



**XXI MEĐUNARODNA NAUČNA KONFERENCIJA  
DEVELOPMENT OF INTEGRATIVE FITNESS – DIF KONFERENCIJA**

**„MEĐUNARODNA KONFERENCIJA NAUKA O SPORTU,  
FIZIČKOM VASPITANJU I ZDRAVLJU“**

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## ***Poštovane kolege i učesnici Konferencije***

Želimo Vam dobrodošlicu na Fakultet sporta i fizičkog vaspitanja Univerziteta u Beogradu i našu 21. međunarodnu naučnu konferenciju, koja se tradicionalno održava povodom Dana fakulteta. Veoma smo radosni što ove godine imamo priliku da konferenciju organizujemo uživo, nakon dužeg perioda nemogućnosti održavanja konferencije na ovaj način, usled situacije izazvane pandemijom Kovid-19. Ove godine Konferencija nosi naziv „Međunarodna konferencija nauka o sportu, fizičkom vaspitanju i zdravlju“, a takođe ove godine radna grupa za organizaciju konferencije je osmislila i novi naziv konferencije na engleskom jeziku u čast našeg skraćenog opštepoznatog, tradicionalnog naziva fakulteta – DIF (*Development of integrative fitness – DIF Conference*). Podršku organizaciji Konferencije ove, kao i prethodnih godina dali su Ministarstvo prosvete, nauke i tehnološkog razvoja Republike Srbije, Ministarstvo omladine i sporta Republike Srbije i Olimpijski komitet Srbije.

Konferencija je organizovana sa ciljem prezentacije teorijskih saznanja, naučnih istraživanja i iskustava kojima se procenjuju efekti primene fizičke aktivnosti na antropomotorički status dece, omladine i odraslih, kao i mogućnosti implementacije dobijenih saznanja u praksi fizičkog vaspitanja, sporta i zdravlja. Prema definisanim kriterijumima, u okviru tematskih područja prijavljen je veliki broj radova, a nakon recenzija Naučni odbor je prihvatio 71 sažetak rada, na srpskom i engleskom jeziku. Odabrani radovi raspoređeni su u 4 sesije za usmene prezentacije i jednu poster sesiju. U pripremanju Zbornika sažetaka izvršeno je raspoređivanje radova prema tematskim oblastima i ujednačavanje metodoloških struktura radova.

Posebno nam je zadovoljstvo da Vas obavestimo da na Konferenciji Fakulteta pored velikog broja naučnika, profesora i studenata iz Srbije učestvuje i izuzetno značajan broj naših poštovanih koleginica i kolega iz država regiona, kao i drugih zemalja kao što su Turska, Grčka, Rusija, Bugarska i Rumunija. Sažeci radova domaćih autora u Zborniku sažetaka dati su na srpskom i engleskom jeziku, dok su sažeci autora iz inostranstva prikazani samo na engleskom jeziku.

Nadamo se da će učesnici Konferencije pored zvaničnog učešća u radu Konferencije, tokom druženja u neformalnoj atmosferi razmenjivati ideje i obogaćivati znanja ali i stvarati nova prijateljstva.

Svim autorima želimo uspešnu prezentaciju radova, aktivno učešće u radu Konferencije uz prijatan boravak u Beogradu, kao i na Fakultetu sporta i fizičkog vaspitanja Univerziteta u Beogradu.

Predsednik Naučnog odbora

dr Ivana Milanović, redovni profesor

## *Dear Colleagues and Conference participants*

We would like to welcome you to the Faculty of Sport and Physical Education of the University of Belgrade and our 21<sup>st</sup> International Scientific Conference, traditionally held to mark the Faculty anniversary. We are very happy that this year's conference is live, after a long period of not being able to organize live events due to the emergency situation caused by the COVID-19 pandemic. This year the Conference is entitled "International Conference of Sport Science, Physical Education and Health", and also this year the working group for the organization of the Conference came up with a new name of the conference in English as a tribute to the abbreviated well-known, traditional name of our Faculty "DIF" (Development of integrative fitness – DIF Conference).

The organization of this Conference, as in previous years, was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia, the Ministry of Youth and Sports of the Republic of Serbia and the Olympic Committee of Serbia.

The Conference is organized to present theoretical knowledge, scientific research and practical experience that assess the effects of applying physical activity on physical fitness of children, youth and adults, as well as the possibilities of implementation of the obtained results in practice of physical education, sport and health. According to the defined criteria, a large number of papers were submitted within thematic areas, and after the review, the Scientific Board accepted 71 abstracts in Serbian and English. The selected papers are divided into 4 sessions for oral presentations and one poster session. When preparing the Book of Abstracts, we grouped the papers according to the thematic areas and the methodological structures of the abstracts.

We are pleased to inform you that, besides a large number of scientists, professors and students from Serbia, the Conference will host a number of our respected colleagues from the region, as well as from other countries such as Turkey, Greece, Russia, Bulgaria and Romania. The abstracts by domestic authors in the Book of Abstracts are published in Serbian and English, while the abstracts of foreign authors are presented in the English language only.

We hope that the Conference participants, beside participation in official part, will use this opportunity to share ideas and enrich their knowledge while socializing in an informal setting, as well as to create new friendships.

We wish all authors the successful presentation of papers, active participation in the work of the Conference and pleasant stay in Belgrade, as well as at the Faculty of Sport and Physical Education of the University of Belgrade.

President of the Scientific Board

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*Socioeconomic characteristics and success of European countries at the Olympic Games, World and European Championships in rhythmic gymnastics (1992 – 2021)*

**Igor L. Biryukov**

*Sports spirituality as educational innovation*

**Sandra Radenović, Nemanja Milojević, Miloš Marković, Goran Kasum**

*Abuse and instigation of conflicts between MMA fighters: the case of Nurmagomedov and McGregor /*

*Zloupotreba i podstrekivanje konflikata između MMA boraca: slučaj Nurmagomedov i Mek Gregor*

**Goran Kasum, Goran Kocić, Bojana Milićević Marinković**

*The social impact of a sports event through the example of the organization of the "European Youth Table Tennis Championship 2022" /*

*Društveni učinak sportskog događaja kroz primer organizacije „Evropskog prvenstva za mlade u stonom tenisu 2022“*

**Petar Gizdić, Ana Penjak**

*Football: From Global Phenomenon to Literary Texts*

**Tvrtko Galić**

*Has top team sport become just a business or not?*

**Branka Savović, Sandra Radenović, Miloš Marković**

*Draft of action research of the course of Bioethics of sport /*

*Nacrt akcionog istraživanja na predmetu Bioetika sporta*

**Milan Hosta**

*Life-coaching: putting the science and education of movement where it belongs*

**Željko Rajković, Vladimir Miletić, Darko Mitrović, Srećko Paležević**

*Improvement of the organization of Balkan shipping school's competition /*

*Unapređenje organizacije takmičenja brogarskih škola Balkana*

## **KEYNOTE LECTURES/ POZIVNA PREDAVANJA**



# Facts, experiences, and developments of the Hungarian National Student Fitness Test (NETFIT) 2014-2022

Tamás Csányi<sup>1,2</sup>

Hungarian University of Sports Science<sup>1</sup>  
Hungarian School Sport Federation<sup>2</sup>

The Hungarian National Student Fitness Test (NETFIT®) is a health-related, criterion-referenced test system developed by the Hungarian School Sport Federation (HSSF) and The Cooper Institute that was implemented in 2014 in schools throughout the country. In the past 8 years, a lot of data and experience have been generated both from the point of view of scientific and practical implementation.

From a scientific point of view, the system can be used to monitor the public health status of our students. Every year, cca. 20.000 physical education teachers upload the test results of 650,000 students into the system. Based on this data-driven evidence, it is possible to design specific physical activity interventions at national, school, and individual levels. Moreover, the most important impact of the system is the support of the fitness education process, including the development of knowledge, skills, and attitudes, necessary for healthy, regular physical activity behavior.

In my presentation, I will give an insight into the development, gaps, and strengths of a digitalized health-related physical fitness monitoring system through the Hungarian „best practice”. Besides that, I will show evidence of the positive health impact of the additional physical education lessons at a national level. Our estimation means 50.000 more kids have healthier CVD profile, and 40.000 have healthier bone health profile thanks for the additional two PE lessons per week.

**Key words:** fitness monitoring, youth, criterion-referenced testing, assessment

## References

- Csányi, T., Finn, K. J., Welk, G. J., Zhu, W., Karsai, I., Ihász, F., ... & Molnár, L. (2015). Overview of the Hungarian national youth fitness study. *Research quarterly for exercise and sport*, 86(sup1), S3-S12.
- Welk, G. J., Saint-Maurice, P. F., & Csányi, T. (2015). Health-related physical fitness in Hungarian youth: age, sex, and regional profiles. *Research quarterly for exercise and sport*, 86(sup1), S45-S57.

# Činjenice, iskustva i razvoj mađarskog nacionalnog sistema za praćenje fitnesa učenika – (NETFIT) 2014-2022

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Mađarski nacionalni sistem fitnes testiranja učenika (NETFIT®) je sistem praćenja fizičkog razvoja i motoričkih sposobnosti učenika sa definisanim zdravstvenim kriterijumima razvijen od strane Mađarskog školskog sportskog saveza (HSSF) i Kuperovog instituta iz SAD, i implementiran u školama širom Mađarske od 2014. godine. U proteklih 8 godina prikupljeno je mnogo podataka i iskustva kako sa stanovišta naučne prakse, tako i praktične primene.

Sa naučnog stanovišta, sistem se može koristiti za praćenje javnog zdravstvenog stanja učenika. Svake godine, okvirno 20.000 nastavnika fizičkog vaspitanja učitava u sistem rezultate sa testiranja za 650.000 učenika. Na osnovu ove baze podataka, moguće je osmisliti specifične intervencije primene fizičke aktivnosti na nacionalnom, školskom i individualnom nivou. Pored toga, najvažniji cilj ovog sistema je podrška procesu obrazovanja učenika o značaju fizičke aktivnosti za njihovo zdravlje, uključujući razvoj znanja, veština i stavova, neophodnih za sticanje zdravih životnih navika učenika.

Prezentacija daje uvid u razvoj, prednosti, ali i primećene nedostatke digitalizovanog sistema praćenja fizičkog razvoja i motoričkih sposobnosti učenika u Mađarskoj koji se smatra jednim od primera „najbolje prakse“ u Evropi. Zahvaljujući ovom sistemu utvrđen je pozitivan uticaj dodatnih časova fizičkog vaspitanja na zdravstveni status učenika na nacionalnom nivou. Procena je da oko 50.000 učenika ima zdraviji kardiovaskularni profil (CV), a 40.000 učenika ima zdraviji profil kostiju zahvaljujući dodatna dva časa fizičkog vaspitanja nedeljno.

**Ključne reči:** praćenje fitnesa, deca i mladi, testiranje na osnovu kriterijuma, procena

## Literatura

Csányi, T., Finn, K. J., Welk, G. J., Zhu, W., Karsai, I., Ihász, F., ... & Molnár, L. (2015). Overview of the Hungarian national youth fitness study. *Research quarterly for exercise and sport*, 86(sup1), S3-S12.

Welk, G. J., Saint-Maurice, P. F., & Csányi, T. (2015). Health-related physical fitness in Hungarian youth: age, sex, and regional profiles. *Research quarterly for exercise and sport*, 86(sup1), S45-S57.

# Internal and External Values of Sport: What to do with transgender athletes?

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## Introduction

The focus on internal and external values of sport was brought into the philosophy of sport by W. J. Morgan in 1987. He applied A. MacIntyre's concept (1985) to sports, putting an emphasis on internal values as essential. By doing that, he has changed the course of the discipline and started a new approach towards (understanding of) sports which will end up in the construction of 'broad internalism' (Russell, 1999; Simon, 2000; Dixon, 2003) - a leading normative ethical theory in the literature up to this day. On the other hand, external values were perceived as negative or instrumental (Morgan, 1987; McNamee, 2002, 2008) and the research on them was completely neglected. With this paper, I intend to correct that and put more emphasis on external values such as inclusion, tolerance and sensibility. Finally, I will use the framework of values of sport to discuss the several transgender athlete's cases in female categories in sports.

## Method

The research was conducted by the application of the critical analysis method and a critical review method.

## Results and discussion

The internalist view of sports is dominant in the philosophy and ethics of sport. According to it, the core or essential values of every sport can be rationally identified and extracted. Moreover, they can serve as a norm or principle for moral behavior in sports. However, certain ongoing cases in sports, especially and specifically about the transgender athletes in female categories in sports, brought to light different external values of sport as central - inclusion, tolerance and sensibility, more than any others.

## Conclusion

Firstly, sports philosophers should pay more attention to discussing the external values of sport. Secondly, they should specifically and more closely consider them when making conclusions about transgender athletes such as Laurel Hubbard and Lia Thomas. In the recent period, two dominant views were established: a) of inclusion (Karkazis, Pielke) and b) of necessary exclusion (Pike, Imbrišević) of transgender athletes in/from sports. Finally, quite different from the context of general society, it seems that internal values should play a more important if not crucial role in the decision-making process in sports, not external ones.

**Key words:** internal values of sport, external values of sport, inclusion, transgender athletes

## References

- McNamee, M. J. Sports, Virtues and Vices. Morality Plays, Routledge, London, New York, 2008.  
Škerbić, M. M. (2020), »Bioethics of Sport – the Look Towards the Future of Sports«, *Pannoniana – Journal for Humanities* 4 (2020) 1, str. 119-140.  
Camporesi, S. & McNamee, M (2018), *Bioethics, Genetics and Sport*, London: Routledge  
Škerbić, M. M. (2019), »Bioethics of Sport and its Place in the Philosophy of Sport«, *Synthesis Philosophica* 34 (2/2019):1-15.

# Unutrašnje i spoljašnje vrednosti sporta: šta raditi sa transrodnim sportistima?

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## Uvod

Fokus na interne i eksterne vrednosti sporta je u filozofiju sporta uneo V. J. Morgan 1987. On je primenio koncept A. MacIntire-a (1985) na sport, stavljajući naglasak na interne vrednosti kao suštinske. Time je promenio tok čitave discipline i započeo novi pristup (razumevanju) sporta koji će završiti u izgradnji „širokog internalizma“ (Russell, 1999; Simon, 2000; Dikon, 2003) – što je i vodeća normativna etička teorija u literaturi do danas. S druge strane, eksterne vrednosti su percipirane kao negativne ili instrumentalne (Morgan, 1987; McNamee, 2002, 2008) i istraživanje o njima je potpuno zanemareno. Ovim radom nameravam da to ispravim i stavim veći naglasak na eksterne vrednosti kao što su inkluzija, tolerancija i senzibilitet. Na kraju, korišću okvir vrednosti sporta da razgovaram o nekoliko slučajeva transrodnih sportista u ženskim kategorijama u sportu.

## Metod

Istraživanje je sprovedeno primenom metode kritičke analize i metode kritičkog pregleda.

## Rezultati sa diskusijom

Internalistički pogled na sport dominira u filozofiji i etici sporta. Prema njemu, bazične ili suštinske vrednosti svakog sporta mogu se racionalno identifikovati i izdvojiti. Štaviše, oni mogu poslužiti kao norma ili princip moralnog ponašanja u sportu. Međutim, pojedini aktuelni slučajevi u sportu, posebno slučajevi transrodnih sportista u ženskim kategorijama u sportu, izneli su na videlo različite eksterne vrednosti sporta kao centralne – inkluziju, toleranciju i senzibilitet, više nego bilo koje druge.

## Zaključak

Prvo, sportski filozofi treba da posvete više pažnje raspravi o eksternim vrednostima sporta. Drugo, trebalo bi da ih posebno i pažljivije razmotre kada donose zaključke o transrodnim sportistima kao što su Laurel Hubbard i Lia Thomas. U novijem periodu uspostavljena su dva dominantna stanovišta: a) inkluzije (Karkazis, Pielke) i b) neophodnog isključivanja (Pike, Imbrišević) transrodnih sportista u/iz sporta. Konačno, sasvim drugačije od konteksta opšteg društva, čini se da interne vrednosti treba da igraju važniju ako ne i presudnu ulogu u procesu donošenja odluka u sportu, a ne eksterne.

**Ključne reči:** interne vrednosti sporta, eksterne vrednosti sporta, inkluzija, transrodni sportisti

## Literatura

McNamee, M. J. *Sports, Virtues and Vices. Morality Plays*, Routledge, London, New York, 2008.

Škerbić, M. M. (2020), »Bioethics of Sport – the Look Towards the Future of Sports«, *Pannoniana – Journal for Humanities* 4 (2020) 1, str. 119-140.

Camporesi, S. & McNamee, M (2018), *Bioethics, Genetics and Sport*, London: Routledge

Škerbić, M. M. (2019), »Bioethics of Sport and its Place in the Philosophy of Sport«, *Synthesis Philosophica* 34 (2/2019):1-15.

# **Lifestyle medicine for prevention and treatment of cardiovascular diseases**

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According to the British Society of Lifestyle Medicine, lifestyle medicine is defined as evidence-based clinical care that supports behaviour change through person-centred techniques to improve mental wellbeing, social connection, healthy eating, physical activity, sleep and minimisation of harmful substances and behaviours. The six pillars of lifestyle medicine include: healthy eating, mental wellbeing, healthy relationships, physical activity, minimising use of harmful substances, and sleep. The lecture will highlight some of the principles of lifestyle medicine and indicate why this area of medicine is important in the prevention and treatment of chronic diseases. It provides a theoretical framework of lifestyle medicine, with further focus on strong scientific evidence that has been incorporated in clinical guidelines to support the concept that regular physical activity, maintenance of a healthy weight, quality diet, and avoidance of tobacco, alcohol, and recreational drugs reduce the risk of cardiovascular diseases. Despite the overwhelming evidence in support of positive lifestyle measures, progress in helping individuals incorporate these practices into their daily lives has been difficult to achieve. While improvements in lifestyle measures have been cited as the major reason for the reduction in cardiovascular disease in the past 20 years, major challenges remain. Despite significant mortality reduction in cardiovascular diseases over the previous 30 years attributed to improvement in clinical care as well as lifestyle-related risk factors such as smoking cessation, increased physical activity, and better control of cholesterol and blood pressure, it is important to note that increases in obesity and diabetes moved in the opposite direction and could potentially diminish the gains achieved in other lifestyle-related risk factors. The lecture will provide an overview of the recent research that has been undertaken by the multidisciplinary teams led by Prof Jakovljevic which addressed the lifestyle factors in the prevention and treatment of cardiovascular diseases. In particular, review of these studies will indicate the effects of physical activity on the prevention of cardiovascular function decline with ageing, and further focus on physical activity and dietary-led improvements in physiological function and quality of life in patients with chronic heart failure and hypertrophic cardiomyopathy. The lecture will provide further recommendations for the future research on the role of the lifestyle medicine in the prevention and treatment of cardiovascular diseases.

**Key words:** cardiovascular diseases, prevention, lifestyle medicine

# Životni stil kao lek u prevenciji i lečenju kardiovaskularnih bolesti

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Prema Britanskom društvu za medicinu životnog stila, medicina životnog stila je definisana kao klinička nega zasnovana na dokazima, koja se zasniva na promeni ponašanja kroz tehnike usmerene na samu osobu, radi poboljšanja mentalnog blagostanja, društvene povezanosti, zdrave ishrane, fizičke aktivnosti, sna i minimiziranja štetnih supstanci i ponašanja. Šest stubova medicine načina života uključuje: zdravu ishranu, mentalno blagostanje, zdrave odnose, fizičku aktivnost, minimiziranje upotrebe štetnih supstanci i san. Na predavanju će biti istaknuti neki od principa medicine životnog stila i ukazano zašto je ova oblast medicine važna u prevenciji i lečenju hroničnih bolesti. Pruža teorijski okvir medicine životnog stila, sa daljim fokusom na jake naučne dokaze koji su deo kliničkih smernica koje podržavaju koncept da redovna fizička aktivnost, održavanje zdrave telesne mase, kvalitetna ishrana i izbegavanje duvana, alkohola i narkotika smanjuju rizik od kardiovaskularnih bolesti. Uprkos ogromnom broju istraživanja koja govore u prilog mera pozitivnog načina života, teško je postići napredak u pomaganju pojedincima da uvedu ove prakse u svoj svakodnevni život. Dok su poboljšanja mera životnog stila navedena kao glavni razlog za smanjenje kardiovaskularnih bolesti u poslednjih 20 godina, idalje preostaju veliki izazovi. Uprkos značajnom smanjenju mortaliteta od kardiovaskularnih bolesti u prethodnih 30 godina koje se pripisuje poboljšanju kliničke nege, kao i faktorima rizika vezanim za način života kao što su prestanak pušenja, povećana fizička aktivnost i bolja kontrola holesterola i krvnog pritiska, važno je napomenuti da se povećanje gojaznosti i dijabetesa kreće u suprotnom smeru i potencijalno bi moglo da umanja dobiti postignute drugim faktorima rizika vezanim za stil života. Predavanje će ponuditi pregled nedavnih istraživanja koje su sprovedi multidisciplinarni timovi na čelu sa prof. Jakovljevićem koji su se bavili faktorima životnog stila u prevenciji i lečenju kardiovaskularnih bolesti. Konkretno, pregled ovih studija će ukazati na efekte fizičke aktivnosti na prevenciju opadanja kardiovaskularnih funkcija sa starenjem, i dalje fokusiranje na fizičku aktivnost i poboljšanja fiziološke funkcije i kvaliteta života uz pomoć kvalitetne ishrane kod pacijenata sa hroničnom srčanom insuficijencijom i hipertrofičnom kardiomiopatijom. Predavanje će ponuditi dalje preporuke za buduća istraživanja o ulozi medicine stila života u prevenciji i lečenju kardiovaskularnih bolesti.

