opatija: University of Zagreb.

CARTOGRAPHY IN SPORTS AND SPORTS IN CARTOGRAPHY

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Introduction: Scientific disciplines have through ages developed their respective methods and ways of presentation of acquired data. The aim of our work is to identify common elements in sport science and cartography, thereby facilitating achievement of goals of both. More precisely, we examined the possibilities of application of cartographic method in the presentation of results acquired in sports sciences

and not strictly scientific sports related topics. Given that the language of cartography is universal, easily understood and widely accepted, it overcomes barriers in representation of diverse topics, categories, languages etc. Methods: Our work will present two modes of cartographical data representation within sports sciences. Firstly, the presentation of scientific topics by cartographical representation of a variety of measurements done on diverse groups in relation to gender, age, region, type of sports... Secondly, we will focus on the analysis of cartographic representations in “informative maps” that are tightly related to and facilitate sports such as maps of ski resorts, orienteering, biking trail maps etc. This will be presented principally through the cartographic method, but also other tools (motion line method, symbol method, diagram map, vector method, isoline method, point method) used in cartographic data presentation. Result: Opening of new possibilities to present research results in an easier to grasp, more precise way, in order to raise the quality of obtained data as well as facilitate presentation and optimization at different levels. Discussion: Uses of cartographic methods of representation of research data are wide and numerous. Several research projects defined the versatility of cartographic methods. Universal procedures used in cartography enable therefore integration of cartography and sports science, resulting in mutual benefit and development. Cartography, by seeking the best way to present research data and results, improves and develops its own methods. At the same time, sports science is presented with another way to make research data easy to grasp, analyse and use. Using cartographic representation methods, sports science develops an improvement in outreach to the scientific community as well as the public, primarily by overcoming the language and communication barrier. References: Abarca-Gómez, L. et al. (2017). NCD Risk Factor Collaboration. 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. ISSN: 0140-6736. Popovic S. (2017). Local Geographical Differences in Adult Body Height in Montenegro, *Monten. J. Sports Sci. Med.* 2017, 6(1), 81-87. Barović G. (2013) Kartografija u klimatologiji&klimatologija u kartografiji, Međunarodni naučni skup Uticaj klimatskih promjena na životnu sredinu i privredu, Institut ekonomskih nauka, Beograd, ISSN 0354-328.

THE RELATIONSHIP BETWEEN SPORTS-RELATED OROFACIAL TRAUMA AND THE DEVELOPMENT OF TEMPOROMANDIBULAR JOINT DISORDER

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Introduction: Temporomandibular joint (TMJ) disorder is one of musculoskeletal diagnoses encompassed by the umbrella term of temporomandibular disorders (TMDs). TMJ disorders are divided into two subgroups: anterior disc displacement and osteoarthritis of TMJ. Macrotrauma is a potential etiological factor in TMDs and it does not imply jaw or facial bone fractures and severe tooth and soft tissue injuries. The aim of this paper is to analyze the effects of microtrauma, in particular trauma related to sports activity, and the development of TMJ disorders. Methods: In the epidemiological study of TMJ disorders, it was determined that 28 patients (aged between 12 and 84, 25% male) had anamnestic history of previous trauma (whiplash neck injury, direct trauma of the stomatognathic system due to a fall or violence). The

patients requested treatment at the Department of Removable Prosthodontics at the School of Dental Medicine in Zagreb. They graded the pain intensity in the joints on a visual-analogue scale during the first examination (VAS-T0) ranging from 0 (no pain) to 10 (strongest pain ever experienced). All patients received the definitive diagnosis of TMJ disc displacement by means of magnetic resonance imaging. The patients were also treated (occlusal splint and/or physical therapy) and the effects of the treatment on the pain in the TMJ were determined in a period of at least 6 months (pain on VAS-T1). Results: In the subgroup of patients who experienced trauma (n=28), the data on sports-related trauma were recorded separately in 7 (25%) patients. Patients with all types of trauma suffered longer periods of pain and had lesser analgesic effects of the treatment (VAS at T1 was 2.1 ± 2.8) than those patients without previous trauma (VAS at T1 was 1.1 ± 2.0), which was statistically significant ($p=0.0363$). In comparing the genders in the total sample of patients, the only statistically significant finding was the positive correlation between the pain variable in period T0 and pain in period T1. Among the patients with previous trauma, there were more males (57.1%) who had some form of sports-related trauma. Conclusion: Magnetic resonance is the gold standard in diagnostics of TMJ disorders and among patients with disc displacement there are more males, particularly in cases of sports-related trauma. This fact is in contrast with the general prevalence of females of reproductive age in the total samples of patients with TMJ disorders (75-90%). Previously experienced trauma is related to smaller effects of the treatment of TMJ disorders. References: Lešić N, Seifert D, Jerolimov V. Orofacial injuries reported by junior and senior basketball players. *Coll Antropol.* 2011;35:347-52. Landzberg G, El-Rabbany M, Klasser GD, Epstein JB. Temporomandibular disorders and whiplash injury: a narrative review. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2017;124:e37-e46.

GOALKEEPER IN CONTEMPORARY SOCCER

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Introduction: The aim of this paper is to gain insight and analyse the changes which have affected the goalkeeper's role throughout the history, and thus have resulted in establishing new perceptions of the goalkeeper game, and to draw specific conclusions on the benefits of such changes in training. The paper focuses on establishing and analysing the characteristics of a goalkeeper in contemporary soccer. Methods: Methods used in this paper comprise of comparative methods and theoretical analysis. By researching online database (PubMed, ResearchGate, Medline, Scribd), 26 research papers have been discovered, which are directly related to the aim of this research. Results: Soccer has developed and has gone through different types of changes throughout history, which has resulted in a new role of goalkeeper position within the game. What was neglected in the past has been assigned a new role in contemporary soccer. A significantly small number of research is connected to the goalkeeper's role. By analysing the goalkeeper, the effects of goalkeeper's game lead towards the structure of developing a training process all in accordance with the requirements of contemporary soccer. Discussion: Gerry G. and co-authors, 2014 was testing technical and tactical abilities of a goalkeeper. The effect of technical and tactical abilities has been analysed by using different modalities and in different time frames throughout which tactical and technical elements of a goalkeeper have changed. The analysis of these research papers conclude that goalkeeper's mode has gone through transformation, if we take into account all the technical and tactical conditions which a goalkeeper must meet. Andrzej S. and co-authors, 2017 was focus on analysing anthropological characteristics of a goalkeeper. The research was based on analysing the effects of an-

thropological characteristics of a goalkeeper, where one cannot see any changes in the goalkeeper's role in contemporary soccer. It has been concluded that specific anthropological characteristics of goalkeepers represent a foundation for their progress in regards to their role in contemporary soccer. Joel, O. and co-authors, 2010. focused on goalkeeper's impact in contemporary soccer. The research analysis focused on goalkeeper's impact, where an overview was presented along with basic impacts of goalkeepers on which the previous content was based. This research has led to a conclusion of basic changes which have affected the mode of a contemporary goalkeeper in soccer. References: Andrzej S., Patrycja L., Michał C. (2010). The Efficiency model of goalkeepers action in soccer, *Baltic Journal of Health and Physical Activity*, 132-138. Garry G. (2014). Evaluating the ability of goalkeepers in English Premier League football, *Journal of Quantitative Analysis in Sport*, 10.1515/2014-0004. Joel O. (2010). Comparing English Premier League Goalkeepers: Identifying the Pitch Action that Differentiate the Best from the Rest, *Journal of Quantitative Analysis in Sport*, Vol. 6 : Iss. 1.

Philosophy and Ethics

THE ROLE OF PLAYERS FAIR PLAY ON SPORTS COMPETITION

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Introduction: The objective of this study represents the players in sports contest, while the main goal will be directional to explaining the role of players fair play in sports competition. The main aim of the study is basically to discuss and explain the behaviour of athletes on the play court, the importance of a fair play in sport competition as the basis for establishing a relationship between rivals and other contest participants. Method: A descriptive method was used for making this study. The authors also consulted with the relevant literature and the latest research and experience from this field. The authors used the analytical and parallel methods that have proved to be the most productive in these types of research. Results and Discussion: The role of sports is to promote and to create a better and more productive society, while ethics as a moral science has the role of directing us into the basic elements of morality and showing true and true values. The usual moral values are widespread in modern sports. They form the basis of sports and learn in family and school. They express the elemental virtues of kindness, compassion, empathy, which are very important for sports, especially collective sports. Among the most important rules of sports behaviour of athletes are: personal integrity, reliability, loyalty, goodwill, justice, modesty, perseverance, stability, objectivity, honesty, patience and courage. In the field of sports, the general rules of behaviour and fair play are not always sufficiently respected. Professional top-class sport, modern gladiation, often does not adhere to true sporting values and fair play in sports competitions. Hence the growing importance of ethics in the field of sports. References: Boxill, J. (2002). *Ethics and Sport*. Blackwell: Oxford. DeSensi, J. & Rosenberg, D. (2011). *Ethics and Morality in Sport Management*. *Sport, Ethics, and Philosophy*, Vol. 5 (No. 4), 457-459. Kokovic, D. (2004). *Sport i mediji*. Fakultet za uslužni biznis: Novi Sad. Milasinovic, R. (2015). *Etika aktera u sportskim događajima*, unpublished master thesis. Novi Sad: Univerzitet u Novom Sadu, Asocijacija centara za interdisciplinarne i multidisciplinarne studije i istraživanja.

Physical Education and Pedagogics

THE ATTITUDES OF THE YOUNG SCHOOL AGED CHILDRENS TO THE TEACHING OF PHYSICAL EDUCATION

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Introduction: Physical Education as a school subject has a great influence on the development of psycho-physical abilities of children. In view of this, it is important to know what the attitude of pupils towards the teaching of Physical Education is. The first purpose of our research was to determine exactly what the attitudes of the junior schoolchildren toward the teaching of Physical Education are in the function of improving or changing the teaching process. Methods: The research involved 327 pupils of the 4th and 5th grade primary schools from Podgorica and Niksic. We tried to answer the question using anonymous standardized questionnaires adapted to this research. The data obtained by the survey were processed as follows: after tabulation data from the questionnaire, the numerical and percentage frequency of the response to the questionnaire is expressed every question. Statistically significant difference between the received and expected frequencies was determined by H² (HI square) which allows the rejection of the hypothesis with error at the level $p=0.01$. Results: The results showed that almost all pupils are eager to attend classes of Physical Education, which they are very pleased to consider contributing to their health and physical development, as well as the development of friendship, strength, care, value and endurance. Most pupils believe that Physical Education is as important as other subjects, and that Physical Education is best performed in a schoolroom. A large number of pupils would also not change anything compared to the previous lessons. As far as favorite sports are concerned boys traditionally prefer to play football, while girls are more oriented towards volleyball, handball, rhythmic and gymnastics. Discussion: The results of the research show positive attitudes of the pupils towards the teaching of physical education. Children believe that Physical Education teaching positively influences their balance and health. Similar results were obtained in previous research at the same or similar age (Bjelica, 2002; Dragić, 2005; Međedović, E., Murić, Međedović, A., 2005; Radisavljević, Višnjić, 2004). We can conclude that children in schools are satisfied with the teaching of Physical Education and are eager to attend, however they should also continue to improve their teaching and remind children of its importance. References: Bjelica, D. (2002). Stavovi učenika osmih razreda osnovnih škola u Crnoj Gori prema nastavnim i vannastavnim aktivnostima fizičkog vaspitanja. Ljetnja škola pedagoga fizičke kulture, Čanj. Dragić, B. (2005). Stavovi i mišljenja učenika prema fizičkom vaspitanju. Sport Mont, 8-9, 309-22. Međedović, E., Murić, B. i Međedović, A. (2005). Stavovi učenika četvrtih razreda osnovnih škola prema nastavi fizičkog vaspitanja. U XI Nacionalni naučni skupsa međunarodnim učešćem "Fis komunikacije 2005" (92-9). Niš: Fakultet fizičke kulture. Radisavljević, S. i Višnjić, D. (2004). Stavovi učenika prema fizičkom vaspitanju. Godišnjak, 12, 141-53.

THE EFFECTS OF TEACHING PHYSICAL EDUCATION ON THE TRANSFORMATION OF MORPHOLOGICAL CHARACTERISTICS IN STUDENTS WITH SPECIAL NEEDS

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Introduction: The need which man has for physical activity is one of the requirements for survival, as species and individuals. During growth and development there are more or less changes in the whole

organism of the child. Physical education as an integral part of the educational process in schools has the basic task of using positive kinesiological operators to influence positive transformation processes in all dimensions (Daseu, 1994). The population of students with special needs represents one of the links in the chain of complex educational and systematic social influence in physical education to which new generations are subjected (Mikić, 2000). Method: The research has been conducted on the students of the Center for Children and Youth with Special Needs in Mostar, the Center Los Rosales Mostar and the Facilities for daily living for children with special needs in Niksic. The sample consisted of girls, a total of 46 examinees, who were included in regular classes of physical education for one school year. Morphological space is evaluated with 9 variables: breast circumference, upper arm circumference, abdominal volume, upper leg circumference, lower leg circumference, scapula skin fold, upper arm skin fold, abdomen skin fold, lower leg skin fold. Results and Discussion: By comparing the results of the measures of the central dispersive parameters of the initial and final measurements, it is evident that the applied curriculum of physical education and sports contributed to the change in the distribution of the tested parameters. This research was aimed at showing how and in what way different kinesiological operators can influence the transformation of anthropological status of students with special needs. The obtained results should contribute to better planning, programming, directing and controlling the effects of physical education and sports on the population of students with special needs as particularly sensitive categories. References: Dašeu, A. (1994). Psihijatarski poremećaji djece i mladeži sa mentalnom retardacijom. Zagreb. Defektologija. Br. 30-2, str.169-185. Mikić, B.(2000). Psihomotorika. Fakultet za tjelesni odgoj i sport, Univerziteta u Tuzli.

TEACHERS ATTITUDES OF THE TEACHING OF PHYSICAL EDUCATION

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Introduction: Physical Education is a very important teaching subject that greatly influences the development of children. However, one of the biggest problems associated with this course is unsupervised hours or organization of time in a dull manner. This is especially true for the younger school age, where other subjects are often referred to as Physical Education. Therefore, the main goal of our research is to determine the attitudes of class teachers to the teaching of Physical Education. Methods: The sample of respondents consisted of 31 class teachers from Podgorica and Niksic. Respondents are divided into 2 sub-samples according to the criteria of the place of living. We used a standardized questionnaire adapted for this research (SecondaryPETeacherSurvey) for the research. The questionnaire contained 12 questions. The results are shown numerically and percentally, and statistically significant differences are calculated by the Hi square test at the significance level of $p = 0.01$. Results: The results showed that teachers have positive attitudes towards teaching Physical Education. Most of them think that Physical Education is very important for students, and that students have to attend regular Physical Education classes regularly. Also, all respondents have written plans for teaching Physical Education and goals and hours plans. Students in the course of this course are active on average from 50% to 74%. However, the results showed that no teacher uses a computer and other resources in Physical Education. The problem that arises is the number of students in time. Almost every respondent answered that more than 30 students participate in physical education classes, which is not methodically correct. Discussion: The results of the research showed positive attitudes of the teachers towards the teaching of Physical Education. Teachers are aware of the importance of teaching and conduct it in a well-organized way. This is very important

since the previous research showed poorer results of the teachers (Dobraš, Kukrić, Petrović i Stojanović, 2016) and that the teacher is an important factor in the teaching of Physical Education (Bilak-Moconja, Dobraš, Tadić, Kukrić, Petrović i Stojanović, 2018; Pavlović, 2016). References: Bilak-Moconja, G., Dobraš, R., Tadić, G., Kukrić, A., Petrović, B., i Stojanović, D. (2018). Nastavnik kao faktor poboljšanja efekata nastave Fizičkog vaspitanja učenika mlađeg školskog uzrasta. *Sportlogia*, 14(1), 107-115. Dobraš, R., Kukrić, A., Petrović, B. i Stojanović, D. (2016). Stavovi nastavnika razredne nastave i nastavnika Fizičkog vaspitanja o fizičkom vaspitanju mlađeg školskog uzrasta. U 3. Međunarodna naučna konferencija „Antropološki i teoantropološki pogled na fizičke aktivnosti od Konstantina Velikog do danas“ (95-99). Leposavić: Fakultet za sport i fizičko vaspitanje.

EFFECTS OF ISOKINETIC RESISTANCE TRAINING ON STRENGTH KNEE STABILIZERS AND THE EFFICIENCY OF THE PERFORMANCE OF GYMNASTIC VAULTS

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Introduction: The aim of this study was to examine whether additional training protocol of isokinetic training results in increased biomechanical values of certain parameters and whether it increases functional correlation between speed and strength leading to improved performance of Gymnastic Vaults. **Methods:** Sample - The participants in this research consisted of (N=80) male students of the Faculty of Sport and Physical Education, University of Sarajevo, (mean age, 19.8 ± 1.7 years; weight, 75.2 ± 2.9 kg; height, 179.7 ± 6.4 cm). The participants were divided, using accidental sampling method, into two groups: control C (N=40) and experimental E (N=40). **Assessment instruments -** Strength test on knee joint extensor and flexor was conducted using Biodex System 3 (Biodex Corporation, Shirley, New York, USA) isokinetic dynamometer. **Examiners for evaluation of gymnastics vaults in this study was** University professors (N=3) with more than 30 years of experience of work in various sports clubs and Faculty of Physical Education and Sport. For evaluation, they used points from 6 to 10 point measuring scale, according to the criteria, where grade 10 is the highest/best. **Data and statistical analysis -** Descriptive statistics (means and standard deviation) was calculated for all variables separately for each group. ANOVA was performed to determine whether there were significant differences. Data were analyzed using oneway ANOVA with repeated measures. Significant level was defined as ($P < 0.05$). **Results:** Average values of body height for control and experimental group were calculated, and they were within the following range (C: 179.13 ± 5.97 ; E: 180.20 ± 7.01) while the values for body weight was (C: 74.90 ± 3.13 ; E: 75.80 ± 2.85) and there were no differences between the control and experimental group. ANOVA showed that significant difference was found for all variables the maximum muscle strength of knee extensors and the maximum muscle strength of knee flexors between unspecific and specific training program on Biodex 3 ($P < 0.05$). **Results ANOVA** showed that there were no statistically significant changes after the second measurement in the two variables that were treated (Ratio between knee extensors and flexors) in AGANLF60 ($F_{1,80} = 2.27$; $P < 0.14$), and AGANRG60 ($F_{1,80} = 2.71$; $P < 0.10$). In two variables assessing the success in performing elements of floor exercises in artistic gymnastics: CAR – cartwheel and FHS – front handspring, we obtained no statistically significant differences in relation to control and experimental group CAR ($F_{1,80} = 1.21$; $P < 0.27$), and FHS ($F_{1,80} = 0.22$; $P < 0.64$). **Discussion:** Our wish was to determine not only whether additional training protocol results in the increased biomechanical values of certain parameters but also to determine whether isokinetic training

or resistance training increases functional correlation between speed and strength leading to improved performance of acrobatic elements in floor exercises. References: None.

VOLLEYBALL AS ONE-YEAR OPTIONAL ACTIVITY OF THE FINAL GRADE STUDENTS IN ELEMENTARY SCHOOLS

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Introduction: The expansion of scientific and technological discoveries, accelerated globalization, and computerization seek substantial and permanent transformation of education (Hardman, 2008). Efficiency of the physical education can be improved with real, professional, and economic planning and monitoring of education effects, as well as with an increase in weekly number of classes (Ljubojević, 2014). **Method:** The study was conducted for one school year on the sample of total 40 female students, divided into two groups. Control group (19 students) consisted of students who attended only physical education classes. Experimental group (21 students) consisted of students who, in addition to physical education classes, attended additional two classes of volleyball during a week. Motor space was monitored through 8 variables of Eurofit battery tests, as follows: flamingo, hand tapping, seated forward bend (modified functional reach test), long jump, lay – sit for 30“, pull-up endurance, and pin running on 10x5m. **Results:** After the conducted study, results showed that the students from control group had better results in 7 out of total 8 motor tests. In test “pull-up endurance” no significantly better results were observed. The students of experimental group achieved better results in 6 out of total 8 tests. The improvement was not observed in the tests “long jump”, and “pull-up endurance”. **Discussion:** The analysis of the results showed that the experimental volleyball program had some influence, but not to the extent that it was expected from two additional hours of volleyball in physical education. **References:** Hardman, K. (2007). Physical education in school: A global perspective, *Kinesiology*, 40(1), 5-28. Ljubojević, M. (2014). *Obrazovni efekti izbornih sportova u nastavi fizičkog vaspitanja (Doktorska disertacija)*. Fakultet sporta i fizičkog vaspitanja, Univerzitet u Beogradu.

VARIABLE CORRELATION IN FATTY TISSUE EVALUATION FOR PRE-SCHOOL CHILDREN

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Introduction: The evaluation of fatty tissue from the earliest days became a necessity. Many studies confirmed relationship existence in obesity with an overall health status (Williams et al., 2015). In body fat evaluation is necessary to apply adequate measuring instruments and assessment methods. Researchers are still looking for a method that is available and applicable to a larger population, as well as sufficiently valid and reliable. The aim of this paper was to determine the correlation between the results of skin folds, body mass index (BMI) and bioelectric impedance (BIA). **Methods:** Measurements were carried out with the written consent of the parents in September 2017. The sample consisted of 134 boys (5.17

years \pm .86) and 101 girls (5.21 years \pm .88) of preschool children in Subotica (Serbia). In addition to measurements of body height and body mass, fat tissue assessment was performed by anthropometric measurements of three skinfolds: abdominal, sub-scapular and triceps (Cronbach's Alpha .99 for all three variables) and BIA (InBody230, Biospace Co., Ltd, Korea). BIA measurements were carried out through a given protocol for children by the manufacturer, with a frequency of 50 kHz. Gender differences were determined using the t-test for independent samples, and the statistical correlation of the variables was determined with Pierson's coefficient of correlation. Results: Statistically significant difference ($p \leq .05$) was determined with all variables evaluating body fat (3 skin-folds and body fat). Results of strength and direction of association between Body mass and fatty tissue variables were significantly related to each other and positively oriented ($p \leq .01$). Discussion: Statistically significant difference was found in variables for the evaluation of body fat between boys and girls. Analysis showed higher values for each variable in favor of girls, which is in line with previous research of Jankovic (2014). The results for skin-fold measurements largely correlates with reliable measurement techniques, as confirmed in previous studies (Hashim, Elumalai, Ab & Rahman, 2017). This study could be a good basis for further research in determining predictive values of anthropometric variables for assessing total body fat in preschool children. This research is a part of project »Body composition, postural state and nutrition quality in preschool children from Subotica« No: 142-451-3018/2017-02-2. Reference: Janković, M. (2014). Meta analiza kvantitativnih razlika antropometrijskih karakteristika i motoričkih sposobnosti dece uzrasta 6 i 7 godina. Fizička kultura. Broj, 1, 5-12. Hashim, A., Elumalai, G., & Ab Rahman, Z. (2017). Reliability and validity for measurement of body composition: A field method. Journal of Fundamental and Applied Sciences, 9(6S), 1187-1206. Williams, E. P., Mesidor, M., Winters, K., Dubbert, P. M., & Wyatt, S. B. (2015). Overweight and obesity: prevalence, consequences, and causes of a growing public health problem. Current obesity reports, 4(3), 363-370.