**Ključne reči:** kardiovaskularne bolesti, prevencija, medicina životnog stila

**PHYSICAL AND HEALTH EDUCATION, INCLUSIVE SPORTS /  
FIZIČKO I ZDRAVSTVENO VASPITANJE, INKLUZIVNI SPORT**

# INTRODUCTORY LECTURE

## Physical activity policies in schools: lessons learned for obesity prevention from the STOP project

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Obesity, physical activity (PA), and sedentary pursuits are complex phenomena that require population-based solutions. For children, schools are frequently identified as an ideal setting for introducing lifestyle change and the prevention of weight gain. In most countries, school is obligatory, at least by mid-adolescence; hence, all children can be reached, which makes schools a perfect setting to reduce health inequalities. Because academic activities are mostly sedentary, ample opportunities for PA should be provided to increase energy expenditure and introduce the well-known benefits of PA for health and academic performance. As schools enable universal reach and represent an ideal setting for obesity prevention policies the STOP research mainly focused on school-related PA. Over the last twenty years we have witnessed an accelerated increase in the quantity of interventions to increase children's physical activity worldwide. Yet, these interventions have had very heterogeneous effects on children's total activity volume. Concerns for children's physical fitness, obesity and well-being have increased with the recent emergence of COVID-19 pandemic and related containment measures that have changed our lifestyle in an unprecedented way for which long-term consequences are yet to be seen. This presentation will provide a collective summary of the innovative research on school-based physical activity policies conducted within the STOP project and will be divided into 3 sections on: 1) active travel; 2) school-based PA interventions; 3) Physical Education interventions studied through the Healthy Lifestyle Intervention case study. Finally, the presentation will highlight the deleterious effects of COVID-19 pandemics on children's fitness and underline the importance of urgent mitigation strategies in the immediate future.

**Key words:** intervention, physical activity, school, fitness



## UVODNO PREDAVANJE

### Politika fizičke aktivnosti u školama: naučene lekcije za prevenciju gojaznosti iz "STOP" projekta

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Gojaznost, fizička aktivnost (FA) i sedentarne aktivnosti su složeni fenomeni koji zahtevaju rešenja zasnovana na populaciji. Za decu, škole se često identifikuju kao idealno okruženje za uvođenje promene načina života i prevenciju gojaznosti. U većini zemalja škola je obavezna, barem do sredine adolescencije, tako da se do sve dece može dopreti, što škole čini savršenim okruženjem za smanjenje zdravstvenih nejednakosti. Pošto su školske aktivnosti uglavnom sedentarne, trebalo bi obezbediti dovoljno mogućnosti za FA da bi se povećala potrošnja energije i uvele dobro poznate prednosti FA za zdravlje i akademski učinak. Kako škole omogućavaju univerzalni pristup i predstavljaju idealno okruženje za politike prevencije gojaznosti, STOP istraživanje se uglavnom fokusiralo na FA u vezi sa školama. Tokom poslednjih dvadeset godina svedoci smo ubrzanog povećanja količine intervencija za povećanje fizičke aktivnosti dece širom sveta. Ipak, ove intervencije su imale veoma heterogene efekte na ukupan obim aktivnosti dece. Zabrinutost za fizičku kondiciju, gojaznost i dobrobit dece porasla je nedavnom pojavom pandemije COVID-19 i povezanih mera suzbijanja koje su promenile naš način života na način bez presedana za koji dugoročne posledice tek treba da se vide. Ova prezentacija će pružiti zbirni rezime inovativnog istraživanja politike fizičke aktivnosti u školama sprovedenog u okviru STOP projekta i biće podeljen u 3 dela o: 1) aktivnom putovanju; 2) intervencije FA u školama; 3) Intervencije fizičkog vaspitanja proučavane kroz studiju *Healthy Lifestyle Intervention case study*. Konačno, prezentacija će naglasiti štetne efekte pandemije COVID-19 na fitness dece i podvući važnost hitnih strategija za ublažavanje posledica u bliskoj budućnosti.

**Ključne reči:** intervencije, fizička aktivnost, škola, fitness

# **Analysis of children's' psychosensory status by using tests of the NTC system of learning**

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## **Introduction**

The human body acts as a unique and adaptable system based on constant learning and taking information from the environment. Stimulation of children's development is based on developing the mental abilities needed to understand the environment. The stimulation of cognitive learning from an early age is crucial, considering that cognitive functions depend on the creation of synapses. One of the essential mechanisms of stimulating learning occurs through physical activity as an indispensable factor in every segment of child development. Therefore, the aim of the study was to determine the psychosensory status of preschool children.

## **Method**

The sample of participants (N=308) included 165 girls and 143 boys from 8 Croatian kindergartens, divided into four age groups. An NTC measuring instrument (Rajović, 2009) for monitoring the conditions and elements of psychophysical development of children was used (Nikola Tesla Center – MENSA Department for gifted children, 2009).

## **Results and discussion**

The analysis of the results in the rank sum according to sex showed that the girls (N=165) had better results than the boys (N=143) only in the tying shoelaces test. The level of significance in the tying shoelaces test was  $p=0.005$ . The results showed that girls performed better than boys. In terms of age groups, older children (5-6 years) performed better than younger children (4-5 years).

## **Conclusion**

The results of the study showed poor motor skills in preschool children. The study attempts to motivate the persons in a child's environment to influence and strive to improve the anthropological characteristics of children. Such research provides an analysis of children's psychosensory status and can serve as a good tool for future testing and assessment of children's progress. Future research should include additional psychosensory tests in a longitudinal study of motor skills after applying the NCT system of learning.

**Key words:** early stimulation, psychophysical development, synapses, boys and girls, differences

## **References**

Rajović, R., 2009., Mensa-Ntc-način učenja, [NTC system of learning], Novi Sad.

# Traditional children's games in the teaching of physical and health education

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## Introduction

Traditional children's games can help develop the intellectual, emotional and moral characteristics of students, and at the same time they can teach students about the customs and culture of the country they come from. Among others, the subject of Physical and Health Education (PHE) should have a leading role in introducing students to traditional children's games. The aim of the research was to examine the possibility of applying traditional children's games in PHE teaching, as well as the knowledge of elementary school students about them.

## Method

The sample of participants had two subsamples. A sub-sample of students (100) of primary school age (from 11 to 14 years old) and a sub-sample of physical and health education teachers (20) from the territory of the city of Valjevo. In September 2022, participants filled out two non-standardized online questionnaires about traditional children's games. The results were processed using descriptive statistics, and the Chi square test was applied to determine the differences in the answers obtained in relation to gender and age when it comes to students, as well as differences in relation to gender and year of services when it comes to teachers.

## Results and discussion

The teacher's opinion is that current generations of students know less about traditional children's games compared to previous generations (89.5%) and they believe that these games are insufficiently applied in classes (78.9%). 72.2% of them rarely apply them in PHE classes, 11.1% do not apply them at all, while only 16.7% of teachers use them in almost all classes. Significant differences were found only in relation to gender in teachers' opinions about the importance of tradition and traditional children's games, as female teachers consider them more important than male teachers ( $\chi^2 (1) = 5.115$ ;  $p < .05$ ). The majority of students are familiar with the concept of traditional children's games (73.5%), most often their parents introduced them to these games (39.6%), and a slightly smaller percentage of students were introduced to traditional children's games in PHE classes (27.5%). Significant differences were obtained only in relation to the age of the students, in favor of the younger ones who use these games more ( $\chi^2 (3) = 31.993$ ;  $p < .00$ ).

## Conclusion

Schools and teachers of Physical and Health education must do more to nurture traditions and traditional children's games.

**Key words:** students, traditional children's games, physical and health education

## References

- Aksić, N. (2019). Tradicionalne društvene igre u Srbiji. Zbornik radova Filozofskog fakulteta, XLIX, 2, 25-42.
- Marjanović, V. (2002). Tradicionalne dečje igre u Vojvodini od druge polovine do kraja veka (Međuetnički odnosi u tradicionalnim dečjim igrama Vojvodine). *Kodovi slovenskih kultura*, 7, 147-170.

# Tradicionalne dečje igre u nastavi fizičkog i zdravstvenog vaspitanja

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## Uvod

Tradicionalne dečje igre mogu da pomognu u razvoju intelektualnih, emocionalnih i moralnih karakteristika učenika, a ujedno mogu da nauče učenike o običajima i kulturi naroda iz koga potiču. Pored ostalih, predmet *Fizičko i zdravstveno vaspitanje* (FZV) bi trebalo da ima vodeću ulogu u upoznavanju učenika sa tradicionalnim dečjim igrama. Istraživanje je imalo za cilj da ispita mogućnost primene tradicionalnih dečjih igara u nastavi FZV, kao i znanja učenika osnovne škole o njima.

## Metod

Uzorak ispitanika je imao dva subuzorka. Subuzorak učenika (100) osnovnoškolskog uzrasta (od 11. do 14. godina) i subuzorak nastavnika fizičkog i zdravstvenog vaspitanja (20) sa teritorije grada Valjevo. Ispitanici su u toku septembra 2022. g popunjavali dva nestandardizovana onlajn upitnika o tradicionalnim dečjim igrama. Rezultati su obrađeni primenom deskriptivne statistike, a Hi kvadrat test je primenjen kako bi se utvrdile razlike u dobijenim odgovorima u odnosu na pol i uzrast kada su u pitanju učenici, kao i razlike u odnosu na pol i radni staž kada su u pitanju nastavnici.

## Rezultati sa diskusijom

Nastavnici su mišljenja da sadašnje generacije učenika manje poznaju tradicionalne dečje igre u odnosu na ranije generacije (89,5%) i smatraju da se one nedovoljno primenjuju na časovima (78,9%). Njih 72,2% ih retko primenjuje na časovima FZV, 11,1% ih uopšte ne primenjuje, dok samo 16,7% nastavnika ih koristi skoro na svim časovima. Dobijene su značajne razlike samo u odnosu na pol kod mišljenja nastavnika o značaju tradicije i tradicionalnih dečjih igara, tako što ih nastavnice smatraju značajnijim od nastavnika ( $\chi^2(1) = 5.115$ ;  $p < .05$ ). Učenici su većini upoznati sa pojmom tradicionalnih dečjih igara (73,5%), najčešće su ih roditelji upoznali sa njima (39,6%), a nešto manji procenat učenika se upoznao sa njima na časovima FZV (27,5%). Dobijene su značajne razlike samo u odnosu na uzrast učenika i to u korist mlađih koji više primenjuju ove igre ( $\chi^2(3) = 31.993$ ;  $p < .00$ ).

## Zaključak

Škole i nastavnici fizičkog i zdravstvenog vaspitanja se moraju više baviti negovanjem tradicije i tradicionalnih dečjih igara.

**Ključne reči:** učenici, tradicionalne dečje igre, fizičko i zdravstveno vaspitanje

## Literatura

Aksić, N. (2019). Tradicionalne društvene igre u Srbiji. Zbornik radova Filozofskog fakulteta, XLIX, 2, 25-42.  
Marjanović, V. (2002). Tradicionalne dečje igre u Vojvodini od druge polovine do kraja veka (Međuetnički odnosi u tradicionalnim dečjim igrama Vojvodine). *Kodovi slovenskih kultura*, 7, 147-170.

# Physical literacy - understanding the concept

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## Introduction

The term "physical literacy" (PL) is generally understood as an individual's ability to lead a physically active lifestyle (Longmuir & Tremblay, 2016), and can be defined as the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life (IPLA, 2017). PL has positive effects on the physical, psychological, social and cognitive health of individuals, and in the last ten years it has attracted the attention of the scientific community as well as practitioners in the field of physical education and sport. The aim of the paper is to present the understanding of the concept of PL.

## Method

The literature review with an inductive approach analyzed the most common and most significant papers in published peer-reviewed journals, with a focus on PL. A comprehensive literature search was conducted using the keyword "physical literacy" in certain scientific databases. A special focus was on papers published in the period from 2010 to 2022, i.e. on papers published after the proposed concept of PL.

## Results and discussion

First, the evolution of PL throughout history is presented, followed by different definitions, within which certain similarities and differences are identified. This is followed by an analysis of the basic components of PL. Then, existing instruments for assessing PL are summarized along with commentary on the advantages and disadvantages of certain instruments. Further, the potential benefits of PL are described.

## Conclusion

Researchers and organizations from different countries have adapted the concept of PL to reflect their own culture and systems, which has led to certain specificities regarding the definition, components and understanding of the concept. What they have in common is that PL is increasingly recognized as the foundation of a healthy and active lifestyle. Based on its association with physical activity, PL has been associated with a wide range of positive health outcomes.

**Key words:** physical activity, motivation, self-confidence, physical competence

## References

- Longmuir, P.E. & Tremblay, M.S. (2016). Top 10 Research Questions Related to Physical Literacy. *Research quarterly for exercise and sport*, 87(1), 28-35.
- Edwards, L.C., Bryant, A.S., Keegan, R.J., Morgan, K. & Jones, A.M. (2017). Definitions, Foundations and Associations of Physical Literacy: A Systematic Review. *Sports medicine*, 47(1), 113-126.

# Fizička pismenost - poimanja i shvatanja koncepta

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## Uvod

Termin „fizička pismenost“ (FP) se generalno shvata kao sposobnost pojedinca za fizički aktivan način života (Longmuir & Tremblay, 2016), te se može definisati kao motivacija, samopouzdanje, fizičke kompetencije, znanje i razumijevanje da se vrednuje i doživotno bavi fizičkom aktivnošću (IPLA, 2017). FP ima pozitivne efekte na fizičko, psihičko, socijalno i kognitivno zdravlje pojedinaca, te je poslednjih deset godina privukla pažnju naučne zajednice ali i praktičara iz oblasti fizičke kulture. Cilj rada jeste prikaz shvatanja i poimanja koncepta FP.

## Metod

Pregledom literature sa induktivnim pristupom analizirani su najčešći i najznačajniji radovi u objavljenim recenziranim časopisima, sa fokusom na FP. Sprovedena je sveobuhvatna pretraga literature uz korišćenje ključne riječi “fizička pismenost” u određenim naučnim bazama podataka. Poseban fokus je bio na radovima objavljenim u periodu od 2010. do 2022. godine, odnosno na radovima koji su objavljeni nakon predloženog koncepta FP.

## Rezultati sa diskusijom

Prvo je predstavljena evolucija FP kroz istoriju, zatim različite definicije, u okviru čega su identifikovane određene sličnosti kao i razlike. Nakon toga slijedi analiza osnovnih komponenti FP. Zatim su sumirani postojeći instrumenti za procjenu FP zajedno sa komentarom o prednostima i nedostacima određenih instrumenata. Nakon ovoga, opisano je koje su potencijalne koristi FP.

## Zaključak

Istraživači i organizacije iz različitih zemalja, prilagođavali su koncept FP tako da odražava njihovu sopstvenu kulturu i sisteme, što je dovelo do određenih specifičnosti u pogledu definicije, komponenata i razumijevanja koncepta. Ono što je zajedničko je da se FP sve više prepoznaje kao temelj zdravog i aktivnog načina života. Na osnovu svoje povezanosti sa fizičkom aktivnošću, FP je povezana sa širokim spektrom pozitivnih zdravstvenih ishoda.

**Ključne reči:** fizička aktivnost, motivacija, samopouzdanje, fizičke kompetencije

## Literatura

Longmuir, P.E. & Tremblay, M.S. (2016). Top 10 Research Questions Related to Physical Literacy. *Research quarterly for exercise and sport*, 87(1), 28-35.  
Edwards, L.C., Bryant, A.S., Keegan, R.J., Morgan, K. & Jones, A.M. (2017). Definitions, Foundations and Associations of Physical Literacy: A Systematic Review. *Sports medicine*, 47(1), 113-126.

# Physical activity among boys and girls aged 15 to 18 years in their free time

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## Introduction

The modern way of living has significant impact of decreasing the level of physical activity among adolescents, obesity is increasing and it is a global worldwide problem. The objective of this research was to determinate the level and types of physical activity, between boys and girls aged 15 to 18 years, in their free time.

## Method

The data collected in the present research is obtained through an online questionnaire which contained questions from different topics, however in this research the focus is on data related to physical activity and free time. The sample of respondents was formed by a total of 503 students (249 male - 253 female) from Skopje, with an average age of 15 to 18 years. The data were processed with the statistical package SPSS for Windows Version 26.0.

## Results and discussion

Based on the results obtained in relation to gender, regarding the level of "Physical activity", it is noted that compared to girls, boys are more physically active. Regarding "Free time" outside of school and home duties, according to the collected data, boys declared that they have more free time than girls. Based on the results obtained from the level of "Physical activity" in relation to the age of 15-16 and 17-18 years (for both genders), there are no statistically significant differences. Regarding the results obtained from "Free time" outside of school and home duties in relation to the age of 15-16 and 17-18 years (for both genders), there are no statistically significant differences.

## Conclusion

Regular physical activity of adolescents has essential role in maintaining their good health and well-being. Besides the school activities, it is extremely important for them, to be physically active on a daily basis and in their free time. The environment, in which they grow and develop, has a big role in this regard, and the involvement of all family members is particularly significant.

**Key words:** physical activity, free time, adolescents.

## References

- CRC, U. C. (2013, April 17). Retrieved October 10, 2022, from General comment No. 17 (2013) on the right of the child to rest, leisure, play, recreational activities, cultural life and the arts (art. 31): <https://www.refworld.org/docid/51ef9bcc4.html>
- Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2019, November 21). Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1·6 million participants. *Lancet Child Adolesc Health*, pp. 23-25.

# The students' free time

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## Introduction

The students' free time can be apprehended only if we see it through work and the position of a man at work, as an integral part of man's time, which is socially conditioned and cannot be studied without economic, political, cultural and historical components. The goal of this research was to study possible difference in the structure of free time of male and female students, as well as the identification of certain life habits of male and female students, which can have influence on preferences towards sport recreational activities in the frame of free time.

## Method

The research had transversal character, with the application of survey method. It was realized in the first term of 2022/2023 school year. As a research instrument a questionnaire was applied, specially constructed for this research with eight questions of closed type with the possibility of two or more answers. The sample of examinees included 175 students divided into two special sub samples – to the criterion of gender: sub sample of 70 male students NSA "Vassil Levski" in Sofia and sub sample of 105 female students at the Faculty of Education in Jagodina. For the determination of the significance of differences between free time of male and female students Pearson's test  $\chi^2$  was applied.

## Results and discussion

The function of free time is primarily in the function of entertainment for both genders. The largest percent of free time is spent on internet, which is becoming an instrument for socializing. Physical recreational activities (interest for walking, picnics, travelling, sport activities and so on) mainly prevail with students. Family and local community are very important factors in enabling different forms of free time.

## Conclusion

Social economic state is in direct correlation with doing sport recreational activities in free time. The change in life style, including larger percent of sport recreational activities can lead to the reduction of a number of diseases or early death. Physical Education, abolished back in 1996, at most universities in the Republic of Serbia should be returned to the students as soon as possible.

**Key words:** students, free time, Serbia, Bulgaria

## References

- Stepanovic, I., Videnovic, M., & Plut, D. (2009). The Patterns of the Behaviours of the Young during Free Time. *Sociology*, (3), 247–261.
- Markovic, Z, & Milanovic, S. (2015). Free Time of the Students of Pedagogical Sciences at the University of Kragujevac. U. V. Vujevic (ed), *Compilation of Works from the Scientific Meeting "Science and Freedom"*, 6-8. June 2014, (page 764–782). Pale: University at Istocno Sarajevo, Faculty of Philosophy, Pale.



# Slobodno vreme studenata

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## Uvod

Slobodno vreme možemo shvatiti samo ako ga posmatramo sa radom i položajem čoveka u radu, kao integralni deo čovekovog vremena, koji je društveno uslovljen i ne može se izučavati bez ekonomskih, političkih, kulturnih i istorijskih činilaca. Cilj istraživanja je bio da se utvrdi eventualna razlika u strukturi slobodnog vremena studenata i studentkinja, kao i identifikacija pojedinih životnih navika studenata i studentkinja koje mogu imati uticaja na opredeljenja prema upražnjavanju sportsko-rekreativnih aktivnosti u okviru slobodnog vremena.

## Metod

Istraživanje je bilo transversalnog karaktera, uz primenu Survey metoda realizovano u prvom semestru školske 2022/2023. Kao instrument istraživanja primenjen je anketni upitnik, posebno konstruisan za ovo istraživanje sa osam pitanja zatvorenog tipa sa mogućnošću na dva i više odgovora. Uzorak ispitanika obuhvatio je 175 studenata podeljenih u dva posebna subuzorka - prema kriterijumu pola i to: subuzorak od 70 studenata NSA „Vassil Levski“ u Sofiji i subuzorak od 105 studentkinja Fakulteta pedagoških nauka u Jagodini. U obradi podataka dobijenih empirijskim istraživanjem pored postupaka deskriptivne statistike za utvrđivanje značajnosti razlika između slobodnog vremena studenata i studentkinja primenjen je Pearsonov  $\chi^2$  test.

## Rezultati sa diskusijom

Kod oba pola funkcija slobodnog vremena je prvenstveno u funkciji zabave i razonode. Najveći procenat slobodnog vremena se provodi na internetu koji postaje instrument u socijalizaciji. Fizičko-rekreativne aktivnosti (interesovanja za šetnju, izlete, putovanja, sportske aktivnosti i sl.) preovladavaju u najvećem procentu kod studenata i studentkinja. Porodica i lokalna sredina su veoma važni faktori u omogućavanju provođenja različitih oblika slobodnog vremena.

## Zaključak

Socio-ekonomski status je u direktnoj vezi sa upražnjavanjem sportsko-rekreativnih aktivnosti u slobodnom vremenu. Promena načina života, uključujući veći obim sportsko-rekreativnih aktivnosti može da dovede do smanjenja broja bolesti ili prerane smrti. Tako da fizičko vaspitanje koje je 1996 godine ukinuto na većini Univerziteta u Srbiji treba u što skorije vreme vratiti studentima.

**Ključne reči:** studenti, slobodno vreme, Srbija, Bugarska

## Literatura

Stepanović, I., Videnović, M., & Plut, D. (2009). Obrasci ponašanja mladih tokom slobodnog vremena, Sociologija, (3), 247–261.  
Marković, Ž., & Milanović, S. (2015). Slobodno vreme studenata fakulteta pedagoških nauka Univerziteta u Kragujevcu. U V. Vujević (ur.), Zbornik radova sa naučnog skupa „Nauka i sloboda“, 6-8. Juni 2014, (str. 764–782). Pale: Univerzitet u Istočnom Sarajevu, Filozofski fakultet Pale.

# The importance of physical activity for the improvement of the activities of daily living in pupils with motor disorders

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## Introduction

Significantly slower motor development in pupils with physical disabilities is related to various aspects of individual functioning. The presence of a deficit in the area of motor functioning can to a certain extent determine the acquisition of various habits and skills. Compared to the typical population, the physically disabled population is often less physically active and has significantly different developed behavior patterns. Abilities and skills important for the performance of basic and instrumental activities of daily living can be improved with different programs based on physical activity.

## Method

The research data were collected by an initial search of the databases ScienceDirect, PubMed, *Taylor & Francis*, using the keywords "motor disorders", "activities of daily living", "physical activity-based programs" and printed materials. The search included works published in their entirety, not older than ten years. Using the selection method, scientific papers were selected that entered the process of further analysis and comparison.

## Results and discussion

Empirical data show that the involvement of pupils with motor disorders in various programs based on physical activity contributes to the improvement of motor skills and abilities necessary for the realization of activities of daily life. The population with the spastic form of cerebral palsy shows significant improvements in the area of gross motor skills, necessary for movement and manual skills, and self-care activities, after the implemented group program based on programmed physical activity (Ko et al., 2019). The program of motor skills development also leads to the improvement of motor skills necessary for the performance of activities such as eating, dressing, and academic skills (Sabiilaa et al., 2022).

## Conclusion

Physical activity, both in the typical population and in the population with disabilities, brings a number of benefits for the overall functioning of an individual. In addition to sports and recreational importance, for people with disabilities, physical activity also has therapeutic importance in improving a number of motor, cognitive, and other skills and abilities.

**Key words:** ADL, cerebral palsy, developmental disorders

## References

- Ko, E. J., Sung, I. Y., Moon, H. J., Yuk, J. S., Kim, H. S., & Lee, N. H. (2020). Effect of Group-Task-Oriented Training on Gross and Fine Motor Function, and Activities of Daily Living in Children with Spastic Cerebral Palsy. *Physical & occupational therapy in pediatrics*, 40(1), 18-30.
- Sabiilaa, S., Hariandja, A., & Laksono, A. (2022). The Effect of the Motor Skill Training Program on Activity of Daily Living in Children with Developmental Coordination Disorder. *Jurnal Ilmu Dan Teknologi Kesehatan*, 10(1), 1-13.

# Značaj fizičke aktivnosti u unapređenju svakodnevnih životnih aktivnosti učenika sa motoričkim poremećajima

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## Uvod

Znatno sporiji motorički razvoj učenika sa telesnim invaliditetom u vezi je sa različitim aspektima funkcionisanja pojedinaca. Prisustvo deficita u oblasti motoričkog funkcionisanja u određenoj meri može determinisati usvajanje različitih navika i veština. U poređenju sa tipičnom, populacija sa telesnim invaliditetom često je manje fizički aktivna i ima značajno drugačije razvijene obrasce ponašanja. Uključenost u različite programe zasnovane na primeni fizičke aktivnosti, može pozitivno uticati na unapređenje sposobnosti i veština neophodnih za realizaciju bazičnih i instrumentalnih svakodnevnih životnih aktivnosti.

## Metod

Inicijalnom pretragom baza podataka: ScienceDirect, PubMed, *Taylor & Francis* upotrebom ključnih reči "motor disorders", „activities of daily living“, „physical activity based programs“ i štampanih materijala, prikupljeni su istraživački podaci. Pretragom su obuhvaćeni radovi publikovani u celosti, ne stariji od deset godina. Metodom selekcije odabrani su naučni radovi koji su ušli u proces dalje analize i komparacije.

## Rezultati sa diskusijom

Empirijski podaci pokazuju da uključenost učenika sa motoričkim poremećajima u različite programe, zasnovane na usmerenoj fizičkoj aktivnosti, doprinosi poboljšanju motoričkih veština i sposobnosti neophodnih za realizaciju aktivnosti svakodnevnog života. Populacija sa spastičnim oblikom cerebralne paralize pokazuje značajna poboljšanja u oblasti grubih motoričkih sposobnosti, neophodnih za kretanje i manuelnih veština i aktivnostima samozbrinjavanja, po realizovanom grupnom programu zasnovanom na programiranoj fizičkoj aktivnosti (Ko et al., 2019). Program razvoja motoričkih veština, takođe doprinosi unapređenju motoričkih veština neophodnih za aktivnosti poput ishrane, oblačenja i savladavanja gradiva u školskom okruženju (Sabiilaa et al., 2022).

## Zaključak

Fizička aktivnost, kako kod tipične, tako i kod populacije sa invaliditetom sa sobom nosi niz benefita po celokupno funkcionisanje pojedinca. Pored sportsko-rekreativnog značaja, kod osoba sa invaliditetom, fizička aktivnost ima i terapijski značaj u unapređenju niza motoričkih, kognitivnih i drugih veština i sposobnosti.

**Ključne reči:** aktivnosti svakodnevnog života, razvojni poremećaji, cerebralna paraliza

## Literatura

- Ko, E. J., Sung, I. Y., Moon, H. J., Yuk, J. S., Kim, H. S., & Lee, N. H. (2020). Effect of Group-Task-Oriented Training on Gross and Fine Motor Function, and Activities of Daily Living in Children with Spastic Cerebral Palsy. *Physical & occupational therapy in pediatrics*, 40(1), 18–30.
- Sabiilaa, S., Hariandja, A., & Laksono, A. (2022). The Effect of the Motor Skill Training Program on Activity of Daily Living in Children with Developmental Coordination Disorder. *Jurnal Ilmu Dan Teknologi Kesehatan*, 10(1), 1-13.
- <https://doi.org/10.32668/jitek.v10i1.934>

# Application of digital technologies in the teaching of physical and health education of students with physical disabilities

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## Introduction

Digitization and modernization of the teaching process during the last decade have a great impact on every segment of the teaching process. The application of digital technologies in the teaching of physical and health education of students with physical disabilities greatly facilitates the work of teachers, which has been the subject of numerous studies. Accordingly, the question arises about the possibilities, ways and outcomes of the application of new digital technologies in the process of teaching.

## Method

The research data were collected by an initial search of the databases: KoBSON, EIRC, PubMed, CEEOL using the keywords “digital technologies in physical education of children with physical disabilities” and printed materials. The search included works published in their entirety, not older than ten years. Using the selection method, scientific papers were selected that entered the process of further analysis and comparison.

## Results and discussion

Research findings indicate that physical education, in addition to motor activities, has an impact on the personal and social development of students with disabilities. Modern digital technologies have an impact on the improvement of education and the application of new methods that encourage cooperation between teachers and students (Adamenko et al., 2022). The application of digital technologies in the teaching of physical and health education of students with physical disabilities, due to the heterogeneity of this population, represents a great challenge and cannot provide adequate results if the teachers themselves are not involved in the reflexive learning process (Bodsworth & Goodyear, 2017). Practically, digital accessibility can be potentially stigmatizing and an additional effort for the teacher, even if students only see the benefits of using digital technologies (Cranmer, 2020).

## Conclusion

By continuously monitoring the development of digital technologies and their methods of application in the teaching of physical and health education, teachers perform classes more productively, which provides benefits not only in education but also in the daily activities of students with physical disabilities.

**Key words:** digital technology, physical and health education, students with physical disabilities

## References

- Adamenko, O., Shevchenko, O., Babiuk, S., Osiptsov, A., Melnik, A., & Sikorska, L. (2022). Innovative Technologies in Physical Education: Neuropsychological Aspect. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, 13(1Sup1), 22-36.
- Bodsworth, H., & Goodyear, V. A. (2017). Barriers and facilitators to using digital technologies in the Cooperative Learning model in physical education. . *Physical Education and Sport Pedagogy*, 22(6), 563-579.

# Primena digitalnih tehnologija u nastavi fizičkog i zdravstvenog vaspitanja učenika sa telesnim invaliditetom

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## Uvod

Digitalizacija i osavremeljivanje nastavnog procesa u toku poslednje decenije imaju veliki uticaj na svaki segment nastavnog procesa. Primena digitalnih tehnologija u nastavi fizičkog i zdravstvenog vaspitanja učenika sa telesnim invaliditetom umnogome olaksava rad nastavnika o čemu su sprovedena brojna istraživanja. Shodno navedenom, otvara se pitanje koje su mogućnosti, načini i ishodi primene novih digitalnih tehnologija u procesu realizacije nastave?

## Metod

Inicijalnom pretragom baza podataka: KoBSON, EIRC, PubMed, CEEOL upotrebom ključnih reči "digital technologies in physical education of children with physical disabilities" i štampanih materijala, prikupljeni su istraživački podaci. Pretragom su obuhvaćeni radovi publikovani u celosti, ne stariji od deset godina. Metodom selekcije odabrani su naučni radovi koji su ušli u proces dalje analize i komparacije.

## Rezultati sa diskusijom

Istraživački nalazi ukazuju na to da fizičko vaspitanje pored motoričkih aktivnosti ima uticaj na lični i društveni razvoj učenika sa invaliditetom. Savremene digitalne tehnologije imaju uticaja na unapređenje obrazovanja i primenu novih metoda koje podstiču saradnju nastavnika i učenika (Adamenko et al., 2022). Primena digitalnih tehnologija u nastavi fizičkog i zdravstvenog vaspitanja učenika sa telesnim invaliditetom, usled heterogenosti ove populacije predstavlja veliki izazov i ne može dati adekvatne rezultate ukoliko se sami nastavnici ne uključe u refleksni proces učenja (Bodsworth & Goodyear, 2017). Praktično, digitalna pristupacnost može biti potencijalno stigmatizirajuća i predstavljati dodatni napor za nastavnika, i ako učenici vide samo prednosti upotrebe digitalnih tehnologija (Cranmer, 2020).

## Zaključak

Kontinuiranim praćenjem ravoja digitalnih tehnologija i njihovih metoda primene u nastavi fizičkog i zdravstvenog vaspitanja nastavnici produktivnije izvode nastavu, što pruža benefite ne samo u obrazovanju već i u svakodnevnim aktivnostima učenika sa telesnim invaliditetom.

**Ključne reči:** digitalna tehnologija, fizičko i zdravstveno vaspitanje, učenici sa telesnim invaliditetom

## Literatura

Adamenko, O., Shevchenko, O., Babiuk, S., Osiptsov, A., Melnik, A., & Sikorska, L. (2022). Innovative Technologies in Physical Education: Neuropsychological Aspect. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, 13(1Sup1), 22-36.

Bodsworth, H., & Goodyear, V. A. (2017). Barriers and facilitators to using digital technologies in the Cooperative Learning model in physical education. *Physical Education and Sport Pedagogy*, 22(6), 563-579.

# A three – year follow up study on the basic morphological characteristics and fitness level at University of criminal investigation and police studies students

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## Introduction

Physical abilities and morphological features are some of the factors that could determine the efficiency of police work conducting. Therefore, the evaluation of these two components is part of the selection process, education and determination of work abilities throughout the career of police officers. This paper aims at ascertaining the alterations in morphological characteristics and physical abilities of the students at the University of Criminal Investigation and Police Studies (UCIPS) throughout the three years of studying.

## Method

134 UCIPS students participated in the research. The measurements were conducted during the entrance exam (initially) and at the end of the third year (finally). Standard procedures were used to determine: body height (BH), body mass (BM), body mass index (BMI), lower-back isometric force ( $F_{\max}BE$ ), lower-body muscular power in the horizontal plane (SLJ), as well as in the vertical plane (ABL), repetitive power of the arm extensors (PU), muscular endurance of abdominal and hip flexors (SU) and general aerobic endurance (RUN). The discrepancies between the initial and final measurements were ascertained by means of the paired sample t-test, at the level of statistical significance  $p < 0.05$ .

## Results and discussion

The results of this research show that, during the course of three-year studies, a statistically significant increase occurs in BM by 3.9% ( $t = 7.844$ ,  $p < 0.05$ ), as well as in BMI by 3.7% ( $t = 7.719$ ,  $p < 0.05$ ). Considering that the tested population was biologically mature, with the process of growth and development fully completed, an alteration in BH had not been expected. Likewise, an increase in  $F_{\max}BE$  by 2.4% ( $t = 2.623$ ,  $p < 0.01$ ) was noted, accompanied by a decrease in RUN by 2.2% ( $t = 3.729$ ,  $p < 0.05$ ). As for the other observed variables, no statistically significant alteration transpired throughout the course of the three-year study.

## Conclusion

BM and maximal isometric force statistically significantly increased throughout the three years of studying at UCIPS, whereas aerobic endurance decreased. The other observed motor abilities did not show a statistically significant alteration between the initial and final measurements. The reasons for this may vary from life habits and training process, to required physical ability norms, etc.

**Key words:** specialized physical education, general physical abilities, students, police

## References

- Dimitrijević, R., Koropanovski, N., Dopsaj, M., Vucković, G., Janković, R. (2014). The influence of different physical education programs on police students' physical abilities. *Policing: An International Journal of Police Strategies & Management*, 37(4), 794-808.
- Koropanovski, N., Kukić, F., Janković, R., Dimitrijević, R., Dawes, J., Lockie, R., Dopsaj, M. (2020). Impact of physical fitness on recruitment and its association to study outcomes of police students. *South African Journal for Research in Sport, Physical Education and Recreation*, 42(1): 23 – 34.

# Promene osnovnih morfoloških karakteristika i motoričkih sposobnosti studenata Kriminalističko-policijskog univerziteta tokom tri godine studija

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## Uvod

Fizičke sposobnosti i morfološke karakteristike jedan su od faktora koji mogu da determinišu efikasnost obavljanja policijskog posla. Zbog toga, evaluacija ove dve komponente je deo selekcionih procesa, edukacije, ali i utvrđivanja radnih sposobnosti tokom karijere policijskih službenika. Cilj ovog rada je utvrđivanje promena morfoloških karakteristika i fizičkih sposobnosti studenata Kriminalističko-policijskog univerziteta (UCIPS) tokom tri godine studija.

## Metod

U istraživanju je učestvovao 134 studenta UCIPS. Merenja su izvršena tokom prijemnog ispita (inicijalno) i na kraju treće godine (finalno). Standardnim procedurama utvrđene su: telesna visina (BH), telesna masa (BM), indeks mase tela (BMI), izometrijska sila opružaća leđa ( $F_{max}BE$ ), brzinska snaga mišića nogu u horizontalnoj ravni (SLJ) i vertikalnoj ravni (ABL), repetitivna snaga mišića opružaća ruku (PU), repetitivna snaga mišića pregibača trupa (SU) i aerobna izdržljivost (RUN). Razlike između inicijalnog i finalnog merenja utvrđene su korišćenjem *paired sample* t-test na nivou statističke značajnosti  $p < 0.05$ .

## Rezultati sa diskusijom

Rezultati ovog istraživanja ukazuju da tokom tri godine studija dolazi do statistički značajnog povećanja BM 3.9% ( $t = 7.844$ ,  $p < 0.05$ ) i BMI za 3.7% ( $t = 7.719$ ,  $p < 0.05$ ). S obzirom na to da je testirana biološki zrela populacija, kod koje je proces rasta i razvoja okončan, očekivano je bilo da se neće uočiti promena BH. Takođe, uočeno je povećanje  $F_{max}BE$  za 2.4% ( $t = 2.623$ ,  $p < 0.01$ ), ali i smanjenje RUN za 2.2% ( $t = 3.729$ ,  $p < 0.05$ ). Kod ostalih posmatranih varijabli tokom tri godine studija nije došlo da statistički značajne promene.

## Zaključak

Tokom tri godine studiranja na UCIPS statistički značajno se povećala BM i maksimalna izometrijska sila, ali se smanjila aerobna izdržljivost. Kod ostalih posmatranih motoričkih sposobnosti nije utvrđena statistički značajna razlika između inicijalnog i finalnog merenja. Razlozi za to mogu biti raznovrsni, npr. životne navike, trenažni proces, traženi normativi fizičkih sposobnosti i drugo.

**Ključne reči:** Specijalno fizičko obrazovanje, bazične motoričke sposobnosti, studenti, policija

## Literatura

- Dimitrijević, R., Koropanovski, N., Dopsaj, M., Vucković, G., Janković, R. (2014). The influence of different physical education programs on police students' physical abilities. *Policing: An International Journal of Police Strategies & Management*. 37(4), 794-808.
- Koropanovski, N., Kukić, F., Janković, R., Dimitrijević, R., Dawes, J., Lockie, R., Dopsaj, M. (2020). Impact of physical fitness on recruitment and its association to study outcomes of police students. *South African Journal for Research in Sport, Physical Education and Recreation*, 42(1): 23 – 34.

# The relationship between the level of physical activity of parents and the level of physical activity of children

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## Introduction

This research aimed to investigate the connection between the level of physical activity of parents and the level of physical activity of children, to determine whether there is a connection between obesity in younger school-aged children and their level of physical activity, whether there is a connection between the age and level of education of parents and the level of physical activity, and whether children are already familiar with behavior patterns that include an optimal level of physical activity in their own homes. In addition, the research included the sports that younger school-aged children prefer, and a ranking was made, from the most popular to the least popular sports.

## Method

The research was conducted in the third and fourth grades of primary schools, where the sample of participants consisted of 46 children with an average age of 9.8 years (SD=0.68) and 46 parents of the same children. The measuring instruments used in the research were questionnaires, IPAQ - SF for parents and PAQ - C for male and female students. The Pearson correlation coefficient was used to determine the relationship between children's physical activity and parents. Kruskal-Wallis ANOVA was used to determine the differences between active and inactive children regarding the activity of their parents. Kruskal-Wallis ANOVA was also used to determine differences in morphological characteristics between children. Spearman's correlation coefficient was used to determine the connection between parental and child sports.

## Results and discussion

No differences were found in parents' physical activity concerning the level of education ( $F=0.70$ ;  $p=0.60$ ), nor were there any differences in morphological characteristics concerning the level of education (BH  $F=0.61$ ;  $p=0.66$ , BWF=0.31;  $p=0.87$  and IBM 0.40;  $p=0.81$ ). However, there is no significant correlation between parents and child's physical activity level.

## Conclusion

The results show that of the total number of parents in the study, 39.13% were not sufficiently active, 41.30% were moderately active, and 19.57% were sufficiently active. On the other hand, of the total number of children in the study, 36.96% are not active enough, 50.00% is moderately active, and 13.04% are sufficiently active. Considering the approximate percentage of active, moderately active, and insufficiently active children and parents, it is possible that the pattern of parental behavior is not a criterion that will influence children's activity, but it is also influenced by other endogenous and exogenous factors.

**Key words:** children of younger school age, parents, sport, physical activity

## References

- Ajman, H., Dapic Štriga, S. i Novak, D. (2015). *Pouzdanost kratke verzije međunarodnog upitnika tjelesne aktivnosti za Hrvatsku*. Hrvatski športskomedicinski vjesnik, 30 (2), 87-90.
- Bates, H. (2006). *Daily Physical Activity for Children and Youth: A Review and Synthesis of the Literature*.



# **Comparison of the effectiveness of different methodological and organizational forms of education in the process of non-swimmer training for children of younger school age**

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## **Introduction**

Water games and swimming are an almost unavoidable activity that children enjoy from an early age. Swimming can achieve significant preventive-corrective and therapeutic effects on the child's body (Topuzov, 1999). The goal of this research was to compare the effectiveness of different intensities and methodically organizational forms of work for psychological adaptation and learning of basic swimming elements of children who are not adapted (non-swimmers) of younger school age.