SEDENTARY FORM OF BEHAVIOR AND LEVEL OF PHYSICAL ACTIVITY AS INDICATOR OF QUALITY OF LIFE IN PRESCHOOL CHILDREN

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Introduction: Sedentary form of behavior and the level of physical activity in preschool children are essential for the quality of life. The constant decrease of the level of physical activity has an impact on the general health condition and quality of growing up in preschool children. Therefore, the aim of this paper was to observe the inclusion of children in various sports activities, as to analyze the sedentary form of behavior. Methods: The study was conducted on a sample of 176 children aged 5 to 7 on the territory of Subotica. The physical activity data was obtained by EY –PAQ survey, which quantifies the level of moderate to intensive physical activity and the time spent in sedentary form. The survey contained two sets of questions, the first referring to the level of physical activity and the second to sedentary behavior. The survey was filled out by parents who were initially asked for permission. Results: The obtained data show that 36.36 % of children are not included in sports activities. These results also show that 71.21% of children spend their time watching TV every day, while 23.48% children uses a tablet or laptop. Discussion: The results show that there is more need for organized physical activity as well as the sedentary form being more present in preschool children which can be confirmed by research (Lear et al, 2014). Active Healthy Kids Canada published a research conducted in 17 countries which shows the connection between

sedentary forms of behavior and obesity. To enhance the quality of life all sedentary forms of behavior have to be reduced by prioritizing physical activity (Tremblay et al, 2010; Salmon et al, 2011). References: Active Healthy Kids Canada. Are we driving our kids to unhealthy habits? The 2013 Active Healthy Kids Canada Report Card on Physical Activity for Children and Youth. Toronto: Active Healthy Kids Canada; 2013. Lear, S. A., Teo, K., Gasevic, D., Zhang, X., Poirier, P. P., Rangarajan, S., & Iqbal, R. (2014). The association between ownership of common household devices and obesity and diabetes in high, middle and low income countries. *Canadian Medical Association Journal*, cmaj-131090. Salmon, J., Tremblay, M. S., Marshall, S. J., & Hume, C. (2011). Health risks, correlates, and interventions to reduce sedentary behavior in young people. *American journal of preventive medicine*, 41(2), 197-206. Tremblay, M. S., Colley, R. C., Saunders, T. J., Healy, G. N., & Owen, N. (2010). Physiological and health implications of a sedentary lifestyle. *Applied physiology, nutrition, and metabolism*, 35(6), 725-740.

Physiotherapy

THE ESTIMATION OF THE STANDING POSTURE MEASURED BY POSTURESCREENMOBILE® APPLICATION

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Introduction: The first objective of this study was to determine the use of new technology for assessing postural status through the PostureScreenMobile® (PSM) mobile application. The second objective was to compare the body posture of children 8-9 years of both sexes and to determine the statistically significant differences between them. **Methods:** The study included 57 subjects aged $8,47 \pm 0,53$ years (height: $135,43 \pm 6,21$ cm; weight: $30,73 \pm 6,78$ kg) of which 30 boys and 27 girls. PSM application was designed for evaluating the position, movement and body composition. The application calculates posture variables using digitized anatomical marks from 4 pictures of the person. The device camera is used within the application to take pictures of subjects from different directions: anterior and posterior (coronal plane), left and right (sagittal plane). Statistical analyses were performed using the IBM SPSS version 2.0. **Results:** The results showed that there are no statistically significant differences between groups classified by gender and age in the analyzed PSM variables. Average values Anterior translation are $2.08 \pm 0,79$ and Lateral translation are $7.59 \pm 1,79$. **Discussion:** Following the results of previous researchers using PSM application, there is very little research available with children. Most researchers focused on the average age of 21 (Szucs, 2018; Boland et al., 2016). However, studies by other researchers studying children (Ilie and Rus, 2018, Tarakci et al., 2018) show similar distances as in our research, which confirms the possibility of widespread use of the application. Tarakci et al. (2018) in their studies found higher mean values in the anterior and lateral translation in patients with juvenile idiopathic arthritis. This study is part of the project named "Postural Status, Physical Activity and Nutrition for Primary School Students" funded by the Provincial Secretariat for Higher Education and Scientific Research under the number (142-451-3687 / 2017-01). **References:** Boland DM, Neufeld EV, Ruddell J, Dolezal BA, Cooper CB (2016). Inter-and intra-rater agreement of static posture analysis using a mobile application. *Journal of physical therapy science*, 28(12), 3398-3402. Szucs KA, Brown EVD (2018). Rater reliability and construct validity of a mobile application for posture analysis. *J Phys Ther Sci*, 30(1), 31-36. Tarakci E, Arman N, Sahin S, Adrovic A, Barut K, Kasapcopur O (2018). FRI0722-HPR Postural problems and pain in patients with juvenile idiopathic arthritis. Ilie E, Rusu L (2018). AB1429-HPR Kinesiotaping might help to improve postural displacements in adolescents.

Psychology

SPORT INTELLIGENCE: CAN IT BE A CRITERION THAT DISTINGUISHES ATHLETIC STATUS OR SPORT TYPE?

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Introduction: Cognitive function has recently become known as one of the essential elements for peak performance in sports (Voss et al., 2010). Therefore, it is necessary to identify elements of sport intelligence and to investigate whether there is a difference of sport intelligence according to the athletic status (athlete vs. non-athlete) and the sport type (interceptive, static vs. strategic sports). Methods: Participants were 120 male including 30 boxers (interceptive sport), 30 shooters (static sport), 30 soccer players (strategic sport), and 30 non-athletes who were young adults (age range 20-30 years). Sport intelligence were examined employing five computerized tests including simple (SRT) and choice reaction time (CRT) test, flanker test (FKT), trail making test (TMT), mental rotation test (MRT), and one paper-pencil test, which is design fluency test (DFT). To compare the differences of cognitive functions according to athletic status and sport types (interceptive, static and strategic), independent t-tests and one way ANOVAs were conducted, respectively. Results: Based on a systematic review of literature, cognitive functions related to sport performance were executive function (inhibition, working memory, cognitive flexibility), information processing (visual processing speed, reaction time), spatial ability (mental rotation ability). Athletes showed better performance on simple and choice reaction time test, trail making test (TMT-A), and design fluency test, relative to non-athletes. As the result of analysis on difference of cognitive function according to sport type, all athletes regardless of sport types showed faster choice reaction time as compared to non-athletes. Interceptive sports athletes exhibited higher accuracy of choice reaction time test maintaining faster information processing speed. Interceptive sport athletes showed better score in mental rotation test, relative to static and strategic sport athletes. Strategic sport athletes showed higher score in design fluency test, relative to static sport athletes and non-athletes. Discussion: Cognitive functions, in which athletes are superior to non-athletes, are cognitive flexibility and information processing speed. It appears that there are cognitive functions critical to each sport types. Since this result was conducted with a limited number of participants and sport types, the study is necessary to be extended to various sport type and skill levels. References: Voss MW, Kramer AF, Basak C, Prakash RS, Roberts B. (2010). *Appl Cogn Psychol*, 24(6), 812-826.

Rehabilitation

IMPACT OF TREATMENT WITH PHYSICAL EXERCISE IN REDUCING OF REHABILITATION PERIOD OF INJURED ATHLETES

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Introduction: Purpose of this study was to compare riathletisation time which is the last phase of the rehabilitation process, in which, exploiting the principles of sports training, the complete recovery of the conditional abilities of the athlete's specific sports abilities, between basketball male player and female

volleyball player using functional and nonfunctional rehabilitation. Methods: The participating subjects of this study were 12 basketball player U18 team and 9 female volleyball players U18 team too. Results: Results collected about the types and frequency of injuries which was: ligament retraction; contusion; distortion; subluxation; luxation and fractures in the places like: Art. Genu (knee); art. falangeal (finger); Talocrural (ankle); Lumbar (low spine); Radiocarpal (hand & wrist) and Scapulohumeral (shoulder). Discussion: According to the results of the study, data suggests that both male and female groups show that women prefer passive rehabilitation at 66.7%, which means that they are expected to passive rehabilitation 16.7% more than males. Also, for functional rehabilitation, an average of 6.22 days should be taken for damage, while rehabilitation days should be 56 for 9 athletes and for nonfunctional rehabilitation should be needed 16.83 days for damage while rehabilitation days should be in total 202 for 12 athletes. It should be said that passive rehabilitation group also includes fractures. Conclusions: This study found that women prefer passive rehabilitation at 66.7% and 16.7% more than men who undergo active rehabilitation. Time for rithletisation with functional rehabilitation is 2,7 time faster than nonfunctional rehabilitation used. Attitude toward active rehabilitation: fewer days are needed to return to functional status (reathletisation). Women are more prone than men to trauma harm and Men injure more distal joint than females. In all the similar kind of injuries, in the same joint or muscles and to the same gravity, active rehabilitation after the acute period is more successful and rehabilitates (reathletises) faster. References: Alicia C. Mcgrath Joan Ozanne-Smith, (1998), Attacking the goal of netball injury prevention: a review of the literature. Report nr. 130. Canaj P. Kapedani K. Canaj F. (2006) .Kineziterapia Tiranë. Canaj P. (2006). Traumatologjia sportive. Tiranë. Canaj P. Canaj F. (2011). Elektroterapija. Tiranë. Chirac M. (2018). La riatletizzazione. I grandi principi. Ed. Calteti Mariuci. Erin Cassell, June, 2001. Spiking injuries out of volleyball: a review of injury countermeasures, report no. 181. Farzana Motala, (2009) Dissertation The prevalence and risk factors of injuries in amateur outdoor and indoor volleyball players in a kwazulu-natal north coast region. Durban, South Africa.

Sociology

IMPACT IDENTIFICATION WITH SUCCESSES MONTENEGRO NATIONAL BASKETBALL TEAM

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Introduction: Sport has a very good position when it comes to the development of national pride, but mostly because there are strong evidence in the scientific literature that the success of national sport team and also organization of major sport events such as world and continental competitions can increase self-esteem and national pride. (Dauncey, & Hare, 1999; Gavin, 2007; Karkatsoulis, Michalopoulos, & Moustakatou, 2005). Methods: The survey was conducted in 2013 and the questionnaires were distributed in three cities which were located in different regions of Montenegro, primarily in Bar and Kotor, which are located in the southern region, then in Podgorica as the capital, Niksic, which is located in Central region, as well as in Bijelo Polje and Mojkovac which are located in the northern region. A total of 700 questionnaires were collected, but the 31 questionnaire was excluded from the analysis because they were not properly filled out, so that the study included a total of 669 respondents. Empirical data were analyzed using Statistical Package for the Social Science (SPSS 20.0). Results: By the analysis of the results received was showed

that 92 respondents or 13.8% have identified with the national basketball team of Montenegro. Discussion: The research showed that only 13.8% of respondents identified with the Montenegrin basketball team, which represents a very small percentage, taking into account the fact that in the year when the survey was conducted, the basketball team of Montenegro in the qualifications for the European Championship took the first place in the group and as the first national team qualified for the European Championship. References: Dauncey, H., & Hare, G. (1999). France and the 1998 World Cup: The national impact of a world sporting event. London: Frank Caas. Gavin, M. H. (2007). Narrating tragedy: from Kennedy to Katrina, from sports to national identities. Unpublished Doctoral Dissertation. College Park, MD: University of Maryland. Karkatsoulis, P., Michalopoulos, N., & Moustakatou, V. (2005). The national identity as a motivational factor for better performance in the public sector: The case of the volunteers of the Athens 2004 Olympic Games. *International Journal of Productivity and Performance Management*, 54(7), 579–594.