## **Method**

The test was conducted on a sample of 100 children, both sexes, aged 9±0.6 years. The program's length was 10 hours, and the respondents were divided into two groups. The first group (G1) was included for a period of 5 days for 120 minutes, while the second group (G2) was included in a period of 10 days for 60 minutes. To assess the level of adaptability to water and elementary knowledge of swimming, 11 variables were used.

## **Results and discussion**

The results of testing show that both intensive programs had positive effects on the respondents, which confirms the statements of similar researches (Grčić-Zubčević et al. 2002). In five variables G1 showed better results: lunge and exhalation under water (IPV<, 001); underwater viewing (GPV<, 000); diving in shallow water (SUPV<, 000); floating on the back (PNL<, 000); floating on the stomach (PNS<, 000), while the G2 showed better results in elementary swimming (EMPMET<, 001). For the G1 the concept was intensive games in and under water, while G2 due to the shorter period had a structured and complex training focused on elementary swimming.

## **Conclusion**

Based on the results, it can be concluded that intensive programs are very effective for psychological adaptation and basic movement in water for beginners. For a relatively short period with a usage of only necessary resources, they create good foundations for continued learning and improving swimming skills.

**Key words:** non-swimmer training, swimming, education

## **References**

- Grčić-Zubčević, N., Čulina, M., Leko G. (2002). Analysis of the progress of learning to swim in on-swimmers. 11. Summer school of kinesiologists of the Republic of Croatia, Rovinj, 57-59.
- Topuzov, I. (1999). Classification of the sports depending on the oxidative stress. International Scientific Congress "Sport - Stress - Adaptation", Bulgaria, 150 - 152.

# The relationship between the perceived motivational climate in the class and the students' motivation and their experience of physical education classes

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## Introduction

The motivational climate in the class created by the physical education (PE) teacher is an important factor in the formation of students' motivational patterns. A task-oriented climate emphasizes personal development, effort, and individual progress, while an ego-oriented climate emphasizes achievement, high ability, and peer comparison among students. The main goal of the research was to examine the connection between the perceived motivational climate in the class and student motivation (from the perspective of self-determination theory) and the experience of PE. Additional goals were to investigate gender and age differences between students and the relationship between perceived motivational climate and students' motivation in PE classes with engaging in physical activities outside of school.

## Method

The research was conducted on a sample of 711 primary and secondary school students. The instruments used were the Learning and Performance Orientations in Physical Education Classes Questionnaire (LAPOPECQ), the Self-Regulation Questionnaire and a questionnaire with questions about gender and physical activities outside of school. Correlation analysis and t-test for independent samples were used for data processing.

## Results and discussion

The results of the correlation analysis showed that the task-oriented motivational climate is positively related to the transitional and intrinsic forms of student motivation (identified motivation,  $r=.38$ ,  $p<.01$ , intrinsic motivation,  $r=.36$ ,  $p<.01$ ) and with a more positive experience of PE teaching ( $r=.37$ ,  $p<.01$ ), while the ego-oriented motivational climate is related to amotivation and external forms of motivation (amotivation,  $r=.27$ ,  $p<.01$ , extrinsic motivation,  $r=.31$ ,  $p<.01$ ). The t-test for independent samples showed that male students, younger students and those who play sports more often perceive that the motivational climate in their classes is focused on the ego, but also that they have a more developed intrinsic motivation in PE classes.

## Conclusion

In order to create positive motivational patterns related to student participation in PE, but also in physical activities outside of school, a task-oriented motivational climate should be developed in teaching, but the motivational potential of an ego-oriented climate should not be neglected either.

**Key words:** motivational climate, self-regulation, students, physical education

## References

- Jaakkola, T., Yli-Piipari, S., Barkoukis, V., Liukkonen, J. (2015). Relationships among perceived motivational climate, motivational regulations, enjoyment, and PA participation among Finnish physical education students. *International Journal of Sport and Exercise Psychology*, 15(3), 1-18.
- Papaioannou, A. (1994). Development of a questionnaire to measure achievement orientations in physical education. *Research Quarterly for Exercise and Sport*, 65(1), 11-20.

# Povezanost opažene motivacione klime u odeljenju sa motivacijom učenika i njihovim doživljajem nastave fizičkog vaspitanja

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## Uvod

Motivaciona klima u odeljenju koju kreira nastavnik fizičkog vaspitanja (FV) je važan faktor formiranja motivacionih obrazaca učenika. Klima usmerena na zadatak stavlja naglasak na lični razvoj, trud i individualni napredak, dok klima usmerena na ego u prvi plan ističe postignuće, visoke sposobnosti i međusobno poređenje učenika. Osnovni cilj rada bio je da se ispita povezanost opažane motivacione klime u odeljenju sa motivacijom učenika (posmatranoj iz igla teorije samoodređenja) i doživljajem FV. Dodatni ciljevi bili su proveriti polne i uzrasne razike između učenika i povezanost opažane motivacione klime i motivacije učenika u nastavi FV sa bavljenjem fizičkim aktivnostima van škole.

## Metod

Istraživanje je sprovedeno na uzorku od 711 učenika osnovnih i srednjih škola. Primenjeni su instrumenti *Upitnik za merenje usmerenosti na učenje i postignuće u fizičkom vaspitanju* (Learning and Performance Orientations in Physical Education Classes Questionnaire – LAPOPECQ), *Upitnik samoodređenja* (Self-Regulation Questionnaire) i upitnik sa pitanjima o polu i bavljenju fizičkim aktivnostima van škole. Za obradu podataka primenjena je korelaciona analiza i t-test za nezavisne uzorke.

## Rezultati sa diskusijom

Rezultati korelacione analize su pokazali da je motivaciona klima usmerena na zadatak pozitivno povezana sa prelaznim i unutrašnjim oblicima motivacije učenika (identifikovana motivacija,  $r=.38$ ,  $p<.01$ , intrinzična motivacija,  $r=.36$ ,  $p<.01$ ) i sa pozitivnijim doživljajem nastave FV ( $r=.37$ ,  $p<.01$ ), dok je motivaciona klima usmerena na ego povezana sa amotivacijom i spoljašnjim oblicima motivacije (amotivacija,  $r=.27$ ,  $p<.01$ , ekstrinzična motivacija,  $r=.31$ ,  $p<.01$ ). T-testom za nezavisne uzorke pokazano je da učenici muškog pola, mlađi učenici i oni koji se bave sportom češće opažaju da je motivaciona klima u njihovim odeljenjima usmerena na ego, ali i da imaju razvijeniju unutrašnju motivaciju u nastavi FV.

## Zaključak

U cilju kreiranja pozitivnih motivacionih obrazaca vezanim za učestvovanje učenika u FV, ali i u fizičkim aktivnostima van škole, u nastavi treba razvijati motivacionu klimu usmerenu na zadatak, ali ne treba zanemariti ni motivacione potencijale klime usmerene na ego.

**Ključne reči:** motivaciona klima, samoodređenje, učenici, fizičko vaspitanje

## Literatura

Jaakkola, T., Yli-Piipari, S., Barkoukis, V., Liukkonen, J. (2015). Relationships among perceived motivational climate, motivational regulations, enjoyment, and PA participation among Finnish physical education students. *International Journal of Sport and Exercise Psychology*, 15(3), 1-18.  
Papaioannou, A. (1994). Development of a questionnaire to measure achievement orientations in physical education. *Research Quarterly for Exercise and Sport*, 65(1), 11-20.

# Examining the attitudes of secondary school students on physical education

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## Introduction

Physical education (PE) classes have an important role in promoting and enhancing students' physical activity. However, their attitudes towards physical education are often different – positive or negative. The aim of this paper was to examine and analyze the attitudes of secondary school students in the Republic of Serbia regarding physical education classes, as well as to determine which factors influence their attitudes – age, gender, grade they attend, as well as whether they practice any sport.

## Method

A questionnaire was developed for the purpose of this research, and secondary school students filled it in electronic form in 2022 and 202 responses were collected. The questionnaire consisted of 20 questions. The first part of the questionnaire included demographic questions, while the second part investigated students' attitudes towards physical education using a scale adapted from Arabaci (2009) and Subramaniam & Silverman (2007). The attitudes were measured on Likert scale from 1 to 5 through two variables – enjoyment in PE classes and perceived usefulness of PE. Descriptive statistics was used for data analysis.

## Results and discussion

The results of the research showed that secondary school students have positive attitudes towards physical education, whereby students almost equally rated their enjoyment in PE (M=3.89) and the perceived usefulness of PE (M=3.85). Contrary to the results of earlier studies (Lukić et al., 2019; Yli-Piipari et al., 2011), the oldest students have the most positive attitudes towards PE. Boys have a more positive attitude towards physical education than girls, similar to the results obtained by other researchers (Vučeraković, 2022; Lukić et al., 2019; Ikeda et al., 2018). Students who practice a sport enjoy PE classes more than those who don't.

## Conclusion

Students' attitudes have a significant impact on the effective implementation of physical education classes, on their acquisition of knowledge and improvement of motor skills. The results of this research can be used to improve PE classes in secondary schools in order to adapt their content to students' needs, interests, gender and age.

**Key words:** physical education, students, secondary school

## References

- Ikeda, T., Aoyagi, O., Han, N. I., Choi, T. H., Koo, K. S., Seo, Y. H. (2018). Motivation towards Physical Activity in Late Childhood. 26(3), 265-272.
- Radisavljević, S., Višnjić, D. (2003). Stavovi učenika prema nastavi fizičkog vaspitanja. Naučni skup „Interdisciplinarni aspekti fizičke aktivnosti“, Godišnjak, br. 12, Fakultet sporta i fizičkog vaspitanja, Beograd, str.141-153.

# Ispitivanje stavova učenika srednjih škola o nastavi fizičkog vaspitanja

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## Uvod

Nastava fizičkog vaspitanja ima važnu ulogu u promovisanju i pospešivanju fizičke aktivnosti učenika. Međutim, učenici često imaju različite stavove prema fizičkom vaspitanju, bilo pozitivne ili negativne. Cilj ovog istraživanja je bio da ispita i analizira stavove učenika srednjih škola u Republici Srbiji o nastavi fizičkog vaspitanja, kao i da utvrdi od kojih faktora zavise stavovi učenika – starost, pol, razred koji pohađaju, kao i da li treniraju neki sport.

## Metod

Za potrebe ovog istraživanja kreiran je upitnik koji su učenici srednjih škola popunjavali u elektronskoj formi u toku 2022. godine, i prikupljeno je ukupno 202 odgovora. Upitnik je sadržao 20 pitanja. Prvi deo upitnika činila su demografska pitanja, a drugi deo upitnika je ispitivao stavove učenika prema fizičkom vaspitanju koristeći skalu koja je prilagođena od Arabaci (2009) i Subramaniam & Silverman (2007). Stavovi učenika mereni su kroz dve varijable – u kojoj meri se učenici dopada nastava fizičkog vaspitanja i u kojoj meri smatraju da im je nastava fizičkog vaspitanja korisna, pri čemu je korišćena Likertova skala od 1 do 5. Korišćena je Likertova skala od 1 do 5. Za analizu podataka primenjena je deskriptivna statistika.

## Rezultati sa diskusijom

Rezultati istraživanja pokazali su da su stavovi učenika srednjih škola prema nastavi fizičkog vaspitanja pozitivni, pri čemu se učenici približno podjednako dopada nastava iz ovog predmeta ( $M=3.89$ ) i smatraju da je za njih nastava korisna ( $M=3.85$ ). Suprotno rezultatima ranijih istraživanja (Lukić et al., 2019; Yli-Piipari et al., 2011), najbolje stavove prema fizičkom vaspitanju imaju najstariji učenici. Dečaci imaju pozitivniji stav prema fizičkom vaspitanju od devojčica, slično rezultatima do kojih su došli drugi autori (Vučeraković, 2022; Lukić et al., 2019; Ikeda et al., 2018). Učenicima koji treniraju neki sport više se dopada fizičko vaspitanje nego onima koji ne treniraju.

## Zaključak

Stavovi učenika imaju značajan uticaj na efektivno sprovođenje časova nastave fizičkog vaspitanja, na njihovo usvajanje znanja i unapređenje motoričkih sposobnosti. Rezultati ovog istraživanja mogu se koristiti za unapređenje nastave iz ovog predmeta u srednjim školama u cilju prilagođavanja sadržaja potrebama, interesovanjima, polu i uzrastu učenika.

**Ključne reči:** fizičko vaspitanje, učenici, srednja škola

## Literatura

Ikeda, T., Aoyagi, O., Han, N. I., Choi, T. H., Koo, K. S., Seo, Y. H. (2018). Motivation towards Physical Activity in Late Childhood. 26(3), 265-272.

Radisavljević, S., Višnjić, D. (2003). Stavovi učenika prema nastavi fizičkog vaspitanja. Naučni skup „Interdisciplinarni aspekti fizičke aktivnosti“, Godišnjak, br. 12, Fakultet sporta i fizičkog vaspitanja, Beograd, str.141-153.

# **Unstable compared to stable core exercises improve muscular endurance in preadolescents and adolescents via prolonged neuromuscular adaptation: an eight-month randomized trial**

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## **Introduction**

Although previous findings indicated the benefits of a core strength/muscular endurance training in preadolescents and adolescents, there is a lack of evidence regarding effects of a long-term core training in unstable conditions. The purpose of this study was to compare the effects of core training in stable versus unstable body positions on core and upper body strength/muscular endurance in non-trained children aged 11-14.

## **Method**

Participants were randomly assigned to either stable (SC) or unstable (UC) core-exercise group and assessed at baseline, four, and eight months for sit-ups, dynamic trunk extension, static trunk extension, and push-ups. Repeated measures ANOVA, with time as a within factor and exercise group, age, and gender as between factors, was employed for data analysis.

## **Results and discussion**

In analyzing significant interactions, post-hoc comparisons indicated significant four- and eight-month improvement ( $p < 0.01$ ) in both SC and UC for all measures except dynamic trunk extension in 11-year-old males in SC after four months (mean difference = 0.131,  $p = 1.00$ ). Further, post-hoc comparisons showed greater absolute improvements after the eight-month training in UC compared to SC for all measures, ages, and both genders ( $p \leq 0.01$ ), as well as greater relative improvements (differences in Cohen's  $d$  between UC and SC ranged from 0.08 to 1.58), except for Trunk extension in 11- and 12-year-old participants. However, the differences between SC and UC in four-month training effects were somewhat inconsistent.

## **Conclusion**

These results point out that core exercises in unstable compared to stable conditions have a greater capacity for long-term improvement of core and upper body strength/muscular endurance in non-trained preadolescents and adolescents.

**Key words:** children, resistance training, abdominal strength, lower back strength, muscular endurance.

## **References**

Allen BA, Hannon JC, Burns RD, Williams SM (2014). Effect of a core conditioning intervention on tests of trunk muscular endurance in school-aged children. *Journal of Strength and Conditioning Research* 28, 2063–2070.  
Behringer M, vom Heede A, Yue Z, Mester J (2010). Effects of resistance training in children and adolescents: a meta-analysis. *Pediatrics* 126, e1199–e1210.

# **Vežbe za mišiće jezgra u nestabilnim uslovima unapređuju mišićnu izdržljivost preadolescenata i adolescenata putem produžene nervno-mišićne adaptacije: osmomesečna randomizovana studija**

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## **Uvod**

Iako dosadašnji nalazi ukazuju na koristi treninga snage i izdržljivosti mišića jezgra preadolescenata i adolescenata, nedostaju dokazi o efektima dugotrajnijeg treninga za jezgro u nestabilnim uslovima – položajima. Cilj ovog istraživanja je bio da se uporede efekti treninga za jezgro u stabilnim i nestabilnim položajima tela na snagu i mišićnu izdržljivost jezgra i gornjeg dela tela netrenirane dece uzrasta 11 do 14 godina.

## **Metod**

Ispitanici su randomizovano raspoređeni u grupu koja je vežbala mišiće jezgra u stabilnim položajima (SC) i grupu koja je vežbala u nestabilnim položajima (UC), a testirani su pre početka programa vežbanja, nakon 4 meseca i nakon 8 meseci testovima ležanje – sed za 30 sekundi, dinamičko opružanje trupa, statičko opružanje trupa i testom sa sklekovima. Za analizu podataka je primenjena ANOVA sa ponovljenim merenjima, uz vreme kao faktor „unutar grupa“, dok su faktori razlika među grupama bili: stabilni/nestabilni položaji, uzrast i pol.

## **Rezultati sa diskusijom**

Analiza značajnih interakcija post-hok poređenjima je pokazala napredak nakon 4 i 8 meseci ( $p < 0.01$ ), u obe grupe vežbača, u svim merenim varijablama, osim u testu dinamičko opružanje trupa, nakon 4 meseca, za uzorak dečaka uzrasta 11 godina koji su vežbali u stabilnim položajima (srednja razlika 0.131,  $p = 1.00$ ). Nadalje, post-hok poređenja su pokazala veća apsolutna poboljšanja nakon 8 meseci treninga u nestabilnim položajima u odnosu na trening u stabilnim položajima, za sve varijable, uzraste i oba pola ( $p \leq 0.01$ ), kao i relativna poboljšanja (razlike u Koenovom d pokazatelju su bile u rasponu od 0.08 do 1.58), osim za statičko opružanje trupa za učenike oba pola, uzrasta 11 i 12 godina. Ipak, razlike između grupa koje su vežbale u različitim uslovima nisu bile konzistentne nakon 4 meseca.

## **Zaključak**

Ovi rezultati ukazuju da vežbe za jezgro u nestabilnim položajima imaju veći potencijal za dugoročne efekte na poboljšanje mišićne snage i izdržljivosti jezgra i gornjeg dela tela netreniranih preadolescenata i adolescenata, nego što imaju vežbe u stabilnim položajima.

**Ključne reči:** deca, trening sa opterećenjem, snaga trbušnih mišića, snaga mišića donjih leđa, mišićna izdržljivost.

## **Literatura**

Allen BA, Hannon JC, Burns RD, Williams SM (2014). Effect of a core conditioning intervention on tests of trunk muscular endurance in school-aged children. *Journal of Strength and Conditioning Research* 28, 2063–2070.  
Behringer M, vom Heede A, Yue Z, Mester J (2010). Effects of resistance training in children and adolescents: a meta-analysis. *Pediatrics* 126, e1199–e1210.

# Differences in exercise motivation between kinesiology students and recreational sport participants

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## Introduction

Sedentary lifestyle is one of the biggest problems of modern society (Šimunić and Barić, 2011). With a change in people's lifestyles and contemporary society, there has been a decrease in physical activity. If we want to change this, and to encourage people to embrace an active lifestyle, it is necessary to investigate reasons why do people exercise. But it is not possible to have the complete picture of motivational structure if we do not investigate motivation of those who exercise a lot and studying kinesiology and those people who exercise only temporarily and irregularly. The aim of this study was to establish motivational structures and investigate gender differences between 124 kinesiology students and 109 recreational exercisers (107 males and 126 females) in early adulthood engaged in some kind of physical activity.

## Method

The study was conducted on 233 participants via online questionnaires on the social networks. The participants provided information about sociodemographic characteristics and completed the authors version of exercise motivation inventory consist of 8 motives: positive health, body shape, challenge and enjoyment, hanging with friends, competition, strength, nimbleness, others (stress management, increasing power and endurance, etc.). Analysis of variance was used to determine whether there is a statistically significant difference in the motivational structure of kinesiology students and recreational exercisers.

## Results and discussion

Descriptive parameters were calculated and given graphically representation of motives for exercise of each group separately. The results showed that they are recreational exercisers the least important motives for exercising are hanging with friends, strength and nimbleness. As the most important motivations for exercise included positive health (30,3%), challenge and enjoyment, and body shape. Kinesiology students exercise because of challenge and enjoyment (26,6%) and positive health; the least important reasons for them are hanging with the friends and nimbleness (no answer). Kinesiology female students exercise because of challenge and enjoyment (30,9%) and health; the least important reasons for them are nimbleness, strength and hanging with friends. Recreational female exercise because of health (24 %) and body shape; the least important reason for them is competition (1,2 %).

## Conclusion

This research was conducted to find out motives that could be potential triggers for inclusion of people who exercise or only occasionally exercise. The goal was to identify the motivational structure of such exercisers and investigate differences in motivation with regard to gender.

**Key words:** motivation, kinesiology students, health

## References

Šimunić, V. i Barić, R. (2011). Motivacija za vježbanje povremenih rekreativnih vježbača: spolne razlike. *Hrvatski športskomedicinski vjesnik*, 26 (1), 19-25.



# The macro didactic structure between two teaching models of physical education depending on the teaching staff

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## Introduction

Modern teaching models, created in order to overcome the shortcomings of the traditional system and represent a kind of attempt to innovate the teaching process. One of such models is the "tandem teaching of physical education in grade school". The preparation of the teaching precedes the planning, should be understood as a complex of various mental and practical-operational activities aimed at providing necessary and relevant conditions for the correct, efficient organization and implementation of the educational activity.