Sport Management and Law

FINANCING OF SPORTS IN MONTENEGRO

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Introduction: In this paper we investigate how the sport is financed in Montenegro, whether there are sufficient funds from the state budget and how to sponsor sports through the sponsorship and private-public partnership, taking the countries of the developed world as role models, with a view of the good, but rare examples in Montenegrin professional sports. Methods: In addition to the theoretical framework from the sports literature, we will present the indicators - the existing regulation and strategy, and conduct structured interviews among sports professionals, based on which we will form the theory and summarize the conclusions of the work, as well as establish recommendations for improving sports among young people. Results: The lack of clear criteria for the allocation of budgetary funds, that is, the rules that would determine which sports are a priority is one of the problems. The second problem is that the percentage of the allocation of games of chance for sport is lower than in Europe. The third problem is that the functions of the president in sports clubs are protocol, not essential, and that they do not seek money for clubs. Discussion: The Sports Law of Montenegro stipulates that the state and municipalities finance, or help the work of national sports federations and clubs. In 2017, the Government of Montenegro allocated 3.34 million Euros through the Ministry of Sports, to the National Sports Associations and the Montenegrin Olympic Committee. The funds were allocated on the basis of a public competition “on the distribution of funds to sports subjects“. There is no special act to determine which sports are the priority. The analysis explicitly crystallizes proposals for improving the distribution system: increasing the allocation percentage for sport from the proceeds of a portion of the income from gambling; strengthening of the criteria for obtaining the funds, strengthening the mechanism for controlling the consumption of allocated money, considering the possibility of allocating part of the funds for the financing of sports infrastructure for the preparation of our national selections, the inclusion of representatives of sports forums in the Commission for distribution of part of the revenues from games of chance. References: Begovic, M., (2013), Financing system for sports in Montenegro, gamesetpeace.wordpress.com Bronic, M. & al., (2012), Research project Sport financing in Republic of Croatia compared to financing in European Union, Zagreb: Institute for public finances. Djurdjevic, N., (2007), Public government and sport, Kragujevac, Faculty of Law. Maksimovic, N., Raic, A., (2011), Sports management, Novi Sad, Faculty

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MEASURING SATISFACTION FROM SPORTS COMPETITIONS ON THE EXAMPLE OF A TRIATHLON

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Introduction: Knowledge about participants of a sporting event is very important. Sponsors expect from the organizers of such events knowledge about participants - who they are, what are their expectations, how much they are willing to spend during a sports event. Mullin et al. (2007) developed The staircase approach to sport marketing, which describes the involvement of sports viewers. Through the development of mass sports (street runs - half marathons and marathons, obstacle courses, triathlons), earlier viewers become factors contributing to sports events. By this fact, there is a lack of knowledge about them (viewers). Shank & Lyberger (2015) noticed that for sponsors, apart from demographic factors, also aspects affecting the satisfaction of the competition. Edwards & Skinner (2009) appreciate the importance of ethnography research. Research carried out by the author in 2017 among triathlonists focused on the recognition of sponsors' brands. Analyzing the collected data, it was noted that the correlation takes place through the place of sponsorship exposure, not the size of sponsorship fees. In connection with such results, the next step is to define the player profile itself and him events satisfaction, so that the sponsors and organizers can prepare a more personalized offer. Aim: Identification of the satisfaction participant of triathlon events for marketing purposes (and organising). Methods: The study of triathletes profiles and event satisfaction was carried out using the on-line survey method (5-point Likert scale), by sending one week after event to participants of the Enea Bydgoszcz Triathlon - the largest amateur event in Poland (2972 participants), messages with a request to supplement the questionnaire. Answers were given by 466 (about 15,7% all Enea Bydgoszcz Triathlon participants). Results and Discussion: Participants assessed the event in three aspects: pre-event activities, event organization, accompanying events. The highest result (on a five-point scale) in the aspect of pre-event activities was achieved by "efficiency of issuing starter packages" - 4.9 points, the lowest "content of starter packages" - 4.3 points. Aspects during the event - the best result was obtained by the change zone (4.89 points), the worst protection of the crossings by tram tracks (3.85 points). References: Shank, M.D., Lyberger M.R. (2015). Sports marketing a strategic perspective. London and New York: Routledge. Skinner, J., Stewart B. (2017). Organizational behaviour in sport. London and New York: Routledge. Masterman G. (2014). Strategic sports event management. London and New York: Routledge. Edwards A., Skinner J. (2009). Qualitative Research in Sport Management. Oxford: Elsevier. Mullin, B.J., Hardy, S., Sutton, W.A., (2007). Sport marketing. Human Kinetics.

LAST DECADE CHANGING PUBLICATION PATTERNS IN THE FIELD OF PHYSICAL EDUCATION AND SPORT IN SERBIA

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Introduction: An analysis of the changing publication patterns in the Physical Education and Sport in the last decade period is presented on the basis of the available peer reviewed journals in Serbia. Method:

Collection of data included analysis the specific parameters in contents in some leading scientific journals in sport sciences. The development of the Serbian peer reviewed journals is analysed and summary of its contents represented indicators of changing publication patterns. From the aspects of coverage all the analysis journals as available publications by relevant database Serbian Citation Index. Results and discussion: Therefore, it is the fact there is no articles published in the peer reviewed journals which is covered by the relevant databases such as Web of Science, Scopus etc. Further strategic development of journals indicates this imperative. Collected data showed increased overall rate in number of publications, e.g. the *Facta Universitatis, Series: Physical Education and Sport*, since 2009 increasing the number of publications for 350% to nowadays. Likewise, scientific journal *Physical Culture* showed progressive growth from year to year in increasing the number of publications for 60% according to beginning of last decade. The *Exercise and Quality of Life* has variable number of publications through decade, with period increasing and decreasing the number of publications, but without significant changes in this period. The high interest of authors for *Facta Universitatis, Series: Physical Education and Sport* is expected according to its high rank position on Serbian Ministry list categorization of domestic journal in last 9 years. Also, insight into the list of categorization journals in sport sciences, showed that three aforementioned of seven journals published in English. That is reason why these journals are specially selected. Likewise, it is the fact there are four journals which articles published in the peer reviewed journals in the area of Physical Education in Serbian language. Likewise, it's clear that no overall shift away from publishing books in English. Lastly, the most of books are published on Serbian language. References: Popovic, S. (2017). Changing Publication Patterns in the Multidisciplinary Field of Sports Sciences (2003–2016) in Montenegro. In Book of Abstracts of the 14th International Scientific Conference on Transformation Process in Sport "Sport Performance" (60), Budva: Montenegrin Sports Academy.

Sport Statistics and Analyses

INFLUENCE OF ANTHROPOMETRIC CHARACTERISTICS ON PHYSICAL PERFORMANCE OF JUNIOR HANDBALL PLAYERS

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Introduction: The purpose of this research was to describe the body structure and morphological characteristics of handball players from Kosovo Junior Super League, also to determine the effect of these variables physical performance levels and its impact on their rankings in Championship. **Material & Method:** The subject of this study was 128 male handball player 18 years' old, active players from eight junior team from regular Championship of Handball Federation of Kosova. Anthropometric measurements are realized from a professional team which are based in International Scientific of Advanced Kinanthropometric (ISAK). The data was analyzed by Statistical Package for Social Sciences (SPSS) for windows 23.00. **Results:** The obtained results was analyzed through descriptive parameters: Means and standard deviation (SD) of the anthropometric characteristics and motoric variables, the ratio between anthropometric characteristics and motoric variables was analyzed by correlation coefficient according to Pearson with reliability level of 95%. The differences between two groups ranking in Championship was analyzed through T-test for independent samples. Statistical significance was set at $p < 0.05$. **Discussion:** Throughout this study we can proved existence of strong correlation between morphological and physical characteristics. The results proved that In handball, it is possible to have a reliable estimate of anthropometric measurements, on physical performances. **References:** None.

Sports Medicine and Orthopaedics

PRETIBIAL CYST FORMATION AFTER ACL RECONSTRUCTION WITH ABSORBIBLE INTERFERENCE SCREW

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Introduction: There is no way to completely prevent infection after anterior cruciate ligament reconstruction (ACL), but there are methods that can help reduce the risk. The aim of this paper is to present 5 cases of pretibial granuloma in reconstruction of ACL with bioabsorbable interference screw. **Material and Methods:** All cases occurred in the period of 6-13 months after surgery. All of them were reconstructed by graft semitendinosus-gracilis with tibial fixation by interferent screw, while femoral fixation was with Rigidfix or XO-buton. All patients were without complications in the early post-operativ, and rehabilitation was carried out according to the defined program. **Clinical course and treatment** - an initial appearance of the swelling and redness in the projection of the operative cut in the tibia. The swelling at a later stage fluctuates, and if it does not respond surgically to the time of fistulisation. The primary swab is sterile, and at a later stage *Stafylococcus aureus* and *epidermidis* are isolated. Patients do not have an elevated temperature. **Laboratory findings:** CRP and sedimentation are slightly elevated. Clinical knee without a swelling with a regular mobility and satisfactory stability. On RTG images, deformity can be seen cystically enlarging the tibial channel in 2 cases. MR shows the neat appearance and position of the tendon graft, without the contents of the joint and the granuloma of the anterior intercondillary incision. All patients were surgically treated with excision of pretibial granulomas, screw in 4 cases, and in 2 cases fragments of screw removed, curetage, lavas with primary closure were found. In no case was there any need to do reartroscopy. **Results:** In all patients, post-surgical treatment recovery was smooth and could return to its sporting activities. **Conclusion:** Although ACL reconstruction using interferential saraph is considered a reliable method, it must be aware of potential problems with the use of this implant. Early recognition of this problem can prevent greater morbidity. **References:** Feldmann DD, Fanelli GC. Development of a synovial cyst following anterior cruciate ligament reconstruction. *Arthroscopy.* 2001; 17:200–202. Benedetto KP, Fellingner M, Lim TE, Passler JM, Schoen JL, Willems WJ. A new bioabsorbable interference screw: preliminary results of a prospective, multicenter, randomized clinical trial. *Arthroscopy.* 2000; 16:41–48. Malhan K, Kumar A, Rees D. Tibial cyst formation after anterior cruciate ligament reconstruction using a new bioabsorbable screw. *Knee.* 2002; 9:73–75. McGuire DA, Barber FA, Elrod BF, Paulos LE. Bioabsorbable interference screws for graft fixation in anterior cruciate ligament reconstruction. *Arthroscopy.* 1999; 15:463–473.

MULTIPLE SCLEROSIS AND ITS IMPACT ON PHYSICAL ACTIVITY

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Introduction: The purpose is to introduce multiple sclerosis and its impact on physical activity and analysis of data obtained from a questionnaire, which was completed by those affected by multiple sclerosis in Slovenia. **Methods:** Data was analysed with the statistical program SPSS and Microsoft Excel. First we calculated central tendency and dispersion (mean, standard deviation). Results were shown in tables

and graphs. T-test for independent samples or a two-way chi-square were used to compare the differences between sexes. Prior to the processing of the data we set the level of risk at 5 %. Results: Data analysis found that MS primarily affects more women than men, 27.5 % of respondents were men and 72.5 % were women. The average age of respondents was 47.7 years. 53.75 % of respondents, which equals 43 patients, were engaged in activities of medium intensity, that slightly increase the respiratory and heart rate. The results show no statistically significant difference between genders in the daily amount of time and the amount of days per week spent performing medium-intensity activities. The study showed that on average, patients spend 6.05 hours sitting. A difference between genders in the amount of time spent sitting has been statistically proven – on average, men spend more time sitting than women. The preferred form of activity among most respondents is walking or swimming. Exactly half of respondents consider chores and household activities as physical activity with no statistically relevant difference between genders. Most respondents tolerate physical activity either fairly well or badly. Most common unpleasant body reactions, detected during physical activity or after it, were tingling, dizziness and fatigue. Most respondents also think that the disease limits their daily lives and daily activities, hence limiting their engagement in sports activities. 86.25 % of patients also think that proper physical exercise helps them alleviate some of the symptoms that accompany MS. Discussion: The results of our research can help us draw up a training program for patients with multiple sclerosis. They can also help us in creating an awareness brochure and informing patients about positive effects of physical activity. Results will be forwarded to the Association of Multiple Sclerosis of Slovenia, which will gain insight into the current attitude of their members toward physical activity and other factors associated with it. References: None.