## Method

The total number of respondents in this research is 220, where 104 are respondents who teach physical education in a model - independent class teacher, 116 are respondents who teach physical education in a model - tandem teaching (with a physical education teacher included). The macro didactic structure was assessed with a survey questionnaire that determines the qualitative components of the macro structure of physical education teaching in the first educational period, through the meaning of: the initiation of the teacher and the initiation of the student, the course and realization of the teaching, the educational effects in the teaching, compatibility or prior knowledge, the role and status of the student and the role and status of the teacher, the language and speech used in the teaching, verbal and non-verbal communication between subjects, climate and atmosphere during teaching and technological support.

## Results and discussion

From the data analysis, it can be seen that the teachers from the two models do not show any differences in the application and significance of their incorporation or structuring for one year and in their global articulation (shaping) of the teaching material (operational tasks of separate thematic areas), in their global articulation of organizational forms of work and in their global distribution by estimated and numerical representation, as well as in their planning within annual (seasonal) or thematic units.

## Conclusion

There is no statistically significant difference in the application and meaning of the macro-method didactic components between the two models of physical education depending on the teaching staff.

**Key words:** Models of physical education, macro didactic structure, students, differences and relations.

## References

- Anastasovski, A. (1999). *Metodika na fizičko vospitanie*. Prosvetno delo, Skopje.  
Vilotijević, M. (1999). *Didaktka: Organizacija nastave*. Beograd: Naučna knjiga.  
Child, D. (2004). *Psychology and the Teacher*. London: Continuum

# Correlation between anthropometric characteristics and swimming speed among kinesiology students

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## Introduction

Anthropometry is factor that significantly affects swimming performance. Accordingly, the aim of this paper was to determine the relationship between anthropometric characteristics and swimming speed with students of kinesiology.

## Method

The sample of variables consisted of eight swimming disciplines at 25 and 50 meters (butterfly, backstroke, breaststroke, crawl) and 7 anthropometric measures (body height, body mass, upper arm circumference, arm length, shoulder width, hip width, and foot length). Canonical correlation analysis was used to determine the relationship between the two groups variables.

## Results and discussion

There is no significant correlation between morphological and motor variables. Research by Bielec and Jurak (2019) on a sample of 41 swimmers looked at the connection between anthropometric characteristics (body height, hand length, hand width, arm span) and the results in the 50-meter freestyle and 200-meter medley. They found a significant correlation between body height, arm span and hand length according to freestyle results. In contrast to these results, the correlation analysis of the association of various anthropometric parameters with the results of the 25 and 50-meter freestyle in this paper did not prove any significant association.

## Conclusion

The obtained results are certainly useful because they show that measurements on students do not give significant results in terms of predicting success in sports, and since this is precisely the case of a diverse sample and equally below-average results in terms of motor skills, i.e., swimming speed.

**Key words:** swimming, anthropological status, students

## References

- Özkadı, T., Demirkan, E., Can, S., Alagöz, I., & Demir, E. (2022). Contribution of motoric and anthropometric components to the fifty-meter four swimming styles: Model approaches. *Science & Sports*, 37(4), 316-e1.
- Bielec, G., & Jurak, D. (2019). The relation between selected anthropometric variables and the sports results of early pubescent swimmers. *Baltic Journal of Health and Physical Activity*, 11(1), 13.

# Comparative analysis of artistic gymnastics curriculum, conducted on physical education classes, 15 years apart

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## Introduction

Previous research has shown that the artistic gymnastics, elementary and high school curriculum is conducted to a certain extent, but not as it was determined. Third year students of Faculty of Sports and Physical Education, fill in a questionnaire that shows the artistic gymnastics content that they have done on their physical education classes in elementary and high school. The subject of this research are the artistic gymnastics contents from the elementary and high school curriculum of Republic of Serbia. The goal of this research is to determine eventual changes that occurred in the extent of the conducted artistic gymnastics contents from the curriculum, in the span of 15 years (from 2006 to 2021).

## Method

This is a descriptive, qualitative research. A special designed questionnaire was used for data gathering. Mann – Whitney test for independent samples for used to analyze the answers that were gathered with the questionnaires from 2006 and 2021, as well as the standard statistical procedures. The data were analyzed with SPSS 20.0 statistical package.

## Results and discussion

After gathering data from the 2006. and 2021. questionnaires, it can be concluded that the artistic gymnastics contents from the curriculum, were conducted in less extent than it was determined by the curriculum.

## Conclusion

Determining factors that negatively affect the rate of conducted contents from the curriculum, are not fully known, but they have definitely negatively affected the extent to which the contents are conducted. Potential problems that may occur, are related to the reduced implementation of teaching content, which results in insufficient preparation of students for the sports gymnastics contents for all elementary and high school grades.

**Key words:** sports gymnastics, curriculum, teaching implementation

## References

- Kocić Paić, S. et al. (2018). Degree of conducted artistic gymnastics contents from the physical education curriculum, on physical education classes in elementary school. Faculty of Sports and Physical Education, Belgrade.
- Radojević, J. (1998). For adequate conduction of physical education in lower elementary school grades. *Physical culture*, 52 (2-4), 154-160.

# Usporedna analiza primenjenih nastavnih sadržaja iz programa sportske gimnastike na časovima fizičkog vaspitanja u školi, u razmaku od 15 godina

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## Uvod

Dosadašnja istraživanja pokazala su da se sadržaji iz sportske gimnastike koji su predviđeni nastavnim planom i programom za osnovnu i srednju školu Republike Srbije, realizuju u određenoj meri, ali ne i u predviđenoj. Studenti treće godine Fakulteta sporta i fizičkog vaspitanja, na početku nastave na predmetu Teorija i metodika sportske gimnastike, popunjavaju upitnik koji daje uvid u anamnezu primenjenih nastavnih sadržaja iz sportske gimnastike koje su studenti realizovali tokom nastave na časovima fizičkog vaspitanja. Predmet rada su sadržaji sportske gimnastike iz nastavnog plana i programa Republike Srbije za osnovnu i srednju školu. Cilj rada je da se utvrde eventualne promene koje su nastale stepenu njihove primene u periodu od 15 godina (od 2006 do 2021).

## Metod

Primenjeno je kvalitativno istraživanje, deskriptivnog tipa. Za prikupljanje podataka korišćen je posebno konstruisan instrument – upitnik, sa 20 pitanja. Za analizu odgovora dobijenih korišćenjem upitnika 2006. i upitnika korišćenog 2021. godine, korišćen je Mann – Whitney test za nezavisne uzorke kao i standardne statističke procedure. Podaci su analizirani statističkim paketom SPSS 20.0.

## Rezultati sa diskusijom

Nakon prikupljanja i analize podataka iz sprovedenih upitnika 2006. i 2021. godine, može se zaključiti da su se nastavni sadržaji sportske gimnastike realizovali u manjoj meri nego što je to predviđeno programom.

## Zaključak

Faktori zbog kojih se sadržaji sportske gimnastike na časovima fizičkog vaspitanja realizuju u nepotpunoj meri, nisu u potpunosti poznati, ali su zasigurno uticali na nedovoljnu realizaciju programa. Potencijalni problemi koji mogu nastati, a povezani su sa smanjenom realizacijom nastavnih sadržaja, rezultiraju nedovoljnom pripremljenošću učenika za program sportske gimnastike svim razredima osnovne i srednje škole.

**Ključne reči:** sportska gimnastika, nastavni plan i program, realizacija nastave

## Literatura

Kocić Pajić, S. et al. (2018). Stepen realizacije sadržaja programa sportske gimnastike na časovima fizičkog vaspitanja u osnovnoj školi. Fakultet sporta i fizičkog vaspitanja, Beograd.  
Radojević, J. (1998). Za adekvatnu nastavu fizičkog vaspitanja u mladem školskom uzrastu. Fizička kultura, 52 (2-4), 154-160.

# Differences in the adoption of skiing technique in relation to motor development in children

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## Introduction

In children of the same age, there can be significant differences in morphological characteristics, as well as motor and functional abilities, due to the different speeds of biological development, which has a different effect on the adoption of skiing techniques.

## Method

The work is empirical and based on theoretical knowledge from the field of teaching methodology in working with children and the legality of children's biological, psychological, and social development.

## Results and discussion

When adopting the skiing technique, progress is quickly noticed in some children. In contrast, some children show little progress at the beginning of the training but, over time, achieve progress that often exceeds expectations. According to the theoretical model of motor development, the fundamental motor skills of preschool children are divided into initial, elementary, and mature levels. The mature stage is characterized by mechanically efficient, coordinated, and controlled movements. A child can be in the mature phase when it comes to certain movement tasks, in others in the elementary phase, and in some in the initial phase. Due to the difference in the development of motor skills, a sequence in the selection of motor information and the demands of the selected content is necessary. When training children's skiing technique, basic motor movements, phylogenetically determined - walking, running, crawling, and rolling, which are developmentally closest to the child, should be included and then gradually modified into more complex and demanding movement tasks, such as coordination and balance.

## Conclusion

Knowing the basic natural tendencies of a child's development, the fundamental laws of learning to ski, and adequately selected tasks and exercises prevent improper adoption of movement stereotypes during skiing training in children. It is also necessary to know the integrity of the child's development, the structure of the child's motor space, the principles of psychomotor learning, the technique and methodology of skiing, and the pedagogical and didactic peculiarities of learning to ski for children.

**Key words:** motor development, skiing, children.

## References

- Gallahue D. L., Ozmun J. C. (2006). *Understanding Motor Development: Infants, Children, Adolescents, Adults* (6th ed). New York: McGraw-Hill.
- Pišot R. (2000). The analysis of the structure of six-and-a-half year old children's motor space in the light of its development as a whole. *Acta Universitatis Carolinae, Kinanthropologica*, 36(1);67-78.

# Razlike u usvajanju tehnike skijanja u odnosu na motorni razvoj kod dece

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## Uvod

Kod dece istog uzrasta mogu postojati velike razlike u morfološkim obeležjima, kao i motoričkim i funkcionalnim sposobnostima zbog različite brzine biološkog razvoja, što različito utiče i na usvajanje tehnike skijanja.

## Metod

Rad je empirijskog karaktera i bazira se na teorijskim saznanjima iz oblasti metodike nastave u radu sa decom i zakonitosti dečjeg svestranog biološkog, psihološkog i socijalnog razvoja.

## Rezultati sa diskusijom

Prilikom usvajanja tehnike skijanja, kod pojedine dece se brzo uočava napredak. Nasuprot njima ima i onih koji u početku obuke ne pokazuju brzi napredak ali vremenom postižu napredak često iznad očekivanja. Prema teoretskom modelu motornog razvoja fundamentalne kretne veštine dece predškolskog uzrasta dele se na inicijalni, elementarni i zreli stepen. Zreli stepen karakterišu mehanički efikasna, koordinisana i kontrolisana kretanja. Dete može biti u zreloj fazi kada je reč o pojedinim kretnim zadacima, a u drugim u elementarnoj fazi a u nekim u inicijalnoj fazi. Zbog razlike u razvoju motoričkih sposobnosti neophodna je postupnost u izboru motoričkih informacija i zahtevnosti izabranih sadržaja. Pri obuci tehnike skijanja kod dece treba uključivati bazična motorička kretanja, filogenetski uslovljena - hodanje, trčanje, puzanje, valjanje, koja su detetu razvojno najbliža i zatim ih postepeno modifikovati u složenije i zahtevnije kretne zadatke, tipa koordinacije i ravnoteže.

## Zaključak

Poznavanje osnovnih prirodnih tendencija razvoja deteta, osnovnih zakonitosti učenja skijanja, kao i adekvatno izabrani zadaci i vežbe, sprečava nepravilno usvajanje kretnih stereotipa pri obuci skijanja kod dece. Takođe je neophodno poznavanje integriteta razvoja deteta, strukture motoričkog prostora deteta, principa psihomotornog učenja, tehnike i metodike skijanja i pedagoško-didaktičke posebnosti učenja skijanja dece.

**Ključne reči:** motorički razvoj, skijanje, deca

## Literatura

Gallahue D. L., Ozmun J. C. (2006). Understanding Motor Development: Infants, Children, Adolescents, Adults (6th ed). New York: McGraw-Hill.

Pišot R. (2000). The analysis of the structure of six-and-a-half year old children's motor space in the light of its development as a whole. Acta Universitatis Carolinae, Kinanthropologica, 36(1);67-78.

# Some relationships of elementary games and motor skills in early school age students

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## Introduction

The top results in the educational process are due to the quality plan and program of the educational contents and their relationship. In order to create such a program, it is necessary to take into account the abilities and requirements of the individual (student) and the teaching content, as well as the current state of the relative abilities and knowledge of the student and the class as a whole. The main objectives of the research are: determination of the application of elementary games in the teaching of physical and health education, examination of the impact of games on students' motor skills and defining parameters in the contribution of the game of the students from the early school age.

## Method

The population from which the sample was derived is defined as a stratified sample, teachers - employed in primary education (I to III grades) from the city of Skopje, as well as students from those grades. The data was collected with a Likert-type survey questionnaire, which was transformed into parametric data that allow the application of appropriate statistical procedures. The questionnaire consists of a total of 10 questions (only for teachers). A set of standardized tests was used to check students' motor skills. Standard central and dispersion statistical parameters, as well as a correlation matrix, were calculated for each applied variable.

## Results and discussion

The results show the importance of using games in teaching and their holistic connection with the motor skills. Teachers believe that games have the greatest general impact on students' motor skills according to the data from the correlation matrix (.64), while the other dimensions have a relatively medium connection of .40-.50 (speed, coordination, balance, precision). The opinion of the teachers is specific that there is no need for exercises to shape the body of the students to realize this teaching content, which in no way coincides with the programmatic and structural guidelines for holding a lesson in physical and health education.

## Conclusion

Elementary games are very often used in the teaching of PE. They have a significant impact on general motor skills and socialization of students. Teachers are of the opinion that speed, coordination, balance and precision are mainly developed through the use of elementary games. We believe that it is necessary to introduce additional training that will be conducted by the professional teaching staff of the Faculty of Pedagogy, Sveti Kliment Ohridski-Skopje, Republic of North Macedonia.

**Key words:** teachers, attitudes, motor dimensions, students

## References

Boyd, S. (2014). Extracurriculars Are Central to Learning. <http://www.usnews.com/> ret. 25.03 2016

**APPLIED SPORTS SCIENCES /  
PRIMENJENE SPORTSKE NAUKE**



## INTRODUCTORY LECTURE

### **Horseback riding school as an extracurricular and out-of-school activity – Case study**

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The importance of physical activity and movement is an increasingly common topic that is widely talked about, and its benefits are often pointed out. Every physical activity brings something good and positive to the person performing it. Man is a being of nature and returning to nature can show us who we really are and where we belong. Horseback riding as an activity is beneficial in many aspects. Horseback riding implies the synergy of the rider and the horse, their continuous appreciation and mutual respect. If one fails, so does the other. A horseback riding school is the beginning and one of the important steps toward equestrian sports. It introduces us to the equestrian world and teaches us how to treat a horse and to do so respectfully. It takes a lot of hard work and dedication to achieve results, as in any other sport.

The main goal of this study was to determine whether a person who had no previous contact with equestrian sports could adopt the elements of a horseback riding school in 35 45-minute class periods and be trained to manage a horse independently.

Set hypotheses: a 35 45-minute class period is a sufficient time period to implement the newly-proposed plan and program of the horseback riding school as an extracurricular and out-of-school activity in physical education teaching; The newly proposed program enabled the positive acquisition of the skills which are the basics of horseback riding. Both hypotheses are accepted.

Given that this paper is a case study with only one participant, which is its limiting factor, it is recommended to increase the number of participants in further research and to implement the same newly-proposed program using a larger sample of participants. Even though this is a case study, the horseback riding school can be recommended as an acceptable form of extracurricular and out-of-school sports activity in physical education teaching.

**Keywords:** horseback riding, kinesiology operator, learning outcomes

## UVODNO PREDAVANJE

### Škola jahanja kao vannastavna i vanškolska aktivnost – Studija slučaja

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Važnost fizičke aktivnosti i kretanja je sve češća tema o kojoj se naveliko priča, najčešće uz isticanje njene koristi. Svaka fizička aktivnost donosi nešto dobro i pozitivno onome ko je obavlja. Čovek je biće prirode i povratak prirodi može nam pokazati ko smo zaista i gde pripadamo. Jahanje kao aktivnost je korisno u mnogim aspektima. Jahanje podrazumeva sinergiju jahača i konja, njihovo neprekidno uvažavanje i međusobno poštovanje. Ako jedno ne uspe, ne uspe i drugo. Škola jahanja je početak i jedan od važnih koraka ka konjičkom sportu. Uvodi nas u svet konjaništva i uči nas kako da se ponašamo prema konju i da to radimo s poštovanjem. Za postizanje rezultata potrebno je mnogo truda i posvećenosti, kao i u svakom drugom sportu.

Osnovni cilj ovog istraživanja bio je da se utvrdi da li osoba koja nije imala dotadašnji kontakt sa konjičkim sportom može usvojiti elemente škole jahanja u 35 časova po 45 minuta i biti obučena da samostalno upravlja konjem.

Postavljene hipoteze: 35 45-minutnih časova je dovoljan vremenski period za sprovođenje novopredloženog plana i programa škole jahanja kao vannastavne i vanškolske aktivnosti u nastavi fizičkog vaspitanja; Novopredloženi program omogućio je pozitivno sticanje veština koje su osnove jahanja. Obe hipoteze su prihvaćene.

S obzirom da je ovaj rad studija slučaja sa samo jednim učesnikom, što je njegov ograničavajući faktor, preporučuje se povećanje broja učesnika u daljem istraživanju i implementacija istog novopredloženog programa na većem uzorku učesnika. Iako je ovo studija slučaja, škola jahanja se može preporučiti kao prihvatljiv oblik vannastavne i vanškolske sportske aktivnosti u nastavi fizičkog vaspitanja.

**Ključne reči:** jahanje, kineziološki operater, ishodi učenja

# Impact of arm swings on volleyball players' maximum jump height performance

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## Introduction

It is known that jump movements increase the player's vertical jump height by about 10% compared with the jump without an arm swing. Still, the exact mechanisms for enhancing player jump performance have not yet been fully described.

## Method

To examine how arm swings, affect jump height (JH) a series of maximal vertical jumps was done by 72 elite male volleyball players using the Sargent Jump, Spike, and Bloc arm modalities, controlled by box jumping with and without arm swings. All participants were the members of the champion team in the premier league of the Algerians (N=72, mean  $\pm$  SD: age =  $23.9 \pm 2.7$  years, body height =  $1.78 \pm 1.02$  m, body mass =  $78.22 \pm 1.26$  kg, BMI =  $21.02 \pm 2.26$  kg/m<sup>2</sup>).

## Results and discussion

Our findings support the use of arm swings as defensive and offensive conditions to determine the effects of arm swings on maximum jump performance in competitive volleyball players. Affirmed by pairwise comparisons LSD at  $p < 0.05$  in the superiority of the box jump test with both arm swings, followed by the bloc, spike, and Sargent Jump at the latest box jump test without an arm swing.

## Conclusion

Our results suggest that the use of arms significantly improved the jumping abilities of top volleyball players. Clamming supported in this study by full arm swing was considered as the optimal setting to record a maximum reach height in volleyball field tests. This was acknowledged in this investigation because of arm/s movements trajectory and its or their relation/s with volleyball skills jumping techniques both defensive or offensive. Confirmed by LSD based on jump height (JH) in the benefits of jumping with both arm swings followed by an arm swing at the last jump test without an arm swing.

**Key words:** arm swings, jump, test field, protocols tests, performance

## References

- Lees, A. Vanrenterghem, J & De Clercq, D. (2004). Understanding how an arm swing enhances performance in the vertical jump. *J Biomech.*37(12),1929-40.
- Vaverka, F., Jandačka, D., Zahradník, D., Uchytíl, J., Farana, R., Supej, M. & Vodičar, J. (2016). Effect of an Arm Swing on Countermovement Vertical Jump Performance in Elite Volleyball Players. *Journal of Human Kinetics*,53(1) 41-50.

# Differences in the functional mobility of karatekas in relation to gender and specialization

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## Introduction

Karate is a multidisciplinary sport in which two competitive disciplines kata and kumite (Cirkovic et al., 2010) are most represented. Different requirements for achieving results in these two disciplines result in different approaches in training technology, which in turn leads to differences in anthropometric and functional abilities (Koropanovski et al., 2011). This resulted in a necessity to examine these potential differences with different tests. The subject of this research is the examination of the difference in the functional mobility of karatekas using the FMS battery of tests in relation to gender and specialization.

## Method

The research sample consisted of 55 karatekas, divided into two subsamples (N=30 female, age 14.6±1.3 years, N=25 male, age 14.4±1.3 years). Each subsample was further divided into two subsamples, one of which consisted of 11 boys and 13 girls practicing kata, and 14 boys and 17 girls practicing kumite. Data on functional mobility were obtained using the FMS battery of tests. In processing the results, descriptive and comparative statistics were applied (Mann-Witney and Kruskal-Wallis test).

## Results and discussion

Boys practicing the kata show better results than girls of the same discipline in the tests of deep squat ( $p=0.005$ ) and trunk stability during handstand ( $p=0.035$ ). Better results can be justified by the fact that boys gain more muscle mass in the period of development (14-15 years) compared to girls. Girls who practice the kumite show better results than boys of the same discipline in the tests of lunge in a line ( $p=0.047$ ), active lifting of a stretched leg ( $p=0.012$ ) and rotator stability test of the trunk ( $p=0.034$ ). These results indicate that girls have better balance and flexibility compared to boys.

## Conclusion

The results of this research showed that different approaches in the training process, applied to kata and kumite, greatly point out the differences in the field of functional mobility at karatekas.

**Key words:** kata, kumite, FMS

## References

- Cirkovic, Z., Jovanovic, S., Kasum, G. (2010). Borenja. Belgrade. Faculty of Sport and Physical Education. University of Belgrade.
- Koropanovski, N., Berjan, B., Bozic, P., Pazin, N., Sanader, A., Jovanovic, S., Jaric, S. (2011). Anthropometric and Physical Performance Profiles of Elite Karate Kumite and Kata Competitors. *Journal of Human Kinetics*, 30: 107-114

# Razlike u funkcionalnoj pokretljivosti karatista u odnosu na pol i specijalizaciju

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## Uvod

Karate je sport multidisciplinarnog karaktera u kome su najzastupljenije dve takmičarske discipline, kate i borbe (Ćirković i sar., 2010). S obzirom na različite zahteve za ostvarivanje rezultata u ovim dvema disciplinama, razlikuju se i pristupi u tehnologiji treninga, čime dolazi do pojave razlika u pogledu antropometričkih i funkcionalnih sposobnosti (Koropanovski i sar., 2011). S tim u vezi stvorila se potreba da se te potencijalne razlike ispitaju različitim testovima. Predmet ovog istraživanja je ispitivanje razlike u funkcionalnoj pokretljivosti karatista primenom FMS baterije testova u odnosu na pol i specijalizaciju.

## Metod

Uzorak istraživanja činilo je 55 karatista, podeljenih u dva subuzorka (N=30 ženskog pola, uzrasta 14.6±1.3 godina, N=25 muškog pola, uzrasta 14.4±1.3 godina). Svaki subuzorak je dodatno bio podeljen na dva subzorka, od kojih je jedan činilo 11 dečaka i 13 devojčica koji se bave disciplinom kate, odnosno 14 dečaka i 17 devojčica koji se bave disciplinom borbe. Podaci o funkcionalnoj pokretljivosti dobijeni su primenom FMS baterije testova. U obradi rezultata primenjena je deskriptivna i komparativna statistika (Mann-Witney i Kruskal-Wallis test).

## Rezultati sa diskusijom

Dečaci koji se bave disciplinom kata pokazuju bolje rezultate od devojčica iste discipline u testovima duboki čučanj ( $p=0.005$ ) i stabilnost trupa tokom podizanja u upor za rukama ( $p=0.035$ ). Bolji rezultati se mogu opravdati time što dečaci u periodu razvitka (14-15god.) dobijaju veću mišićnu masu u odnosu na devojčice. Devojčice koje se bave disciplinom borbe pokazuju bolje rezultate od dečaka iste discipline u testovima iskorak u liniji ( $p=0.047$ ), aktivno podizanje opružene noge ( $p=0.012$ ) i testu rotatorne stabilnosti trupa ( $p=0.034$ ). Ovi rezultati ukazuju da devojčice imaju bolju ravnotežu i fleksibilnost u odnosu na dečake.

## Zaključak

Rezultati ovog rada su pokazali da različiti pristupi u trenažnom procesu, koji se primenjuju kod kataša i borbaša, u velikoj meri ističu razlike na polju funkcionalne pokretljivosti kod karatista.

**Ključne reči:** kate, borbe, FMS

## Literatura

Ćirković, Z., Jovanović, S., Kasum, G. (2010). Borenja. Beograd. Fakultet sporta i fizičkog vaspitanja. Univerzitet u Beogradu.

Koropanovski, N., Berjan, B., Bozic, P., Pazin, N., Sanader, A., Jovanovic, S., Jaric, S. (2011). Anthropometric and Physical Performance Profiles of Elite Karate Kumite and Kata Competitors. *Journal of Human Kinetics*, 30: 107-114

# Gaze fixations of U18 basketball players during contested three-point jump shots after passes from two different angles

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## Introduction

Quiet eye (QE) phenomena representing gaze fixation during final arm extension has been suggested to influence shooting performance in basketball (Sirnik et al., 2022). Higher angle of pass regarding basket could affect QE, as it requires more complex body-head stabilization and consequently gaze fixation. Additional temporal and spatial constraints are presented by defensive players. Therefore, the aim of this pilot study was to analyze the effect of two different passing angles on QE characteristics under opponents' defensive pressure.

## Method

QE behavior during three-point shots after receiving passes from two different angles (from below the basket and from the side) was measured in ten Slovenian U18 national team basketball players using mobile eye tracker. QE duration, onset, and shooting performance were analyzed. Differences in QE onset and duration between the two passing angles, and hits and misses were analyzed using two-way repeated measures ANOVA and post hoc tests. In addition, correlations between observed parameters were analyzed.

## Results and discussion

While two-way ANOVA presented with a nonsignificant effect of passing angle on QE duration and performance, it revealed a main effect of passing angle on QE onset. Post-hoc analysis for passing angle during hits on QE onset was marginally significant. We also found a correlation between QE duration and shooting performance after a pass from below the basket but not from the side.

## Conclusion

As suggested by our results passing angle does not affect shooting performance and duration of QE. Nevertheless, there may be adjustments in the way QE is used at different passing angles, with a delayed onset leading to smaller time window for gaze fixation. In addition, successful shots after a pass from below the basket were correlated with a shorter QE duration. The results from our study must be applied with caution due to small sample size.

Key words: basketball, quiet eye, visual attention, jump shot

## References

Sirnik, M., Erčulj, F., & Rošker, J. (2022). Research of visual attention in basketball shooting: A systematic review with meta-analysis. *International Journal of Sports Science and Coaching*, 17(5), 1195–1210.

# The influence of the training process within the volleyball camp on technique performance

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## Introduction

Volleyball camp for children of primary school age includes increasing the volume of training in terms of the number and duration of practices. However, the impact of such training process on the level of development of basic technical elements has not been sufficiently investigated in literature. The aim of our research is to determine the influence of the seven-day volleyball camp on the improvement of basic technical elements in volleyball.

## Method

The study used a quasi-experimental approach, conducting the research on a sample of 20 volleyball players, members of the "DIF Volleyball School", aged  $13 \pm 1.1$  years. The experimental treatment lasted for 7 days. Five variables of the technical area were assessed by expert evaluation (overhead pass, forearm pass, spiking without jump, spike over the net and service) 3 days before and 3 days after the camp. Five expert evaluators evaluated performance of the technique. Comparative statistical method utilized was t - test for dependent variables.

## Results and discussion

The implemented training led to improvements in technical elements: spiking without jump ( $p=.029$ ) and spike over the net ( $p=.014$ ). The aforementioned elements of performance improved (from 0.43 to 0.57 absolute increase in relation to average values), while there were no statistically significant changes in the other elements, although a positive trend change was present. The variability of the results is the highest when it comes to spiking without ( $S=0.816$ ) and with jump ( $S=0.941$ ) due to the fact that the spike technique is extremely complex and represents a combination of explosiveness, agility, coordination and reaction time (Wicaksono, 2022). Taking into account the complexity of the mentioned elements and the observed variability in the test subjects, which is a consequence of insufficiently adopted technique, it is expected that there will be a certain increase in those elements, compared to the elements that are already mastered and whose variability among respondents is very low (forearm pass -  $S=0.351$ ).

## Conclusion

The training process within the volleyball camp can be very important for improving the player's technique. The practical application of this research relates to training technology modification within the volleyball camps, which should primarily be aimed at improvement of insufficiently adopted technical elements.

**Keywords:** volleyball, expert evaluation, technical elements

## References

- Nešić, G., Ilić, D., Majstorović, N., Grbić, V., Osmankač, N. (2013). Uticaj treninga na opšte i specifične motoričke sposobnosti odbojkašica uzrasta 13-14 godina. *SportLogia*, 9(2): 201-216.
- Wicaksono, D. (2022). The effect of training based on part and whole combinations on smash techniques improvement in volleyball sports for 11-12 year old athletes. *Physical Education Theory and Methodology*, 22(1): 62-69.

# Uticaj trenažnog procesa u okviru odbojkaškog kampa na ispoljavanje tehnike

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## Uvod

Odbojkaški kamp za decu osnovnoškolskog uzrasta podrazumeva povećanje obima u smislu broja i trajanja treninga, međutim u literaturi nije dovoljno istražen uticaj takvog trenažnog procesa na promene nivoa razvijenosti osnovnih tehničkih elemenata. Cilj istraživanja je utvrditi uticaj sedmodnevnog odbojkaškog kampa na ispoljavanje osnovnih tehničkih elemenata u odbojci.

## Metod

U radu je primenjen kvazi - eksperimentalni pristup. Istraživanje je sprovedeno na uzorku od 20 odbojkašica, članica "Škole odbojke DIF", uzrasta  $13 \pm 1.1$  godina, a eksperimentalni tretman je trajao 7 dana. Ekspertskom ocenom ocenjivano je pet varijabli tehničkog prostora (odigravanje lopte prstima, "čekićem", smečiranje u paru/napucavanje, smeč preko mreže i servis) 3 dana pre početka kampa i 3 dana nakon što je kamp završen. Ocenama od 1 do 10 evaluirana je tehnika od strane pet ekspertskih ocenjivača. Za obradu podataka korišćena je komparativna statistika (t - test za zavisne uzorke).

## Rezultati sa diskusijom

Sprovedeni tretman doveo je do poboljšanja kod tehničkih elemenata: napucavanje ( $p=0.029$ ) i smeč preko mreže ( $p=0.014$ ). Izvođenje navedenih elemenata je poboljšano (od 0.43 do 0.57 apsolutni prirast kod prosečnih vrednosti), dok kod ostalih elemenata nije došlo do statistički značajnih promena, iako je trend pozitivne promene bio prisutan. Varijabilnost rezultata je najveća upravo kod napucavanja ( $S=0.816$ ) i smeča ( $S=0.941$ ) iz razloga što je tehnika smeča izuzetno kompleksna i predstavlja spoj eksplozivnosti, agilnosti, koordinacije i vremena reakcije (Wicaksono, 2022). Uzevši u obzir kompleksnost pomenutih elemenata i uočenu varijabilnost kod ispitanica, što je posledica nedovoljno usvojene tehnike, očekivano je da će upravo kod tih elemenata da dođe do određenog značajnijeg prirasta, u odnosu na elemente koji su već u velikoj meri savladani i čija je varijabilnost među ispitanicima vrlo niska ("čekić" -  $S=0.351$ ).

## Zaključak

Trenažni proces u okviru odbojkaškog kampa može biti od izuzetnog značaja za poboljšanje tehnike. Praktična primena ovog istraživanja odnosi se na modifikovanje trenažnih tehnologija u okviru odbojkaških kampova koje bi prevashodno trebalo da budu usmerene na usavršavanje nedovoljno usvojenih elemenata tehnike.

**Gljučne reči:** odbojka, ekspertsko ocenjivanje, tehnički elementi

## Literatura

Nešić, G., Ilić, D., Majstorović, N., Grbić, V., Osmankač, N. (2013). Uticaj treninga na opšte i specifične motoričke sposobnosti odbojkašica uzrasta 13-14 godina. *SportLogia*, 9(2): 201-216.  
Wicaksono, D. (2022). The effect of training based on part and whole combinations on smash techniques improvement in volleyball sports for 11-12 year old athletes. *Physical Education Theory and Methodology*, 22(1), 62-69.



# Correlation between some motor skills and knowledge of skiing

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## Introduction

Process of learning and improving skiing skills depends on numerous endogenous and exogenous factors. In addition to the previous level of motor information, as well as methods of acquisition and improvement, the level of acquisition of ski knowledge depends on the complexity of the movement structure and the level of characteristics and skills of the learner. The aim of this study was to examine the degree of association between motor skills and basic skiing knowledge among novice skiers.

## Method

The sample of respondents consisted of 33 kinesiology students who participated in a 7-day field ski course with 6 lessons per day. The motor set of variables included the following tests: figure eight agility test, countermovement jump, both leg, left and right leg slalom jumps, and five Biodex tests. Snow plow turn and basic ski turn were the criteria used to evaluate driving proficiency. The objectivity of the tests measuring skiing ability was checked using the inter-item correlation (Iir) and the Cronbach alpha ( $\alpha$ ) and the degree of the connection between motor skills and skiing ability using correlation analysis. The data were processed in the Statistica 13 program.

## Results and discussion

For the motor variables, there was a statistically significant association between snow plow turn and the Total Balance Index assessment test ( $p=0.02$ ), while for basic ski turn execution there was a statistically significant association with the Front Central Balance assessment test ( $p=0.03$ ). The obtained results confirmed the finding that respondents with a better balance position have a greater predisposition to improve their skiing abilities (Aerenhouts et al., 2013, Raschner et al., 2017).

## Conclusion

In alpine skiing, specific ski movements such as continuous and coordinated mobility of the lower extremities must be mastered during the acquisition of skiing skills. Current study revealed that within the motor set of variables, dynamic balance compared to specific agility and explosiveness has a primary impact on acceptability of snow plow turn and basic ski turn. In addition to learning skiing skills, balance makes a significant contribution to achieve top athletic performance and to prevent injuries.

**Key words:** alpine skiing, motor skills, ski technique, ski beginners

## References

- Abrahamson, J., Aminoff, A. S., Todd, C., Agnvall, C., Thoreson, O., Jónasson, P. i Baranto, A. (2019). Adolescent elite skiers with and without cam morphology did change their hip joint range of motion with 2 years follow-up. *Knee Surgery, Sports Traumatology, Arthroscopy*, 27(10), 3149-3157.
- Cigrovski, V., Franjko, I., Rupcic, T., Bakovic, M. i Matkovic, A. (2017). Comparison of Standard and Newer Balance Tests in Recreational Alpine Skiers and Ski Novices. *Montenegrin Journal of Sports Science and Medicine*, 6(1), 49-55.

# Differences in situational efficiency parameters between the teams competing in professional and amateur football league

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## Introduction

Very few studies compared the situational efficiency of the teams from different levels of competition. The aim of this study was to determine the differences in situational efficiency parameters in football.

## Method

The study sample was conducted from 12 football matches, six of FC Osijek (1. League) and FC Čepin (3. League). Data analysis was conducted using ONCE software. Variables in this study are: the number of passes, dribbling, shooting on goal, and corner kick. For data analysis, descriptive parameters and the Man-Whitney U test for testing data differences, are calculated.

## Results and discussion

The FC Čepin plays an equal number of passes in depth and in the width of the field. Players of the team do not dribble often. Goal kicks are performed dominantly with the foot. The NK Osijek team passes are more orientated in the depth of the field. The rate of successful dribbles is much higher. Most of the goal kicks are performed with the feet.

## Conclusion

The results indicate a significant difference in the variable number of passes in depth, while in other variables there are no significant differences. The differences between the teams should be tested in other categories of competitive activity.

**Key words:** amateur football, competition rank, scouting

## References

- Broich, H., Mester, J., Seifriz, F. & Yue, Z. (2014). Statistical analysis for the First Bundesliga in the current soccer season. *Progress in Applied Mathematics*, 7(2), 1-8.
- Hughes, M., & Franks, I. (2005). Analysis of passing sequences, shots and goals in soccer. *Journal of sports sciences*, 23(5), 509-514.

# Effects of comprehensive warm-up program on performance parameters of elite and sub-elite male skiers

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## Introduction

A comprehensive warm-up program involves the whole body active in the movement sequence rather than traditional warm-up models. It aims to both reduce the possibility of injury and increase performance for poor posture, decreased muscle strength and endurance that cause injuries (1) FIFA 11+ warm-up protocol is an injury-preventive warm-up program developed by experts from sports and health institutions such as OSTRC (Oslo Sports Trauma Research Center), SMSMF (Santa Monica Orthopedic and Sports Medicine Research Foundation) and F-MARC, under the leadership of FIFA. It aims to both reduce the possibility of injury and increase performance for poor posture, decreased muscle strength, and endurance that cause injuries (2). The aim of this study is to examine the effects of the FIFA 11+ comprehensive warm-up program on some performance parameters (balance, proprioception, agility, and anaerobic power) in alpine skiers.

## Method

A total of 20 sub-elite (n:10) and elite (n:10) male ski athletes participated in the study. FIFA 11+ warm-up protocol was carried out on sub-elite athletes and elite ski athletes for 8 weeks. Anthropometric measurements, balance, agility, and proprioception tests were applied to the participants as a pre and post-test. Statistical analyzes of the study results were performed with SPSS software. Comparisons between groups were performed with the independent sample t-test and within-group comparisons were made with the paired sample test

## Results and discussion

In the comparisons between the groups, no statistical difference was found between the agility, balance, and high box-test results of sub-elite athletes and elite ski athletes, but a statistical difference was found between the left leg at 30° and left leg 45° proprioception values. In group comparisons, there were statistically significant differences in agility test (p=0.001), proprioception test (p=0.001), high box test (p=0.001), dynamic right leg balance test (p=0.016), national athlete's agility test (p=0.001), proprioception test (p=0.001), high box test (p=0.001) and dynamic right leg balance test (p=0.022) of sub-elite athletes.

## Conclusion

In conclusion, the FIFA 11+ warm-up protocol applied 3 days a week for 8 weeks had positive effects on the dynamic and static balance, anaerobic power, and agility parameters of skiers. On the other hand, it was determined that the FIFA 11+ warm-up protocol had no effect on the sense of proprioception in skiers, with these results, it is recommended to apply the FIFA 11+ warm-up protocol regardless of the status of being elite or sub-elite athletes.

**Key words:** skiers, warm-up program, elite or sub-elite athletes

## References

N Sahin, VV Gurses, B Baydil, MS Akgul, K Feka, A Iovane, G Messina The effect of comprehensive warm up (FIFA 11+ Program) on motor abilities in young basketball players: a pilot study  
N Sahin, VV Gurses, B Baydil, MS Akgul, K Feka, A Iovane, G Messina Acta medica 34, 703.

# Functional abilities of kinesiology students in spinning training

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## Introduction

Spinning is a type of indoor fitness activity performed on stationary bikes by participants who pedal together to the rhythm of music and motivating words of an instructor (Caria et al., 2007). The main aim of this study was to determinate the differences in cardiovascular variables during a standard 50-min class between the male and female kinesiology student groups.

## Method

The research was conducted on 11 male (age 21 +/- 2.7 years, height 183.3 +/- 7.6 cm, weight 83.1 +/- 14.2 kg) and 9 female (age 21 +/- 1.8 years, height 168.1 +/- 4.7 cm, weight 60.9 +/- 8.4 kg) students of Faculty of kinesiology in Osijek. The study was approved by the University's ethics committee. All participants were monitored by H9 Polar system. Standard descriptive statistics were used to generate mean values and standard deviations. The t-test was used to verify the significance of differences relative to the most relevant variables between males and females. The results are reported as means +/- standard deviations. Statistical significance was set at  $p < 0.05$ .

## Results and discussion

A statistically significant difference between the male and female group was detected in the measures of functional characteristics: percentage of average heart rate per minute (PROS%), percentage of maximum heart rate per minute (MAX%), calories burned (KCAL) and time spent in a certain zone during training (ZONA).

## Conclusion

The results show that this type of fitness activity has a high impact on cardiovascular function and suggest that it is suitable for sport students and especially the population willing to begin a recreational physical activity programme.

**Key words:** students, spinning, heart zones,

## References

Caria, M. A., Tangianu, F., Concu, A., Crisafulli, A., & Mameli, O. (2007). Quantification of Spinning bike performance during a standard 50-minute class. *Journal of sports sciences*, 25(4), 421–429.

# Differences in the agility tests values performed on different types of sports surfaces

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## Introduction

Sports surfaces play an important role for all people who are involved in sports, whether they are recreational or professional players. The aim of this study was to determine differences in the values of the results of the agility tests on different types of sports surfaces.

## Method

The research was conducted on 23 students of the Faculty of kinesiology Osijek (19 males and 4 females). Agility testing was performed on artificial grass and a wooden floor. Tests in the study were: 4x5m, 93639 and T-test. The results of the study are analyzed with a statistical program Statistical, descriptive parameters and T-test for dependent samples for testing differences in results were calculated.

## Results and discussion

The results of this study have determined statistically significant differences in the results of all three agility tests depending on the sports surface. The tested subjects achieved significantly better results (4x5m 5,05 vs 5,83s; 93639 8,32 vs 9,22s; T-test 9,22 vs 9,85s) when they were tested on a wooden floor compared to artificial grass.

## Conclusion

The obtained results confirmed the research hypotheses. Agility results are better in all tests (4x5 meters, 93639 and T-test) performed on the wooden floor versus artificial grass. The obtained research results were significantly influenced by the properties of the sport surface.

**Key words:** agility, artificial grass, students, wooden floor

## References

- Šimonek, J. (2019). Agility in sport. Cambridge Scholars Publishing.  
Lin Elan Leung, F., Ming Choi S., Way Raymond Sum, K. (2015). Comparison between Natural Turf and Artificial Turf on Agility Performance of Rugby Union Players. *Advances in Physical Education*, 5, 273-281.