DIVING-RELATED CHANGES IN FLOW-MEDIATED DILATION

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Introduction: Endothelial dysfunction is considered to be one of the most prominent reasons of decompression sickness – one among the most frequent complications related to SCUBA diving. Vascular endothelial function can be determined by a non-invasive method, estimating the arterial flow-mediated dilation (FMD). Consequently, the aim of the study was to compare the values of FMD pre- and post-dive, determining the diving-induced changes in the function of the vascular endothelium. Methods: Twelve male divers were recruited for this study, who performed a single-dive at a depth of 18 m with a 47-min bottom time and two-minute ascent to surface without any decompression stops. Endothelium-dependent vasodilator function of the brachial artery was assessed pre- and post-dive using a rapid inflation and deflation blood pressure cuff and a vascular ultrasound system with the belonging computer software. The measurements included the baseline diameter, peak diameter, time to peak diameter, shear rate and the absolute and relative values of FMD. Results: As a result of the study statistically significant ($p < 0.05$) changes were observed in the absolute and relative values of FMD pre-dive vs. post-dive towards the decrease of these values, paralleled with the same changes in shear rate. Post-dive baseline diameter, peak diameter and time to peak showed no statistically remarkable changes ($p \geq 0.05$). Discussion: We can conclude that there are significant changes in the vascular endothelial function related to SCUBA diving, and we suppose that these modifications are the result of cumulative effects of different diving-related factors, first of all hyperoxic and hyperbaric conditions, which lead to the damage of the endothelial function, presumably by modifying the bioavailability of nitrogen-monoxide (Yang et al., 2015; Thom et al., 2015). References: Yang M, Barak OF, Dujic Z, Madden D, Bhopale VM, Bhullar J, Thom SR

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Training and Testing

PRE-SEASON STRENGTH CHARACTERISTICS OF PROFESSIONAL SOCCER PLAYERS AND RELATIONSHIP WITH INJURY OF LOWER LIMB IN THE SEASON

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Introduction: The aim of study was to identify relationship between pre-season isokinetic strength and injuries of lower extremities throw to season in professional adult soccer players. In fact, the lack of strength of the quadriceps muscle is often a hidden culprit for such injuries (Hart, Pietrosimone, Hertel & Ingersoll, 2010). Hamstring are active knee stabilizers and if hamstrings are weak or do not function properly, the athlete is exposed to a greater risk of ACL transmission. Several studies have revealed a correlation between the strength of quadriceps and hamstring and the increased risk of injuries to the lower limbs (Croisier, Ganteaume, Binet, Genty & Ferret, 2008). Other studies, however, present an insignificant association of weak thigh muscles and the risk of injury (Engebretsen, Myklebust, Holme, Engebretsen & Bahr, 2010). **Material and method:** The strength characteristics in the senior category were observed in 227 healthy soccer players playing in the highest league competition in the Czech Republic. Tests of strength (flexors and knee extensions) were performed before the 2017/2018 season. Isokinetic strength parameters were monitored using an isokinetic dynamometer (Cybex Humac Norm®, USA). Retrospectively we compared the injury to pre-seasonal strength imbalances. **Results:** For the dominant leg at an angle of 60°/s for uninjured players, the mean H:Q ratio was $61.0 \pm 9.63\%$. Paradoxically injured players were at higher average values. For ACL injuries, players had an average ratio of flexors to knee extensions of $64.1 \pm 8.29\%$, $63.2 \pm 8.85\%$ for menisci injuries, and $61.4 \pm 10.3\%$ for ankle injuries. We can see a lower ratio only for other injuries (55.9 ± 6.90). In the non-dominant leg at a 60° angle, we observe the same effect as the lower limb of the dominant. **Discussions and conclusions:** Results show higher H: Q ratios in injured players compared to non-injured players in pre-season testing, suggesting that the low strength of the knee extensors may indicate a probability of lower limb injury in the season. **References:** Croisier, J.-L., Ganteaume, S., Binet, J., Genty, M., & Ferret, J.-M. (2008). Strength imbalances and prevention of hamstring injury in professional soccer players: a prospective study. *The American journal of sports medicine*, 36(8). Engebretsen, A. H., Myklebust, G., Holme, I., Engebretsen, L., & Bahr, R. (2010). Intrinsic risk factors for hamstring injuries among male soccer players: a prospective cohort study. *The American journal of sports medicine*, 38(6). Hart, J. M., Pietrosimone, B., Hertel, J., & Ingersoll, C. D. (2010). Quadriceps Activation Following Knee Injuries: A Systematic Review. *Journal of Athletic Training*, 45(1).

THE CONNECTION BETWEEN THE DYNAMIC BALANCE AND MUSCLE STIFFNESS OF THE LOWER LIMBS IN THE GROUP OF BASKETBALL PLAYERS

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Introduction: The purpose of this study was to analyse the relationships between the dynamic balance and muscle stiffness of the lower limbs in the group of basketball players. **Methods:** The data was collected from 16 young basketball players from Sports Championship School in Katowice. The measurements were made using the Optojump Next system. The study consisted of: Stiffness test, which indirectly assesses muscle stiffness and the Drift test, which assesses the dynamic balance. The Pearson correlation and Spearman's rank correlation were performed to examine the relationship between the variables of both tests. **Results:** The conducted analysis showed the dependence and high correlation strength between: the average shift / dispersion front / rear for the left limb in the Drift test, and the average flight time ($r = -0.51$), the average jump height ($r = -0.50$) and the average generated power ($r = -0.62$) in the Stiffness test, between the average standard deviation forward / back for the right limb in the Drift test, and the average flight time in the Stiffness test ($r = -0.51$) and between the right foot contact area in the Drift test and the average power in the Stiffness test ($r = -0.53$). **Discussion:** The conducted analysis showed the dependence and high correlation strength between many parameters of both tests. This indicates a significant relationship between the dynamic balance and muscle stiffness of the lower limbs. Both for improving athletic performance, as well as the prevention of injury, basketball players should take care to improve these parameters in the training process. In basketball, jumps are one of the more frequently undertaken motor acts. The players jumps both during throws in order to score points, as well as in defense trying to block the opponent's shot and on both sides of the court, rebounding the ball after missed shots. On average, it gives about 50 jumps during the match (Abdelkrim 2007). If the improvement of the dynamic balance can have a positive effect on the jump parameters such as flight altitude, flight time and generated power and also increase the landing safety, it is reasonable to imply a dynamic balance training in basketball training, especially for young players. **References:** Latash ML, Zatsiorsky VM (1993) Joint stiffness: Myth or reality. *Human Movement, Science* 12. Słomka K, Furmanek M, Juras G (2016) The interdependence of functional and dynamic stability of the 16-18 years old basketball players – a pilot study. 34 International Conference of Biomechanics in Sport. Drakos M (2010) Injury in the National Basketball Association: A 17-Year Overview. *Sports Health*.

COMPARATIVE ANALYSIS OF THE DYNAMICS OF HEART RHYTHM VARIABILITY INDICATORS OF LONG-DISTANCE RUNNERS DURING TRAINING UNDER THE CONDITIONS OF MEDIUM ALTITUDE AND ON FLAT TERRAIN

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Introduction: In the course of adaptation of the long-distance runners' bodies to the conditions of training and competition, all the life support mechanisms of the body are involved. This affects the formation of the structural trace of adaptation, which must be considered in the training of these athletes. Low partial

pressure at medium altitudes and an increase in the load on the compensating systems of the body and organs result in stress of the regulatory systems of the body of long-distance runners, which changes the course of adaptive reactions of athletes to the conditions of sports activity. Methods: To assess the athletes' adaptation to the conditions of training loads under the conditions of medium altitude and on flat terrain, as well as to assess the regulatory and compensatory mechanisms, the study used the analysis of pulsometry and heart rate variability (HRV) of athletes using rhythmocardiography (RCG). Results: Improvement in the process of arranging and expanding the content of training for long-distance runners using multidirectional means under the conditions of medium altitude aimed at developing stamina creates favorable conditions for the further development of the adaptive capabilities of the functional systems of their body. This contributed to the effectiveness of competitive activity of long-distance runners. Discussion: In the course of the study, two groups of long-distance runners with seven athletes in each group were examined. The first group (EG-1) trained under the conditions of the flat terrain, and the second group (EG-2) trained under conditions of medium altitude at an altitude of 2,100 meters. Studies were conducted at the training camps during their preparation for the competition. The level of sports preparedness of long-distance runners in both groups was the same. Their heart rate variability was examined before the commencement. Then they were examined 35 days later, after exposure to training loads under the conditions of medium altitude and on flat terrain. Five days before the start of the competition, we conducted comparative analysis of changes in heart rate variability in long-distance runners under the influence of physical exertion at medium altitude and on flat terrain. We assessed the dynamics in changes in heart rate variability under the influence of training loads at medium altitude and on flat terrain (Bolotin & Bakayev, 2017; Perialisi et al., 2017). References: Bolotin A, Bakayev V: Peripheral circulation indicators in veteran trail runners. *JPTS*, 2017, 29: 1092–1094. Bolotin A., Bakayev V. (2017). The differences in response of the respiratory system of long and middle-distance runners and their influence on recovery rate. *JPES*, 17(4), 2443-2446. Perialisi, M., et al. (2017). An Electromagnetic Sensor for the Autonomous Running of Visually Impaired and Blind Athletes (Part II: The Wearable Device). *Sensors* (Basel, Switzerland), 17(2), 381.

META-ANALYSIS OF ORIGINAL SCIENTIFIC PAPERS FROM THE AREA OF BASIC AND SPECIFIC MOTOR SKILLS IN HANDBALL THAT WERE PUBLISHED IN SPORT MONT JOURNAL

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Introduction: Modern handball belongs to a group of polistructural sports with a lot of basic and specific motor skills, and as such requires scientific analyses based on original research papers. The main goal of this research was to carry out a meta-analysis of the published original scientific papers in the area of handball. The papers dealt with problems from the area of motor and specific motor abilities, published in *Sport Mont Journal*. Methods: The scientific papers that are singled out according to similar problem or goal will be presented using a meta-analysis. By analysing these original scientific papers, it is evident that the authors dealt with the differences of male and female handball players of different ages in the indicators of motor skills (Milanovic et al., 2013), and with a comparative analysis of handball cadets and junior cadets in the motor and the specific motor skills as well (Vuleta et al. al., 2012; Muratovic et al., 2014). Some papers were aimed at establishing the factorial structure of some tests for the assess-

ment of motor and situational motor abilities, as well as the analysis of the relation of motor and situational motor abilities of handball players (Markovic & Pivac, 2005). Results: Statistical procedures for determining the central and dispersion parameters of the variables and the method of multivariate and univariate analysis of variance for calculating the total and individual differences between the two groups were applied from the review of the analysed scientific papers. The statistical significance of the differences between the two groups of handball players was determined by the t-test for independent samples. A canonical correlation analysis was applied when it comes to the relation of motor and situational motor abilities. Discussion: On the basis of the obtained results, we can conclude that statistically significant differences between the two groups of respondents - cadets and junior cadets were determined in favour of the cadets, and when it comes to cadets and seniors, it was determined in favour of the seniors. These results can be attributed to their biological growth and development as well as systematic planning and programming of the training process. The authors concluded that there is a high correlation among a group of variables for assessing basic motor and situational motor abilities. Therefore, we can say that the situational motor tests have a significant contribution especially when it comes to the results of basic motor skills. References: Milanović D, Vuleta D, Tomašević, S (2013). Sport Mont, XI(37-38-39), 441-446. Muratović A, Vujović D, Bojanić D, Georgiev G (2014). Sport Mont, XII(40-41-42), 148-151. Vuleta D, Milanović D, Nikolić A (2012). Sport Mont, X(34-35-36), 34-38. Markovic S, Pivac N (2005). Sport Mont, III(8-9), 72-85.

THE EFFECTS OF ADDITIONAL VOLLEYBALL TRAINING ON THE ANTHROPOLOGICAL DIMENSION OF ELITE FEMALE VOLLEYBALL PLAYERS

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Introduction: The objective of this study was to determine the effects of additional volleyball training on a certain number of morphological and motoric indicators of elite female volleyball players. Methods: The study was conducted on a sample consisting of 38 First National League female volleyball players. The determination of differences was realised through multivariate and univariate analysis of the variance for repeated measures (MANOVA i ANOVA repeated measures). The additional training in this study lasted for twelve weeks. During this period the participants in the study had trainings twice a week, i. e. twenty-four training sessions in total. Results: The basic result of this study is the fact that the additional volleyball training has had positive effect, meaning that all the motoric parameters which were the subject of this research have improved except 20 m sprint test. Discussion: The results of this study show that there are improvements in the vertical high jump test, which, based on the importance of results in this test, implies that the players' on-court performances will improve as well. Numerous scientific studies have established that more successful volleyball players have better results in the vertical standing jump test, which also implies that additional training can lead to improvement of volleyball players' performances. (Ziv and Lidor, 2010). Significant improvements in the vertical standing jump test as well as in the jump with preparation were visible after the eight-week plyometric programme by Lehnert, Lamrova & Elfmark (2009). Since additional volleyball training consists dominantly of plyometric stimuli, these results can be considered congruent. References: Lehnert M, Lamrova I, Elfmark M (2009). Acta Univ Palacki Olomuc Gymn 39(1), 59-66. Ziv G, Lidor R (2010). Scand J Med Sci Sports, 20(4), 556-567.

PHYSICAL PROFILE OF BOSNIAN YOUNG MALE SOCCER PLAYERS

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Introduction: The first aim of this study was to establish physical composition and running speed at 20 meters for soccer players at 13, 15, 17 and 19 years of age in Bosnia and Herzegovina. The second aim of this study was to analyse and compare the results with referent values taken from research of Nikolaidis, P. T. et al. 2016. **Methods:** Sample - A total of 169 young male Bosnian and Herzegovinian soccer players participated in this study. The players were divided into categories based on their age U13 – 65 players (12.46±0.44 years); U15 – 54 players (14.48±0.50 years); U17 – 33 players (16.24±0.43 years); U19 – 17 players (18.11±0.33 years). **Assessment instruments -** Body composition was analysed based on a recommendation by the author Čović et al. 2017 including: BM=body mass, BMI=body mass index, BF=body fat percentage, FM=fat mass, FFM=fat-free mass. The running speed of 20 meters was measured with photocell system (Microgate photocell, Bolzano, Italy). Three pairs of photocells were used, and they were positioned at a range from 0,10 to 20 meters. **Data and statistical analysis -** So as to confirm the correlation level between years of age and running speed, Pearson correlation coefficient was applied. In order to determine the differences between the age groups One-Way Analysis of Variance was applied using Bonferroni method. **Results:** The achieved body composition results in this research indicate that the values are equally similar to the referential values of research performed by Nikolaidis, P. T. et al. 2016. Statistically significant differences were discovered between the sampled age groups in regards to the running speed of 20 m ($p < 0.01$, $\eta^2 = 0.531$), speed 0-10 m ($p < 0.01$, $\eta^2 = 0.403$) and speed 10-20m ($p < 0.01$, $\eta^2 = 0.205$), where one can detect that better results were achieved by older groups (U17 and U19). **Discussion:** The current findings support the values discussed in the research of Nikolaidis, P. T. et al. 2016 when it comes to height, weight and BMI. However, when one takes into account body fat percentage (BF%) and fat mass (FM), it is evident that soccer players in this study have slightly lower values in regards to these parameters. **References:** Nikolaidis, P. T., Knechtle, B., Clemente, F., & Torres-Luque, G. (2016). Reference values for the sprint performance in male football players aged from 9–35 years. *Biomedical Human Kinetics*, 8(1), 103–112. Čović, N., Čaušević, D., Jelešković, E., Alić, H., Talović, M., & Rađo, I. (2017). Kompozicija tijela kao indikator brzinskih sposobnosti mladih nogometaša. *Kondicijska priprema sportaša*. Nikolaidis, P. T., Ruano, M. A. G., de Oliveira, N. C., Portes, L. A., Freiwald, J., Lep-rêtre, P. M., & Knechtle, B. (2016). Who runs the fastest? Anthropometric and physiological correlates of 20 m sprint performance in male soccer players. *Research in Sports Medicine*, 8627(August), 1–11.

SHOULD WE CONSIDER DIFFERENT FORMS OF REACTIVE AGILITY AS UNIQUE CAPACITY? AN ANALYSIS AMONG AGILITY TRAINED MALE ATHLETES

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Introduction: The importance of reactive agility (RAG) in sports is well known, but no study so far examined the associations between different forms of reactive agility. This study aimed to evaluate relationships between stop-and-go RAG and non-stop RAG among male athletes involved in agility saturated sports. **Method:** The sample of participants were 31 male athletes (age: 23.1±2.1 years) with at least 7

years of experience in agility saturated sports (i.e. football, basketball, handball). The variables were tests of stop-and-go RAG (SNG_RAG) and non-stop RAG (NS_RAG), measured on dominant and non-dominant side by previously suggested protocols (Scanlan et al., 2014; Sekulic et al., 2014). Additionally, participants were tested on test of change-of-direction-speed, which corresponded to SNG_RAG (SNG_CODS). Results: Results showed small to moderate correlations between SNG_RAG and NS_RAG irrespective of side of execution (dominant vs. nondominant side) with coefficients of correlation ranging from 0.15 ($p > 0.05$) to 0.43 ($p < 0.05$). Meanwhile, the correlation between SNG_CODS and NS-RAG numerically slightly exceeded the correlation established between SNG_RAG and NS_RAG ($r: 0.45, p < 0.05$). Discussion: This study was the first one which established the association between different types of RAG. Results confirmed that different types of RAG should not be considered as unique conditioning capacity in male athletes involved in agility saturated sports, which is consistent with previous reports on differences between various CODS performances (Metikos et al., 2003; Sekulic et al., 2013). The significant correlation between SNG_CODS and NS_RAG, highlights the necessity of clear identification of movement templates included in each agility maneuver in order to define the most proper type of training and conditioning. This study examined the problem among agility training males, but the sample of participants included athletes involved in different sports. Therefore, further analyses in more homogenous samples are warranted. References: Metikos, D., Markovic, G., Prot, F., & Jukic, I. (2003). *Kinesiology*, 35(1), 14-29. Scanlan, A., Humphries, B., Tucker, P. S., & Dalbo, V. (2014). *J Sports Sci*, 32(4), 367-374. doi: 10.1080/02640414.2013.825730. Sekulic, D., Krolo, A., Spasic, M., Uljevic, O., & Peric, M. (2014). *T J Strength Cond Res*, 28(11), 3306-3312. doi: 10.1519/JSC.0000000000000515. Sekulic, D., Spasic, M., Mirkov, D., Cavar, M., & Sattler, T. (2013). *J Strength Cond Res*, 27(3), 802-811. doi: 10.1519/JSC.0b013e31825c2cb0.

COMPARISON OF REPEATED SPRINT ABILITY AND AEROBIC CAPACITY BETWEEN UNDER 19 ELITE AND SUB-ELITE SOCCER PLAYERS

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Introduction: Repeated sprint ability (RSA) and maximal aerobic power (VO₂max) are observed as essential specific fitness component in soccer. This study determined differences in RSA and VO₂max between U19 elite and sub-elite male soccer players. Methods: Data were collected from 64 players from teams in elite ($n = 30$) and sub-elite ($n = 34$) soccer players at national (highly skilled) and regional (moderately skilled) level. Each player performed the 30-15 intermittent fitness test to determine their VO₂max and a test for RSA involving the players completing 6×40 m sprints (turn after 20 m) with 20 s recovery between each sprint. Results: The analysis revealed significant differences in favour of elite players in RSA_{best} ($p = 0.015$) and RSA_{mean} (0.002) while no differences ($p > 0.05$) were observed in percent decrement (RSA_{dec}). Results also indicated that elite players had higher speed reached at the end of the 30-15 Intermittent Fitness test (VIFT) than sub-elite players (20.00 ± 0.83 vs. 19.22 ± 1.22). However, we found no significant differences in VO₂max between elite and sub-elite U19 soccer players. Discussion: The repeated sprint ability was found to be suitable enough to highlight the difference among U19 players with moderate-to-high level of play. Therefore, multi-testing approach should include RSA testing to delineate players of a higher level. References: None.

ACUTE EFFECT OF SELF-MYOFASCIAL RELEASE WITH THE GOLF BALL TECHNIQUE IN THE SIT-AND-REACH SCORE

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Introduction. Self-myofascial release (SMFR) is a type of myofascial release performed by the individual themselves rather than by a clinician, often using a tool. Acutely, SMFR seems to increase flexibility and reduce muscle soreness (Beardsley & Skarabot, 2015). The purpose of this study was to value if plantar fascia self-massage using the golf ball technique for 5 minutes increases the flexibility using the Sit-and-Reach (SR) test in a sample of college students. **Methods.** A sample of 62 college students volunteers (38 men and 24 women) with an age of 21.17 ± 1.92 , a weight of 68.52 ± 11.35 kg and a height of 171.93 ± 10.14 cm took part in this study. The sample was divided into a Control Group (N:31, 11 women and 20 men) and an Experimental Group (N:31) The subjects signed an informed consent to take part in the study. **Results.** The results of the one-way ANCOVA (with pre-intervention score as covariance) showed that the experimental group students statistically significantly improved their sit-and-reach scores (i.e., post-intervention – pre-intervention) compared with the control group students ($F = 4.667$; $p = 0.035$; $\eta^2 p = 0.073$). **Discussion.** In line with our results. Merino et al. (2011) found an increase in SR score using the golf ball technique in the plantar fascia. Grieve et al. (2015) reported an increase in SR following SMFR applied to the plantar fascia, which they suggested might be related to the continuity of fascia through the lower limb. Patel et al. (2016) concluded a single session of SMFR on bilateral plantar aspect of foot is effective in increasing hamstrings length. **References.** Beardsley Ch, Skarabot J (2015). Effects of self myo-fascial release. A systematic review. *J Bodyw Mov Ther*, 19, 747-758. Grieve R, Goodwin F, Alfaki M, Bourton AJ, Jeffries C, Scott H (2015). The immediate effect of bilateral self myo-fascial release on the plantar surface of the feet on hamstring and lumbar spine flexibility: a pilot RCT. *J Bodyw Mov Ther*, 19, 544-552. Merino R, Mayorga D, Fernández E, García R (2011). The effect of sole self-massage on the extensibility of the back muscle chain in triathletes. *A pilot study. J of Sport and Health Research*, 3(1), 17-26. Patel DG, Vyas NJ, Sheth MS (2016). *Intern J of Therapeutic Applications*, 32, 94-99.