# Rhythmic gymnastics routine components as factors of competitive success

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## Introduction

Analyses of development trends in rhythmic gymnastics have so far provided a lot of useful information to sports experts (Agopyan, & Örs, 2019; Dobrijević & Moskovljević, 2021), which, as an important guideline in the training process, could significantly contribute to the development of the competitive capacities of their athletes. The aim of this study was to determine the influence of different routine components on the competitive success of gymnasts in the individual program of competition in rhythmic gymnastics.

## Method

In accordance with the aim of the study, the competitive routines of the participants of the 37th and 38th World Championships were analyzed, a total of 1044 routines, 261 with each type of apparatus (hoop, ball, clubs and ribbon). For the analysis, official bulletins of results of these competitions were used. Four variables, which refer to the grades for individual composition components, were considered (Body difficulty, Apparatus difficulty, Artistry value of routine and Execution). The correlation of routine components with the achieved rank was assessed by Spearman's test, while the application of linear regression analysis determined the extent to which individual components of the composition are predictors of the achieved rank.

## Results and discussion

The results of the analysis of all routines, regardless of the type of apparatus used, showed the highest correlation between the Execution score and the achieved rank, while the smallest is between the score of Apparatus difficulty and the achieved rank. However, there are significant differences in the impact of different composition components on competitive success when considering separately routines with different types of apparatus.

## Conclusion

In general, the greatest influence on success at the highest competitive level in rhythmic gymnastics, is precision and accuracy in performance, while success depends on the quality of the manifestation of the various components, when observing separately routines with different type of apparatus.

**Key words:** difficulty, artistry, execution, apparatus, rank

## References

- Agopyan, A., & Örs, B. S. (2019). An analysis of variations in body movement difficulty of 2016 Olympic Games rhythmic gymnast candidates. *International Journal of Performance Analysis in Sport*, 1-18.
- Dobrijević, S., & Moskovljević, L. (2021). Components of competition routines in rhythmic gymnastics depending on the type of apparatus. *Fizička kultura*, 75(2).

# Komponente sastava u ritmičkoj gimnastici kao činioci takmičarske uspešnosti

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## Uvod

Analize razvojnih trendova u ritmičkoj gimnastici do sada su dale puno korisnih informacija sportskim stručnjacima (Agopyan, & Örs, 2019; Dobrijević & Moskovljević, 2021), koje su kao važne smernice u trenažnom procesu mogle značajno doprineti razvoju takmičarskih kapaciteta njihovih sportista. Cilj ovog rada bio je da se utvrdi uticaj različitih komponenti sastava na takmičarsku uspešnost gimnastičarki u individualnom programu takmičenja u ritmičkoj gimnastici.

## Metod

U skladu sa ciljem rada, analizirani su takmičarski sastavi učesnica 37. i 38. Svetskog prvenstva, ukupno 1044 i to po 261 sa svakim tipom rekvizita (obruč, lopta, čunjevi i traka). Za analizu su korišćeni zvanični podaci o rezultatima sa ovih takmičenja, a razmatrane su četiri varijable, koje se odnose na ocene za pojedine komponente sastava (težine telom, težine rekvizitom, artističku vrednost sastava i kvalitet izvođenja). Povezanost pojedinih komponenti sastava sa ostvarenim plasmanom procenjavana je Spearman-ovim testom, dok je primenom linearne regresione analize utvrđeno u kojoj meri su pojedine komponente sastava prediktori ostvarenog plasmana.

## Rezultati sa diskusijom

Rezultati analize svih sastava, bez obzira na tip rekvizita koji se koristi, pokazali su da između ocene za kvalitet izvođenja tehnike i ostvarenog plasmana postoji najveća povezanost, dok je ona najmanja između ocene za težine rekvizitima i ostvarenog plasmana. Ipak, postoje značajne razlike po pitanju uticaja različitih komponenti sastava na takmičarsku uspešnost kada se posmatraju posebno sastavi sa različitim tipovima rekvizita.

## Zaključak

U sastavima gimnastičarki na najvišem takmičarskom nivou, generalno najveći uticaj na uspešnost ima preciznost i tačnost u izvođenju, dok u zavisnosti od tipa rekvizita koji se koristi, uspeh je različito uslovljen kvalitetom ispoljavanja ostalih komponenti sastava.

**Ključne reči:** težine, artistika, izvođenje, rekviziti, plasman

## Literatura

Agopyan, A., & Örs, B. S. (2019). An analysis of variations in body movement difficulty of 2016 Olympic Games rhythmic gymnast candidates. *International Journal of Performance Analysis in Sport*, 1-18.

Dobrijević, S., & Moskovljević, L. (2021). Components of competition routines in rhythmic gymnastics depending on the type of apparatus. *Fizička kultura*, 75(2).

# The force-velocity profile of elite volleyball players

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## Introduction

Mechanical muscle capacities expressed through force, speed, and power are essential determinants of specific movements (i.e., blocking, serving, spiking) in volleyball (Baena-Raya et al., 2021). Assessment of these capacities in field settings enables efficient planning and supervising of the strength and conditioning program, particularly at the initial pre-competition preparatory phase. The aim of this study was to assess the F-V profile of male senior Serbian national volleyball team players.

## Method

Thirty-one male volleyball player (age:  $22.6 \pm 2.5$ , body height:  $1.98 \pm 0.08$  m, body mass:  $91.4 \pm 10.5$  kg) from senior Serbian national team squads were tested for countermovement jump performance (CMJ) at the beginning of the preparatory phase: 12 outside hitters (OH), 8 middle blockers (MB), 3 opposites (O), 5 setters (S), 3 liberos (L). All players performed loaded CMJs (20, 40, 60 kg) using My Jump 2 smartphone application. The maximal theoretical force ( $F_0$ ), velocity ( $V_0$ ), power ( $P_{max}$ ), and slope of the F-V relationship ( $a$ ) were calculated.

## Results and discussion

With respect to  $F_0$ , the greatest value was produced by O, followed by OH, S, L, and MB (35.6, 34.0, 32.9, 32.6, and 32.1 N/kg). Contrarywise, the highest  $V_0$  was observed in L, followed by S, OH, MB, and O (5.28, 4.56, 4.33, 4.31, and 3.68 m/s), respectively. The mean values of  $a$  were OH= -8.08, MB= -7.30, O= -9.54, S= -8.21, and L= -6.14 Ns/m/kg. Consequently, the highest  $P_{max}$  achieved L= 42.9, S= 35.7, OH= 36.1, MB= 34.2 and O= 32.7 W/kg. Results of F-V relationship parameters indicate different F-V profiles across player positions which could be related to the specific requirements of the game.

## Conclusion

These results confirm that the establishment of the F-V profile represents a useful diagnostic tool for optimizing strength training based on player-specific lower limb mechanical characteristics providing training design according to the individual need of each volleyball player.

**Key words:** CMJ, sport, smart-phone application

## References

Baena-Raya, A., Soriano-Maldonado, A., Rodríguez-Pérez, M. A., García-De-Alcaraz, A., Ortega-Becerra, M., Jiménez-Reyes, P., & García-Ramos, A. (2021). The force-velocity profile as determinant of spike and serve ball speed in top-level male volleyball players. *PLoS ONE*, 16(4), 1–11.



# Profil relacije sila-brzina elitnih odbojkaša

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## Uvod

Mehaničke karakteristike mišića ispoljene preko sile, brzine i snage predstavljaju fundament specifičnim kretnim aktivnostima (blokiranju, serviranju, smečiranju) zastupljenim u odbojci (Baena-Raya et al., 2021). Procena pomenutih karakteristika u praksi omogućava efikasno planiranje i kontrolu trenažnog programa usmerenog na razvoj fizičkih sposobnosti, posebno na početku pripremnog perioda za određeno takmičenje. Cilj ove studije je kreiranje F-V profila muških seniorskih reprezentativaca Srbije u odbojci.

## Metod

Uzorak ispitanika sačinjen je od trideset jedanog odbojkaša (starost:  $22.6 \pm 2.5$ , telesna visina:  $1.98 \pm 0.08$  m, telesna masa:  $91.4 \pm 10.5$  kg), članova seniorske odbojkaške reprezentacije Srbije: 12 primač servisa (OH), 8 srednja blokera (MB), 3 korektora (O), 5 dizača (S), 3 libera (L). Svi ispitanici su izvodili CMJ sa opterećenjem (20, 40, 60 kg) koristeći My Jump 2 aplikaciju za mobilni telefon u cilju akvizicije podataka. Maksimalna teorijska sila (F0), brzina (V0), snaga (Pmax) i nagib F-V relacije ( $a$ ) su izračunati.

## Rezultati sa diskusijom

U odnosu na F0, najveće vrednosti proizveli su O, praćeni OH, S, L i MB (35.6, 34.0, 32.9, 32.6 i 32.1 N/kg). Nasuprot pomenutom, najveća V0 prikazana je od strane L, potom S, OH, MB, i O (5.28, 4.56, 4.33, 4.31 i 3.68 m/s). Prosečne vrednosti  $a$  su bile: OH= -8.08, MB= -7.30, O= -9.54, S= -8.21, L= -6.14 Ns/m/kg. Posledično, najveću Pmax ostvarili su L= 42.9, S= 35.7, OH= 36.1, MB= 34.2 i O= 32.7 W/kg. Rezultati varijabli dobijenih F-V relacijom ukazuju na različite F-V profile svojstvene različitim igračkim pozicijama što bi se moglo dovesti u vezu sa specifičnim zahtevima igre.

## Zaključak

Rezultati ove studije sugerišu da kreiranje F-V profila predstavlja korisno dijagnostičko sredstvo prilikom kreiranja optimalnog treninga snage zasnovanog na mehaničkim karakteristikama mišića nogu igrača na određenim igračkim pozicijama, a sve u cilju konstrukcije trenažnog programa dizajniranog na osnovu individualnih potreba odbojkaša.

**Ključne reči:** CMJ, sport, mobilna aplikacija

## Literatura

Baena-Raya, A., Soriano-Maldonado, A., Rodríguez-Pérez, M. A., García-De-Alcaraz, A., Ortega-Becerra, M. P., & García-Ramos, A. (2021). The force-velocity profile as determinant of spike and serve ball speed in top-level male volleyball players. *PLoS ONE*, 16(4), 1–11.

# Intergroup differences in motor and specific motor abilities in basketball students at the Sports Academy - Skopje

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## Introduction

During school, basketball students, actively participate in all sports activities organized by the Sports Academy. Each student, basketball player is tested for motor and specific motor abilities at the beginning and end of the school year.

## Method

Each subgroup performed the same tests, which assessed their motor and specific motor abilities. A total of 16 variables were used in the research, of which 9 were used to assess specific motor abilities and 7 to assess the motor abilities of student athletes. The descriptive data were calculated for all applied variables. The significance of the differences between the arithmetic means of the initial and final measurements was determined using ANOVA and the Student's t-test for small dependent samples.

## Results and discussion

Among first-year basketball students, out of 15 tested variables, only 8 had significant differences between the mean values of the initial and final measurements. It can be noted that out of 15 tested variables, only 6 had significant differences between the mean values of the initial and final measurements for the second year and 9 tested variables for the third year basketball students. The analysis of variance shows which of the applied tests determined significant differences among the student basketball players from all three years.

## Conclusion

In the initial measurement, significant differences between the means were found for three variables. Among the specific motor variables of the initial measurement, significant differences were determined in the five variables. The final measurement showed significant differences between student basketball players from different years in the four motor variables and three significant differences between student basketball players from different years.

**Key words:** motor abilities, specific motor abilities, basketball students, intergroup differences

## References

- Badrić M. And Petračić T. (2007): Differences in anthropometric characteristics and motor abilities of students from urban and rural environments. Proceedings of the interdisciplinary scientific conference of international students - Anthropological status and physical activity of children and youth, 265-271.
- Daskalovski, B., Naumovski, M., Misovski, A., & Aceski, A. (2017). Tendencies of motor skills development in students-basketball players from the sports academy in skopje. *Research in Physical Education, Sport & Health*, 6(1).

# Comparison of intensity and interpretation of anxiety in individual and team sports

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## Introduction

Due to constant pressure to achieve high levels of competitive performance, athletes often experience anxiety. Since the requirements of individual and team sports are different, as well as the stressors that elicit anxiety, it can be assumed that there are differences in the intensity and interpretation of anxiety in regard to competitive performance. Therefore, the main goal of this research was to determine the differences in the intensity and interpretation of state anxiety on competitive performance between individual and team sport athletes.

## Method

The sample included 120 athletes, with half competing in individual sports (tennis, athletics, gymnastics, wrestling, kayaking and swimming) and half in team sports (volleyball, handball, football and basketball). The athletes age from 17 to 33 years, with an average length of sport experience  $M=12.03$  years. Data were collected using the Competitive State Anxiety Inventory 2 (CSAI-2; Martens et al., 1990), which assesses the intensity and interpretation of cognitive and somatic anxiety components, as well as self-confidence.

## Results and discussion

The results of the multivariate analysis of variance (MANOVA) and the accompanying univariate analyses of variance (ANOVA) showed significant differences between these two groups of athletes in the intensity of somatic anxiety  $F_{(1, 118)} = 6.593, p < .05$ , and interpretation of somatic anxiety  $F_{(1, 118)} = 5.638, p < .05$ . Specifically, individual sport athletes show a significantly higher intensity of somatic anxiety and interpret its effects more negatively. Differences in the intensity and interpretation of cognitive anxiety and self-confidence are not significant, although both groups perceive the effects of cognitive anxiety as debilitating for competitive performance.

## Conclusion

It can be concluded that both groups of athletes should systematically develop skills to improve control over their cognitive symptoms of anxiety, while it is also recommended for individual sport athletes to implement and acquire skill in physical relaxation techniques.

**Key words:** somatic anxiety, cognitive anxiety, self-confidence, individual sports, team sports

## References

- Cox, R.H. (2005). *Psihologija sporta: Koncepti i primene*. Jastebarsko: Naklada Slap.
- Martens, R., Burton, D., Vealey, R.S., Bump, L.A., Smith, D.E. (1990). Development and Validation of the Competitive State Anxiety Inventory-2 (CSAI-2). In Martens, R., Vealey, R.S., Burton, D. (Eds.). *Competitive Anxiety in sport* (117-190). Champaign: Human Kinetics.

# Poređenje intenziteta i delovanja anksioznosti u individualnim i kolektivnim sportovima

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## Uvod

Usled pritiska za pobedom i postizanjem visokih nivoa takmičarskog postignuća, sportisti često dožive anksioznost. Budući da su zahtevi individualnih i kolektivnih sportova različiti, pa samim tim i stresori koji podstiču anksioznost, može se pretpostaviti da postoje razlike u intenzitetu i interpretaciji delovanja anksioznosti na takmičarsko izvođenje. Osnovni cilj ovog istraživanja je bio da se utvrde razlike u intenzitetu i u opaženom delovanju stanja anksioznosti na takmičarsko postignuće između sportista koji treniraju individualne i kolektivne sportove.

## Metod

U uzorku je bilo 120 sportista od kojih se polovina takmiči u individualnim sportovima (tenis, atletika, gimnastika, borenja, kajak i plivanje), a polovina u kolektivnim (odbojka, rukomet, fudbal i košarka). Sportisti su uzrasta od 17 do 33 godine, sa prosečnom dužinom sportskog staža  $M=12.03$  godine. Podaci su prikupljeni Upitnikom o takmičarskoj anksioznosti (Competitive State Anxiety Inventory 2 – CSAI-2; Martens et al., 1990) kojim se procenjuje intenzitet i interpretacija smera delovanja kognitivne i somatske komponente anksioznosti i komponente samopouzdanja.

## Rezultati sa diskusijom

Rezultati multivarijantne analize varijanse (MANOVA) i pratećih univarijantnih analiza varijanse (ANOVA) pokazali su da između ove dve grupe sportista postoje značajne razlike u intenzitetu somatske anksioznosti  $F(1, 118) = 6.593, p < .05$ , i u opaženom delovanju somatske anksioznosti na postignuće  $F(1, 118) = 5.638, p < .05$ . Konkretno, sportisti u individualnim sportovima pokazuju značajno veći intenzitet i negativnije interpretiraju delovanje somatske anksioznosti. Razlike u intenzitetu i u smeru delovanja kognitivne anksioznosti i samopouzdanja između ove dve grupe sportista nisu značajne, iako obe grupe procenjuju delovanje kognitivne komponente na izvođenje kao negativno.

## Zaključak

Može se zaključiti da obe grupe sportista treba sistematski da razvijaju veštine unapređivanja kontrole nad kognitivnim simptomima anksioznosti, pri čemu se sportistima koji treniraju individualne sportove može preporučiti i usvajanje i savladavanje tehnika telesne relaksacije.

**Ključne reči:** somatska anksioznost, kognitivna anksioznost, samopouzdanje, individualni sport, kolektivni sport

## Literatura

Cox, R.H. (2005). Psihologija sporta: Koncepti i primene. Jastebarsko: Naklada Slap.  
Martens, R., Burton, D., Vealey, R.S., Bump, L.A., Smith, D.E. (1990). Development and Validation of the Competitive State Anxiety Inventory-2 (CSAI-2). U Martens, R., Vealey, R.S., Burton, D. (Eds.). Competitive Anxiety in sport (117-190). Champaign: Human Kinetics.

# Morphological characteristics and motor abilities differences: First and Second Montenegrin league female volleyball players

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First secondary vocational school, Nikšić<sup>2</sup>

## Introduction

The aim of this study is to determine whether there is a statistically significant difference in morphological characteristics and motor abilities of the first and second league female volleyball players.

## Method

The sample comprised of 20 players of the first and 20 players of the second league. Eight morphological measures have been taken for the purpose of this study: body height; body mass; arm span; hand length; chest circumference; hip circumference; upper leg circumference and 8 variables of the motor space: long jump from a standing position; high jump from a standing position; sprint 20m; t-test; reach height; deep bend on the bench; stork test with closed eyes; lying down, sitting for 30 sec. Differences were determined by using a t-test for small independent samples, with a statistical significance of  $p < 0.05$ .

## Results and discussion

The difference was found only in the variable for assessing balance in favor of first league female volleyball players. The obtained results are very similar to the results of other scientific research conducted on a similar sample of subjects (Nikolaidis et al., 2012; Martin-Matillas et al., 2014; Carvalho et al., 2020).

## Conclusion

We can conclude that Montenegrin volleyball players deviate to a certain extent from the results when in terms of height of the players of quality European teams

**Key words:** morphological characteristics, motor abilities, volleyball, differences.

## References

Nikolaidis, P.T., Ziv, G., Arnon, M. & Lidor, R. (2012). Physical characteristics and physiological attributes of female volleyball players – The need for individual data. *Journal of Strength and Conditioning Research*, 26(9), 2547- 2557.  
Carvalho, A., Roriz, P. & Duarte, D. (2020). Comparison of morphological profiles and performance variables between female volleyball players of the first and second division in Portugal. *Journal of Human Kinetic*, 71, 109-117.

# Modeling of the relationship between anthropometry and food patterns of professional athletes

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## Introduction

The knowledge of volleyball players about nutrition was found to be inadequate (Danh et al., 2021; Faccin et al., 2017), so the goals of the research were to evaluate the knowledge in nutrition of professional volleyball players, and to put the results in relation with anthropometric parameters.

## Method

This research included 17 female volleyball players. Body mass, percentage of adipose tissue, fat mass and body mass index were calculated on Tanita Pro BC-418. Validated questionnaires were used to assess knowledge about nutrition. The data was presented as percentage frequencies and PLS regression was used to assess the quantitative relationship between anthropometry and food patterns.

## Results and discussion

Macronutrient knowledge was divided into protein, carbohydrates, and fats in food. Pasta and honey weren't recognized as food low in fats, and butter was put into category of foods rich in carbohydrates. Protein knowledge was without any major confusions. Overall knowledge about macronutrients in food was 53 % which is categorized as inadequate (Andrews et al., 2016). The most surprising answer was zero correct answers in the statement "A high-carbohydrate diet helps reduce muscle degradation in the body". Hydration knowledge was deemed adequate with 65 % of correct answers. Only 47 % of respondents recognized carbohydrates as macronutrients that are most important for volleyball, and 12 % correctly answered that the timeframe for food intake is within 30 minutes after activity. Supplementation had the lowest percentage of correct answers (35 %) and proved to be most complex for athletes (Heikkila et al., 2017). In PLS modeling, the coefficient of determination,  $R^2$ , and the dependent variables (body mass, percentage of adipose tissue, and fat mass) were observed.  $R^2$  for variables is in the range from 0.33 to 0.67 and indicates a moderate prediction accuracy.

## Conclusion

Knowledge about nutrition in general and sports nutrition is inadequate (45 % of correct answers). The highest percentage of correct answers had older subjects, with higher percentage of adipose tissue and who consumed less than three meals. Based on quantitative model, the strongest connection is between fat mass (kg) and the dietary habits.