TEST OF THE JUMP SERVICE SPIN IN VOLLEYBALL

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Introduction: The aim of this pilot study was testing a procedure to evaluate in the short term the improvement of the performance between incoming and outgoing period about the volleyball fundamental of the spin jump service measuring accuracy and differential in the jump. **Methods:** The procedure was submitted to a sample of 11 male players (amateur team), aged between 15 and 20 years. Data were collected at the beginning and the end of a 4-week intensive training period (Altavilla et al., 2018, D'Isanto et al., 2018): mean and standard deviation of anthropometric data, reach to a hand, Vertec test and estimation of the training effect with percentages of improvement (D'Isanto et al., 2018). The statistical analysis of the data was conducted with a T-Test to verify the difference between the pre and post-workout. The significant difference was set with $p < 0.05$. **Results:** After 4 weeks of training the jump increased 3.45 cm 8mean). In the jump service with a choice of area, the training has produced a precision increase of

37%; while in the jump service in zone 1, it produced an increase of 27%. Discussion: Testing the spin service is useful because it allows to monitor performance, design training properly and choose the most effective training methodology. This test can be a fundamental tool for training and to identify the best adaptations to be made to the training program. References: Altavilla, G., D'Isanto, T., Di Tore, A.P., Raiola, G. (2018) Free throw and outcomes: Pilot study on intensive training versus extensive one, *Journal of Human Sport and Exercise*, 13 (3), pp. 494-503. D'isanto, T., Di Tore, P.A., Altavilla, G. (2018) Correlation of the anthropometric characteristics and the ability to jump in volleyball, *Journal of Human Sport and Exercise*, 13, pp. S393-S400. D'Isanto, T., Altavilla, G., Raiola, G. (2017). Teaching method in volleyball service: Intensive and extensive tools in cognitive and ecological approach, *Journal of Physical Education and Sport*, 17, art. no. 233, pp. 2222-2227

DIFFERENCES IN ISOKINETIC STRENGTH OF THIGH MUSCLES BETWEEN TRACK AND FIELD AND KARATE ATHLETES

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Introduction: The aim of the research was to determine the isokinetic strength differences between two groups of athletes (track and field athletics and karate), and to analyze factors that possibly contribute to the differences. We examined possible differences in peak power output and power ratio between agonist and antagonist thigh muscles of the knee. Methods: Inclusion criteria featured male athletes 16-21 years of age. For the purpose of this study, a valid test (CV<5%) of the isokinetic strength output of the knee extensor's and flexor's, was used at the angular velocity of 60°/s. Age and morphological characteristics of the first tested group (track and field): n = 10, 18 ± 2.6, 182 ± 5.4 cm, 76.1 ± 4.5 kg; and second tested group (karate): n = 10, 19 ± 2.4, 184 ± 7 cm, 76.1 ± 4.5 kg. Variables: Peak torque in extension for both legs (Nm), Peak torque in flexion for both legs (Nm), Total work for both legs (J), Strength deficit involved/uninvolved leg and Agonist/antagonist ratio for involved and uninvolved leg. T-test for independent samples was used and Pearson r correlation coefficient. Results: In the set of ten variables, the first tested group of athletes (track and field) achieved higher power output in eight variables, except in the case of unilateral relationship between dominant and non-dominant leg. In the second tested group of athletes (karate), results in dominant leg variables have higher measured values than the non-dominant leg. In the variables, peak torque of dominant leg (p=0.002) and peak torque of non-dominant leg (p=0.019), statistically significant differences were noted between two groups of athletes (p<0.01, p<0.05). The unilateral relationship of the dominant leg (p=.003) significantly differentiates two groups of athletes (p <0.01). Discussion: By analyzing the track and field athlete's training structure, it is possible to assume the reason of their dominance in relation to athletes in karate. Track and field training movements develop the entire musculature. The specificity of training and competitions in karate is likely to make more impact with a dominant leg. Dominance of one leg may cause asymmetry between muscle groups and develop predisposition for injury (Zakas, 2006). Different resistance training programs should consider the specific neuromuscular demands of each sport (Oliveira et al., 2013). Training exercises need to be carefully selected, depending on the sport as well as the individual in the sport. References: Oliveira, F.B.D., Oliveira, A.S.C., Rizzato, G.F. & Denadai, B.S. (2013). Resistance Training for Explosive and Maximal Strength: Effects on Early and Late Rate of Force. *J Sports Sci Med*. 12(3), 402-408. Zakas, A. (2006). Bilateral isokinetic peak torque of quadriceps and hamstring muscles in professional soccer players with dominance on one or both two sides. *J Sports Med Phys Fitness*, 46(1), 28-35.

DIFFERENCES ACCORDING TO MODALITIES, DISTANCES AND GENDERS OF HOW THE TRIATHLETES CARRY THEIR BICYCLES FOR THE BOXES DURING THE FIRST TRANSITION IN THE SPANISH CHAMPIONSHIPS

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Introduction: Fernandez-Rodriguez et al. (2015) studied the last part of T1, paying attention to the way in which triathletes carry their bicycles into the boxes. There were four habitual types of hold-riding bikes in the transition area: Hold-riding of the bicycle by the saddle, by the handlebar, “by the front/rear” and by the stem. The purpose was to compare the proportion in the use (by elite or pro category) of the 4 types of hold-riding the bicycle during the transition between triathletes’ sex (men and women), distance or modality (Olympic, sprint, long and cross) at the Triathlon Spanish Championships. Method: It was decided to place two cameras in box (Fernandez-Rodriguez et al., 2015; 2016). The sample was composed by 648 Spanish triathletes, participants of eight elite Spanish championship triathlon during 2016. Results: Most of triathletes hold-ride the bike by the seat only while driving it (76.2%), followed by the handlebar (14.9%), seat-handlebar (7.1%) and stem styles (1.9%). The same tendency was showed within sex, category and race subcategories, except for Olympic (seat style was used for the 95% of triathletes), sprint (seat and handlebar styles were similar), and long (seat-handlebar and stem styles were equal). The results showed that there were statistically significant differences in the proportion of triathletes that used each hold-riding of the bicycle between sex, race, and sex-race subcategories ($p < 0.05$). As regards the sex race analyses, although both, men and women, elite triathletes mostly used the seat style during the short (Olympic), sprint and long distances, while during cross race men used more the handlebar style, women used the seat style. However, when men and women were compared within each race subcategory independently, statistically significant differences were not found ($p > 0.05$; Cramer’s $V = 0.000-0.244$). Discussion: The difference between men and women is that men have twice the grip on the handlebars. The videos show that this may be because the groups of men in the boxes are greater than those of the women, and this sometimes forces them, to take the bike by the handlebar to control it better and avoid incidents. While in the Olympic, sprint and long-distance elite triathletes mostly used the seat style, and in the cross race the handlebar style. This may be because in the first one, the surface is asphalt or similar, so taking the saddle goes more comfortable, fast or without problems. In contrast, in the triathlon cross as the surface (boxes) is usually more unstable, it requires a more secure grip so that the handlebar does not deviate. References: Fernández-Rodríguez, E., Merino-Marban, R., Romero-Ramos, O., & April, J. (2015). JPES. 15(4), 864-870. Fernández-Rodríguez, Romero-Ramos, Romero Ramos & April Cullimore (2016). JPES 16(3), 761-769.

HAND GRIP STRENGTH IN CADET MALE SAMBO ATHLETES

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Introduction: During the International Olympic Committee’s Executive Board meeting held in Tokyo, Japan on 30 November 2018, provisional recognition was granted to the International SAMBO Federa-

tion (FIAS) pursuant to Rule 25 of the Olympic Charter. Strength and conditioning coaches are interested in measures that can objectively monitor progress and guide programming for rehabilitation and strength training of the hand, forearm and surrounding musculature (Cronin et al., 2017). Thus, the aims of the present study were to compare the maximal isometric hand grip strength of cadet sambo athletes from different weight categories. Methods: Data were collected on a total of 56 male sambo athletes. Athletes were evaluated during an official World Cadets Sambo Championships with the consent of the International Sambo Federation (FIAS). Maximum hand grip strength for both hands was measured with a portable Takei hand grip dynamometer (Takei Scientific Instruments CO., Tokyo, Japan). Data are presented as the mean and standard deviation (\pm). Weight categories were compared using a one-way analysis of variance, followed by the Turkey test for unequal samples when a difference was found in the analysis of variance. Results: Results showed that the maximal isometric hand grip strength among cadet sambo athletes increased across the weight categories, with statistically significant differences. The greatest discrepancies between right and left hand hand grip strength are observed among the lightest and the heaviest athletes with the following values: 32.0 ± 2.8 for the right hand and 27.0 ± 7.1 kgf, for the left hand (48 kg – weight category); 58.0 ± 8.0 for the right and 54.0 ± 9.1 kgf for the left hand (+84 kg – weight category), although the most of athletes achieved similar results with both hands. Discussion: As it could be anticipated, sambo athletes that compete in heavier weight categories had a stronger hand grip than their lighter counterparts. Overall, all examined participants had a stronger grip with one hand, usually (most likely) their dominant hand. When comparing the subsequent categories, the greatest difference occurred between 66 kg and 72 kg weight category, with the difference of 9.5 kgf for the right and 6 kgf for the left hand. Nevertheless, our results showed that the common practice of putting athletes from successive weight categories to train together could also be applied to sambo. References: Cronin J, Lawton T, Harris N, Kilding A, McMaster DT. (2017). *J Strength Cond Res*, 31(11), 3187-217.

HAND GRIP STRENGTH IN JUDOKAS BEFORE THE COMPETITION

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Introduction: All scoring actions in judo depend on a grip in the opponent's judogi (judo uniform) (Calmet et al., 2010; Courel-Ibáñez et al., 2014). The ability of maximal strength-endurance isometric handgrip tests to discriminate properly between judo athletes from different competitive levels probably depends on the weight category, combat style and the interaction with other physical characteristics of the athlete (Franchini et al., 2018). This study aimed to verify the effect of "regain weigh-in" period on handgrip strength in judo athletes. Methods: Data were collected on a 57 male judo-kas (21.94 ± 4.36 years; 179.90 ± 7.73 cm; 80.55 ± 21.28 kg). Athletes were evaluated during an official Serbian judo senior championship 2018, day before and on the competition day. Maximum handgrip strength for both hands was measured with a portable handgrip dynamometer. When homogenous variances were verified for normally distributed data, baseline (day before) versus follow-up (competition day) measures were compared by paired t test. Results: Possibility to be drawn on the weigh-ins, the day before the competition, caused the regain of only about 1 kg in judokas body mass between the weigh-ins day and the competition day. Values on the day before and on the competition day, when athletes had their weight regained, were significantly different. Generally, all of examined athletes showed decrease of handgrip strength, with lower obtained values in their left hand compared to the right one, with the mean of 2.46 kgf for the left ($58.54 \pm 9.72 \rightarrow 56.08 \pm 9.55$ kgf) and 1.1 kgf for the right hand ($59.66 \pm 10.52 \rightarrow 58.56 \pm 10.45$ kgf), during

the follow-up measurement. Discussion: Since the grip dispute represents around 50% of the judo match time (Franchini et al., 2018), the handgrip strength seems to play an important role in competitive judo. Judokas showed stronger handgrip the day before the competition. Although they had enough time to recover from cutting weight and regain it, expecting the stronger handgrip on the competition day seems to be wrong. Weaker handgrip observed during the other day of assessment, may be a result of an arousal of athletes caused by the draw during the initial weigh-ins. Further investigations are needed in order to provide more specific explanation of this phenomenon. References: Calmet M, Miarka B, Franchini E. (2010). *Int J Sport Perform Anal Sport*, 10, 229-40. Courel-Ibáñez J, Franchini E, Femia P, Stankovic N, Escobar-Molina E. (2014). *Int J Sport Perform Anal Sport*, 14, 138-47. Franchini E, Schwartz J, Takito MY. (2018) *Journal of Exercise Rehabilitation*, 14(6), 968-973.

EFFECTS OF THE BASIC PERIOD IN SWIMMING TRAINING WITH AGE GROUPS

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Introduction: The purpose was to monitor the progress of a group of 17 swimmers in the basic swimming period during 3 years (2016-2018). Total load and zones of intensity were defined in annual plans. The training effects were measured by speed, speed endurance and endurance tests. Initial testing was in the 2nd while final testing was in the 12th week. The goal of basic period is development of basic endurance (Issurin, 2008). Zones of intensity for particular age (12-14) were supposed to stimulate development of endurance in basic period. Speed and speed endurance had to be maintained on initial level in the same period. In specific and competition period, endurance had to be maintained while speed and speed endurance had to be developed (Leko et al., 2017). Methods: The sample consisted of 17 male swimmers (age 12-14). All of them are participants of training programs at "HAPK Mladost" swimming club. They conducted swimming program during basic period in 3 years. Three tests were used: speed (25m freestyle), speed endurance (8x50m freestyle) and endurance (1500m freestyle). Statistic for Windows 13.4, statistical software package was used to compute and report the data. Descriptive statistics were used to analyze effects of basic period. The normality of distribution was tested. T-test was used for each of the tests within 3 years. Results: Statistically significant positive outcomes were achieved in all test results during 3 years of basic training (12 weeks per year). Discussion: Endurance test showed statistically significant progress in basic period 2016-2018 (1,29.6- 1,06.8-43.3 respectively). Statistically significant progress was also recorded in speed estimation test (0.32-0.37-0.53 respectively) and speed endurance test (2.52-1.9-1.3 respectively) in 3 years in basic period of training cycle. Contrary, some of the previous claims (Maglischo, 2006) noted the conflict between endurance development and speed in the same period. During the observed period all tests showed progress, but the progress of the speed test increased with each additional year while progress of the remaining two tests decreased. Increasing the volume of training in aerobic zones will cause greater impact on endurance, limiting progress in speed and speed endurance. Swimmers that were measured in this research have won first place on national championship. So, the existing training plan for age group should be used further. This research has provided guidelines for further planning of swimming training. References: Issurin V (2008). *J Sports Med Phys Fitness*, 48(1), 65-75. Leko G, Karaula D, Šiljeg K (2017). Endurance – speed conflict in swimming. 8th International Scientific Conference of Kinesiology. Opatija. Maglischo EW (2006). *Swimming fastest. Human Kinetics*.

Workshops

Workshop 1

WHY PUBLISH IN MONTENEGRIN JOURNAL OF SPORTS SCIENCE AND MEDICINE

The main purpose of this workshop will be about the progress accomplished by the Montenegrin Journal of Sports Science and Medicine (MJSSM). In this presentation, the general mission of the MJSSM will be shared. Overall, I will give information about how the editors started the journal and what kind of strategies has been used to promote the journal. I will also mention about the publication types and submission processes. Lastly, I will give examples about countries where the submissions were made, most cited articles, and the impact factor. I will also talk about the ways to promote journals across and beyond the scientific world; including scientists, authors, and etc. Some examples will be given especially for networking, creating e-mail lists, being in the high respected indexes, and making connections between conferences and seminars. Thus, this presentation will provide information for the researchers and organizations to start a new journal. www.mjssm.me



Selcuk Akpinar is an Associate Professor that is currently employed at Nevsehir Haci Bektas Veli University at the Faculty of Education, Department of Physical Education and Sport as a Faculty Member. He finished his bachelor degree with honors (first rank position) at Hatay Mustafa Kemal University. He was assigned to be a Physical Education Teacher by the Ministry of Education. He worked as PE teacher for two years. He continued his education as master degree at Bolu Abant Izzet Baysal University where he became a research assistant. Later on, he moved to Middle East Technical University for the doctorate where he focused on motor learning and control studies. During his doctorate, he went to the Penn State University, USA, as a visiting scholar for one and a half years and later on Post-doc for 6 months. During his stay at the Penn

State University, he worked at a motor control laboratory with Prof Robert Sainburg and tried to find out the effect of participation of sports training on motor lateralization. After finishing his doctorate, he moved to Nevsehir. He was promoted as an Associated Prof by the Higher Educational Council of Turkey in December 2017. He has developed many international cooperation and has many colleagues from all over the world. His area of interest mainly focused on motor lateralization in sports, arm selection, motor learning and pedagogy, and body composition. Recently, he started work on some special groups like disabled and elderly people. In the work with disables, he collaborates with medical doctors and tries to investigate the effect of Equine Assisted Interventions on some perceptual motor performances and lateralization. He has many papers in respected journals and more than 300 citations to those papers.

Workshop 2

UNIVERSITY OF COIMBRA: POST GRADUATE OFFER AND EXCELLENCY

The purpose of this oral presentation is to disseminate the post graduate offer in Sport Sciences and Physical Education at the University of Coimbra, Portugal, and highlight the scientific activities and in-

ternational publications generated by CIDAF (Sport and Physical Activity Research Centre) as the scientific structure supporting research and post graduate training. The Sport Sciences and Physical Education Faculty offers three masters and one PhD course both in Portuguese and English languages directed to international students from different parts of the world (Europe, China, USA, Brazil).

Students are stimulated to develop both master and PhD thesis in articles publication format usually integrated in existent national or international research project and European networks promoting knowledge, expertise and international networking to be reinforced in a near future. It's a Faculty strong commitment to offer and promote intensive peer tutoring to international students aiming to facilitate their integration into Portuguese culture and to promote personal success. <https://www.uc.pt/en>



José Pedro Ferreira is an Associate Professor at the Sport Sciences and Physical Education Faculty at the University of Coimbra, Portugal. Jose finished his undergraduate in Physical Education (1991), in Special Education and Rehabilitation (1993) and his Master Course in Motor Development (1998) at the Faculty of Human Kinetics, Lisbon Technical University. In 2002 he completed his Mphil in the University of Exeter, UK and in 2004 concluded his PhD in Exercise and Health Sciences at the University of Bristol, UK, under the supervision of Professor Kenneth R. Fox. From 2007 to 2011 he was the Dean of the Sport Sciences and Physical Education Faculty, at the University of Coimbra, Portugal. His present research interests are focused on the psychological and cognitive functioning effects of exercise in special groups. Since 2005 he is

the coordinator of the Master programme in Exercise, Health and Well-being for Special Groups at the University of Coimbra and since 2009 he is the president of the Sport Observatory of the University of Coimbra. At international level Jose Ferreira is an invited professor on the Erasmus Mundus Master in Adapted Physical Activity at Leuven University, Belgium, since 2010. Between 2006-2014 he was the vice-president and the president elect of European Federation of Adapted Physical Activity and since October 2014 he was appointed as president of the EUFAPA.

Workshop 3

INERTIAL MEASUREMENT UNITS IN BIOMECHANICS

The purpose of this workshop is to transfer the knowledge about applications of inertial measurement units (IMUs) in biomechanics studies. During the oral presentation and the practical application, pros and cons of IMUs for measurement and analysis of kinematic data will be discussed. The workshop will comprise the basic description of IMUs and their place in biomechanics, data collection and handling (filtering & interpolation methods), integration of IMUs into other measurement methods, and a demonstration of basic gait analysis with multiple IMUs.



Uğur Ödek is presently employed as an assistant professor at Nevsehir Haci Bektas Veli University, Faculty of Education, Department of Physical Education and Sport. He received his bachelor degree after studying at Sports Sciences Department in Hacettepe University School of Sports Science and Technology. He attained his master of science degree after studying Sports Nutrition

and Ergogenic Aids from the same institution. He continued his post-graduate education in Middle East Technical University, and following his studies on sports Biomechanics, he got his Ph.D. In parallel his education he worked as a lecturer at Baskent University, as a research assistant at Middle East Technical University and as a Sports Science and Operations Supervisor at Gloria Sports Arena. His studies are mainly focused on kinetic and kinematic analyses of human movement in various sports like swimming, boxing, karate and running. Recently, he and his research group has been studying on the application of Inertial Measurement Units in the kinematic analysis of athletes and disabled people.

Workshop 4

GAMES OF THE SMALL STATES OF EUROPE MONTENEGRO 2019

The Games of the Small States of Europe (GSSE) are an Olympic, multi-sport competition featuring athletes from the small countries of the European continent. Since 1985, the GSSE have been held every two years and are currently bringing together nine countries: Andorra, Iceland, Liechtenstein, Luxembourg, San Marino, Malta, Monaco, Cyprus and Montenegro. The idea for Games of the Small States of Europe was initiated at the European Olympic Committee meetings, when the representatives of small states posed an idea of establishing a small-states-only competition consisting of several sports. The first Congress was held in Baden-Baden in 1981, where the National Olympic Committees of eight small European states discussed how the Games for their athletes should be organized. GSSE were founded in 1984, during the Olympic Games in Los Angeles. The initiative to form such an association was supported by then-president of the IOC Juan Antonio Samaranch, who saw it as a unique opportunity to spread the spirit and vision of the Olympic movement. Games are organized according to the rules of international federations, with the support of the European Olympic Committee. The organization of the Games of the Small States of Europe in Montenegro is based on a concept of an Olympic, functional, cost-effective and safe athletic competition with great international importance; one which will ensure a one-of-a-kind athletic event to its participants. GSSE Montenegro 2019, organized by the Montenegrin Olympic Committee, gets under way on May 27, 2019 and the main purpose of this workshop will be about the promotion of the mentioned event.



Igor Vusurovic is currently engaged in Montenegrin Olympic Committee at the organization of Games of the Small States of Europe which will be held in Budva in 2019. Prior to this engagement in the Olympic Committee, he worked as the General Director of the Department of Youth and Sport 2013-2016, Executive Director of the Volleyball Federation of Montenegro 2009-2013, member of the IOCOK 2008-2012, head of the Montenegrin Olympic Committee Mission at the Summer Olympics 2012 in London, Head of Mission MI Tarragona 2018, Head of Mission Games of the Small States of Europe 2011 in Liechtenstein, 2017 in San Marino. In his sports career, he played volleyball for clubs from Italy, Russia, Greece and France, while for the national teams of Yugoslavia, later Serbia and Montenegro, he played over 300 games. He is the first captain of Montenegrin national selection after the restoration of statehood in 2006. He is an Olympic champion from Sydney 2000, European champion 2001 and vice-champion of Europe 1997, and vice-champion of the world in 1998. He has won numerous national and international awards.

Workshop 5

COMPETING IN THE HOT TOKYO 2020: A THERMOREGULATION PERSPECTIVE

In less than two years, the 2020 Summer Olympics and Paralympics will be held in a very hot and humid Asian summer weather. After many years of hard training it is imperative for the athlete to arrive at the Games as ready as possible for exercising in the heat in order to win the gold. This workshop will first discuss the general aspects of heat on endurance performance and the consequences for athletes. Evidence-based countermeasures for better thermoregulation will be discussed, with a special emphasis on heat acclimation and in-competition cooling strategies. Effectiveness and practicality of the available methods will be cross compared. Finally, this workshop will discuss special demands of thermoregulation for athletes with motor disabilities.



Yang Zhang joins the Faculty for Sport and Physical Education, University of Montenegro in 2018. His main responsibilities include lead research at the newly established Diagnostic Centre at Podgorica. Prior to joining the University of Montenegro, he was a coach for the Chinese Badminton Association – Zhejiang Jiaxing Branch. During his previous time in academia he taught various courses in the areas of nutrition, fitness and applied physiology. He has conducted research in the areas of thermoregulation, work physiology, and meta-analysis. Originally from Jiaxing, China, Yang Zhang earned his Bachelor's from Shanghai University of Sport. In 2011 he graduated with his PhD from the University of Alabama in Human Performance.

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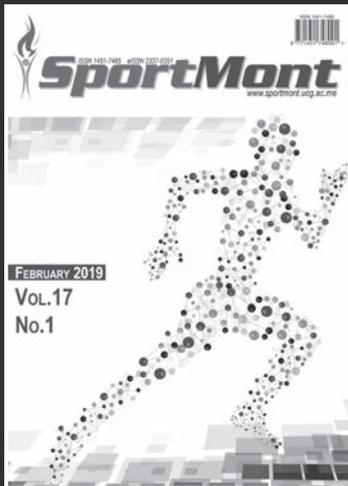
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Национална библиотека Црне Горе, Цетиње

ISBN 978-9940-569-24-2 (Montenegrin Sports Academy)
COBISS.CG-ID 38115600

ISBN 978-9940-569-24-2

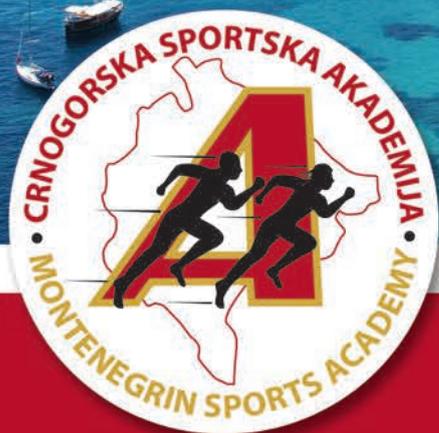


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