**Key words:** volleyball, nutrition, anthropometry

## References

- Andrews A, Wojcik JR, Boyd JM, Bowers CJ (2016) Sports Nutrition Knowledge among Mid-Major Division 1 University Student-Athletes. *Journal of Nutrition and Metabolism*
- Danh PJ, Nucci A, Doyle A, Feresin GR (2021) Assessment of sports nutrition knowledge, dietary intake, and nutrition information source in female collegiate athletes: A descriptive feasibility study. *J Am Coll Health*, 1-4.
- Heikkila M, Valve R, Lehtovirta M, Fogelholm M (2017) Nutrition Knowledge Among Young Finnish Endurance Athletes and their Coaches. *International Journal of Sports Nutrition and Exercise*

# Differences in anthropometrics characteristics and body composition between two elite junior male basketball clubs

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## Introduction

The aim of this research was to determine the differences among the junior basketball players of the BC Partizan and BC Budućnost Voli, in terms of their anthropometric characteristics and body composition.

## Method

A sample of 22 subjects was divided into two sub-samples: basketball team Partizan (Belgrade), of the average age  $17.18 \pm 0.50$ , and basketball team Budućnost Voli (Podgorica), based on the average age of  $17.28 \pm 0.30$ . All players were tested in Podgorica, in two days. Anthropometric characteristics in the body composition were evaluated by a battery of eleven variables: body height (cm), body weight (kg), triceps skinfold, back skinfold, biceps skinfold, abdominal skinfold, thighs skinfold, calf skinfold, body mass index (BMI), percentage of fat and muscle mass (kg).

## Results and discussion

Differences were determined with t-test for small independent samples. It was found that the basketball players of Partizan are slightly higher ( $196.45 \pm 6.69$ ) than Budućnost Voli ( $191.27 \pm 8.81$ ) and have lower values body mass. Also, there are significant statistical differences in seven variables: triceps skinfold, back skinfold, biceps skinfold, abdominal skinfold, calf skinfold, thigh skinfold and BMI, all in favor of junior players of Partizan.

## Conclusion

Junior players of Partizan are younger, taller, and have lower skinfold values.

**Key words:** anthropometric characteristics, body composition, junior male basketball players

## References

Karalejić, M., Jakovljević, S. (2009). *Dijagnostika u košarci*. "3D+" Novi Sad i Visoka sportska i zdravstvena škola, Beograd, 2009.

Ljubojevic, M. & Nikolic, B. (2012). Antropometrijske karakteristike i motoricke sposobnosti mladih kosarkasa Crne Gore. *Sport Mont*, 34,35,36:174-180, 2012.

# Differences in body composition between young football players of football clubs in Montenegro

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## Introduction

Typical for the cadet age of football players is the appearance of accelerated growth and weight gain, because the growth rate is not the same in each individual, although the growth takes place in approximately the same period of time. The goal of this study is to determine the differences in the level of anthropomorphic characteristics for the assessment of body composition between football players of cadet age in Montenegro.

## Method

The sample of respondents in this study consists of 29 top football players of cadet age who play in the First Football League of Montenegro, which is divided into two subsamples. The first subsample consists of 14 players FC Bokelj from Kotor, average age of  $13.32 \pm 2.32$ , and 16 players FC Dečić from Tuzi, average age of  $13.17 \pm 3.99$ . Differences in body composition of these two clubs are determined by applying a discriminatory parametric procedure, t-test for small independent samples with a statistical significance of  $p < 0.05$ .

## Results and discussion

The players of both clubs have average mean values of analyzed variables, which is not surprising because they are the two best clubs in Montenegro for the cadet age where the concentration of the best players is the highest. Also, the football players of FC *Bokelj* have lower values of the body mass index of fat, 18.32 compared to 19.45 of the football players of FC *Dečić*.

## Conclusion

The results obtained by this research can serve as model parameters in the estimated variables for all other players of football clubs in Montenegro, because the analyzed cadet players are among the best and most successful in their national league.

**Key words:** anthropomorphic characteristics, football, players.

## References

Vukotic, M., Corluka, M., Vasiljevic, I. & Bubanja, M. (2018). Differences in the morphological characteristics and body composition of handball players WHC Levalca in Montenegro and WHC Grude in Bosnia and Herzegovina. *Journal of Anthropology of Sport and Physical Education*, 2(2), 49-53.



# Profile of morphological characteristics and motor abilities of female volleyball players aged 12-13 years

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## Introduction

Volleyball demands certain standards when it comes to morphological characteristics of players, as well as high level of motor skills (Duncan, 2006). The aim of this research was to form a profile of morphological characteristics and motor abilities of female volleyball players aged 12-13 years, after running some tests.

## Method

The research was done on a sample of 40 players, aged 12-13 years, from volleyball school "DIF" - a project of the Faculty of Sports and Physical Education – Belgrade. Three tests were used to assess the morphological status and five to assess motor abilities. All tests are standardized and appropriate equipment was used for their implementation. The data were analyzed by descriptive statistics with the use of the SPSS 20.0 program.

## Results and discussion

According to the obtained results, it can be determined that female volleyball players are  $163.4 \text{ cm} \pm 8.39 \text{ cm}$  tall, weigh  $54.11 \text{ kg} \pm 10.01 \text{ kg}$  and have a BMI  $20,70 \pm 3,19$ . As for the motor abilities, volleyball players achieved the following results: high jump – "Sargent"  $32.8 \text{ cm} \pm 5.56 \text{ cm}$ , medicine ball throw  $584 \text{ cm} \pm 0.74 \text{ cm}$ , agility test  $9.23\text{s} \pm 0.96\text{s}$  ("X - test"). The flexibility tests showed the following results: Sit and Reach test -  $22.59 \text{ cm} \pm 8.09 \text{ cm}$  and shoulder mobility test -  $73.6 \text{ cm} \pm 14.82 \text{ cm}$ . These results are consistent with previous studies (Nešić et al., 2014; Duncan et al., 2006), and future research should include larger and more diverse samples of respondents and a wider range of sample variables.

## Conclusion

This study confirms the results of previous research that female volleyball players: are taller than the general population, they have good jumping ability and are agile. Also, the results confirm that they have good mobility of the joints that are dominantly included in locomotion during the volleyball game. The significance of this research is in determining certain guidelines for selection in volleyball, as well as proposing improvement in the volleyball training proces.

**Key words:** volleyball, profile, motor abilities, morphological characteristics.

## References

Nešić, G., Majstorović, N., Sikimić, M., Marković, S., Ilić, D., Grbić, V., Osmankač, N., Savić, Z. (2014). Anthropometric characteristics and motor abilities in 13-15 year old female volleyball players, *Facta Universitatis*, Vol. 20, No 3, 327 - 339.  
Duncan, J., Woodfield, L., and Nakeeb, Y. (2006). Anthropometric and physiological characteristics of junior elite volleyball players, *British Journal of Sports Medicine*, 40(7): 649 - 651.

# Profil morfoloških karakteristika i motoričkih sposobnosti odbojkašica uzrasta 12-13 godina

Jovana Došović<sup>1</sup>; Ivana Krstić<sup>1</sup>; Miljana Simonović<sup>1</sup>; Tatjana Stajić<sup>1</sup>; Milomir Miladinović<sup>1</sup>; Mina Ivanović<sup>1</sup>; Petar Janković<sup>1</sup>

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## Uvod

Odbojka zahteva određene standarde kada su u pitanju morfološke karakteristike igrača, kao i visok nivo motoričkih sposobnosti (Duncan, 2006). Cilj istraživanja je da se, nakon sprovedenih testova, formira profil morfoloških karakteristika i motoričkih sposobnosti odbojkašica uzrasta 12-13 godina.

## Metod

Istraživanje je rađeno na uzorku od 40 odbojkašica, uzrasta 12-13 godina, polaznica Škole odbojke "DIF" – u okviru projekta Fakulteta sporta i fizičkog vaspitanja u Beogradu. Tri testa su korišćena za procenu morfološkog statusa i pet za procenu motoričkih sposobnosti. Svi testovi su standardizovani i za njihovo sprovođenje korišćena je odgovarajuća oprema. Podaci su analizirani deskriptivnom statistikom uz korišćenje programa SPSS 20.0.

## Rezultati sa diskusijom

Prema dobijenim rezultatima može se utvrditi da su odbojkašice visoke  $163,4 \text{ cm} \pm 8,39 \text{ cm}$ , teške  $54,11 \text{ kg} \pm 10,01 \text{ kg}$  i imaju BMI od  $20,70 \pm 3,19$ . Što se tiče motoričkih sposobnosti, odbojkašice su ostvarile sledeće rezultate: skok u vis - "Sargent"  $32,8 \text{ cm} \pm 5,56 \text{ cm}$ , bacanje medicinske lopte  $584 \text{ cm} \pm 74 \text{ cm}$ , test agilnosti  $9,23 \text{ s} \pm 0,96 \text{ s}$  ("Ks - test"), testovi za procenu fleksibilnost su pokazali sledeće rezultate: test Pretklon u sedu -  $22,59 \text{ cm} \pm 8,09 \text{ cm}$  i test pokretljivosti ramenog pojasa -  $73,6 \text{ cm} \pm 14,82 \text{ cm}$ . Ovi rezultati su u skladu sa prethodnim studijama (Nešić et al., 2014; Duncan et al., 2006), a buduća istraživanja bi trebalo da obuhvate veće i raznovrsnije uzorke ispitanika i širi spektar posmatranih varijabli.

## Zaključak

Ova studija potvrđuje rezultate prethodnih istraživanja da su odbojkašice: više od opšte populacije, imaju dobre skakačke sposobnosti i agilne. Takođe, rezultati potvrđuju da imaju dobru pokretljivost zglobova koji su dominantno uključeni u lokomociju tokom odbojkaškog nadigravanja. Značaj ovog istraživanja je u utvrđivanju određenih smernica za selekciju u odbojci, kao i predlaganju pomaka u trenažnom procesu odbojke.

**Ključne reči:** odbojka, profil, motoričke sposobnosti, morfološke karakteristike.

## Literatura

Nešić, G., Majstorović, N., Sikimić, M., Marković, S., Ilić, D., Grbić, V., Osmankač, N., Savić, Z. (2014). Anthropometric characteristics and motor abilities in 13-15 year old female volleyball players, *Facta Universitatis*, Vol. 20, No 3, 327 - 339.  
Duncan, J., Woodfield, L., and Nakeeb, Y. (2006). Anthropometric and physiological characteristics of junior elite volleyball players, *British Journal of Sports Medicine*, 40(7): 649 - 651.

# Analysis of the start reaction time in the 60 m running discipline at the World Indoor Championships – Belgrade 2022

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## Introduction

Hundredths and, in certain situations, thousandths of a second are important for winning or setting a sprint record. The aim of this research was to analyze the results and start reaction times in men's and women's competition achieved in the 60 m running discipline at the World Indoor Championships in Athletics, held in Belgrade in 2022.

## Method

The research included 70 male and 77 female sprinters. The results were processed using standard descriptive and comparative statistical procedures. The linear Pearson correlation coefficient was used to examine the relationship between the achieved results and the start reaction time. The *t test* for independent samples was used for comparison. It was investigated whether there are statistically significant differences between the starting reaction times of men and women: all participants in the 60 m, participants in the qualifications, semi-final and final races.

## Results and discussion

The research results showed that there is a statistically significant correlation between the results and the start reaction time in women when observing the entire sample of participants ( $r=0.27$ ,  $p<0.05$ ) and when observing participants in the qualifications ( $r=0.29$ ,  $p<0.05$ ). When comparing the results of men and women, it was found that there is a statistically significant difference between the reaction time: of all competitors and female competitors ( $t=2.48$ ,  $p=0.01$ ), male and female competitors in qualifications ( $t=2.47$ ,  $p=0.02$ ), and there are no significant differences in the semi-finals and finals.

## Conclusion

The results of the research show that there is room for improving the start reaction time, according to the fact that the athletic rules define a value of less than 0.100 s for disqualification. The obtained results are to the greatest extent in agreement with previous researches.

**Key words:** world championship, sprint, start

## References

- Juhas, I., Matić, M., Janković, N. (2016). Uperedna analiza vremena startne reakcije elitnih sprintera/ki na svetskim prvenstvima 2013. i 2015. godine. *Godišnjak*, 21, 42-52.
- Tonnessen, E., Haugen, T., Shalfawi, S.A. (2013). Reaction time aspects of elite sprinters in athletic world championships. *The Journal of Strength and Conditioning Research*, 27(4), 885-892.

# Analiza vremena startne reakcije u disciplini trčanja na 60 m na svetskom dvoranskom prvenstvu – Beograd 2022

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## Uvod

Za pobedu ili postavljanje rekorda u sprintu su značajni stoti, a u određenim situacijama i hiljaditi delovi sekunde. Cilj ovog istraživanja je bio da se analiziraju rezultati i vremena startne reakcije u muškoj i ženskoj konkurenciji ostvareni u disciplini trčanja na 60 m na svetskom dvoranskom prvenstvu u atletici, održanom u Beogradu 2022. godine.

## Metod

Istraživanjem je obuhvaćeno 70 sprintera i 77 sprinterki. Rezultati su obrađeni standardnim deskriptivnim i komparativnim statističkim procedurama. Za ispitivanje povezanosti postignutih rezultata i vremena startne reakcije korišćen je koeficijent linearne Pirsonove korelacije. Za komparaciju je korišćen *t test* za nezavisne uzorke. Istraženo je da li postoje statistički značajne razlike između vremena startne reakcije muškaraca i žena: svih učesnika/ca na 60 m, učesnika/ca u kvalifikacijama, polufinalnim i finalnim trkama.

## Rezultati sa diskusijom

Rezultati istraživanja pokazuju da postoji statistički značajna povezanost između rezultata i vremena startne reakcije kod žena kada se posmatra ceo uzorak učesnica ( $r=0,27$ ,  $p<0.05$ ) i kada se posmatraju učesnice u kvalifikacijama ( $r=0,29$ ,  $p<0.05$ ). Kada se uporede rezultati muškaraca i žena utvrđeno je da postoji statistički značajna razlika između vremena reakcije: svih takmičara i takmičarki ( $t=2,48$ ,  $p=0,01$ ), takmičara i takmičarki u kvalifikacijama ( $t=2,47$ ,  $p=0,02$ ), a u polufinalu i finalu nema značajnih razlika.

## Zaključak

Rezultati istraživanja pokazuju da postoji prostor za poboljšanje vremena startne reakcije, shodno činjenici da je atletskim pravilima definisana vrednost manja od 0,100 s za diskvalifikaciju. Dobijeni rezultati su u najvećoj meri u saglasnosti sa prethodnim istraživanjima.

Ključne reči: svetsko prvenstvo, sprint, start

## Literatura

Juhas, I., Matić, M., Janković, N. (2016). Uporedna analiza vremena startne reakcije elitnih sprintera/ki na svetskim prvenstvima 2013. i 2015. godine. *Godišnjak*, 21, 42-52.  
Tonnessen, E., Haugen, T., Shalfawi, S.A. (2013). Reaction time aspects of elite sprinters in athletic world championships. *The Journal of Strength and Conditioning Research*, 27(4), 885-892.

# Heart frequency during training and competition in kick boxing and savate boxing

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## Introduction

Physiological response of an organism represents a frequently researched problem in martial arts. Due to specificity of the competition activity, in kick boxing and savate boxing, heart frequency is an acceptable and available parameter of load to which the competitor is exposed. The objective of this paper is to determine the heart frequency value before training and before a competition using the sample of kick boxing and savate boxing competitors. The values measured are those of heart frequency before warm-up in training and before warm-up in a competition, as well as those before fight commencement (before putting on gloves and immediately before getting into the fight).

## Method

Research design has comprised three quantitative measurements in previously defined situations using the sample of 28 savate and kick boxing competitors, juniors and seniors.

## Results and discussion

On the basis of the obtained results analysis, it has been determined that the values of heart frequency were increasing starting from the situation before warm-up in training, followed by the situation before the warm-up in the competition, whereby the greatest values of those monitored were reached before the commencement of the fight. As getting closer to the competition circumstances and competition situation, the values of heart frequencies became greater.

## Conclusion

In these three situations monitored, it has been determined that the heart frequency values are lower before warm-up in training compared to the situation before warm-up in a competition, whereby the greatest values are reached before the competition activity itself. For the purpose of adapting the competitor to the specific competition conditions, as observed through heart frequency monitoring, it is necessary to bring closer the physiological condition of the competitor in training circumstances to his expected physiological condition in the competition. The recommended activities which can positively influence the mentioned adaptation are as follows: change of sparring partner, change of the place of training, the use of competition equipment and the like.

**Key words** - heart frequency, kick boxing, savate boxing

## Literature

Gavrilovic, D., Mudric, M., Ćirkovic, M. (2010). Measurement of heart response after training and competition load of the fighters in savate boxing, Collection of summaries, Faculty of Sport and Physical Education, Belgrade, 136-137.  
Gavrilovic, D., Petrovic, A., Dopsaj, M., Kasum, G., Pajic, Z., Koprivica, V. (2016): Work and rest peak heart rate variability response during the different technical and tactical situations of elite kick boxers, International Journal of Performance Analysis in Sport, 16, 96-110.

# Frekvencije srca tokom treninga i takmičenja u kik boks u i savateu

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## Uvod

Fiziološki odgovor organizma je često istraživani problem u borbama sportovima. Zbog specifičnosti takmičarske aktivnosti, u kik boks u i savateu, frekvencija srca je prihvatljiv i dostupan parametar opterećenja u kojoj se nalazi takmičar. Cilj ovog rada je utvrđivanje vrednosti frekvencije srca pre treninga i pre takmičenja na uzorku kik boks u i savate takmičara. Merene su vrednosti frekvencije srca pre zagrevanja na treningu, zatim pre zagrevanja na takmičenju i vrednosti frekvencije srca pre početka borbe (pre stavljanja rukavica i neposrednog ulaska u borbu).

## Metod

Dizajn izraživanja je uključivao tri kvantitativna merenja u unapred definisanim situacijama na uzorku od 28 savate i kik boks takmičara, juniorskog i seniorskog uzrasta.

## Rezultati sa diskusijom

Analizom dobijenih rezultata utvrđeno je da se vrednosti frekvencije srca povećavaju od situacije pre zagrevanja na treningu, dalje u situaciji pre zagrevanja na takmičenju da bi najviše vrednosti od praćenih, dostigle pre početka borbe. Sa približavanjem takmičarskim uslovima i takmičarskoj situaciji vrednosti frekvencije srca su bile više.

## Zaključak

U praćene tri situacije utvrđeno je da su vrednosti frekvencije srca niže pre zagrevanja na treningu u odnosu na situaciju pre zagrevanja na takmičenju, dok su najviše vrednosti dostignute pre same takmičarske aktivnosti. Da bi se postigla adaptacija takmičara na specifične takmičarske uslove, posmatrano kroz praćenje frekvencije srca, neophodno je približiti fiziološko stanje takmičara u uslovima treninga fiziološkom stanju takmičara uslovima takmičenja. Preporučene aktivnosti koje mogu pozitivno uticati na navedenu adaptaciju su: promena sparing partnera, promena mesta treninga, korišćenje takmičarske opreme i sl.

**Ključne reči:** frekvencija srca, kik boks, savate

## Literatura

Gavrilović, D., Mudrić, M., Ćirković, M. (2010). Merenje srčanog odgovora nakon trenažnog i takmičarskog opterećenja kod boraca u savateu, Zbornik sažetaka, Fakultet sporta i fizičkog vaspitanja, Beograd, 136-137.

Gavrilovic, D., Petrovic, A., Dopsaj, M., Kasum, G., Pajic, Z., Koprivica, V. (2016): Work and rest peak heart rate variability response during the different technical and tactical situations of elite kick boxers, International Journal of Performance Analysis in Sport, 16, 96-110.

**POSTER PRESENTATIONS/  
POSTER PRESENTACIJE**

# The effects of L-Carnitine supplementation during Concurrent training on body composition and functional capacities in obese men

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## Introduction

L-Carnitine is the essential endogenous factor for the transport of long-chain fatty acids from the cytoplasm to within the mitochondrion where the  $\beta$ -oxidation process takes place. The purpose of the present research is to investigate the efficacy of L-carnitine (LC) during Concurrent training on body composition and functional capacities in obese men.

## Method

Thirty non-active healthy Men (Age =  $37.22 \pm 1.49$  years, BMI =  $33.83 \pm 2.52$  kg/m<sup>2</sup>) participated in this research. They were randomly into three groups: Experimental group 1: (L-Carnitine supplementation + 8 weeks training), Experimental group 2: (L-Carnitine supplementation + without training) and Control group. Data samples were also collected at the pre, mid and post testing period, before, after the 4 and 8-weeks training program. Concurrent training included combining endurance training with strength training and duration of training was 3 sessions per week with intensity of 60-75 percent of maximal reserve heart rate and one Repetition maximum for 70-85 minutes. Data analyzed by Factorial Anova test with post hoc analysis ( $p \leq 0.05$ ) in SPSS 22 software.

## Results and discussion

This study showed that eight weeks L-Carnitine supplementation during concurrent training have a significant effect on the development of Functional capacities and would improve body composition in obese men.

## Conclusion

In addition, the results of the current study would highlight the beneficiary effects of L-Carnitine on the functional capacities as a potential supplementation on the muscle regeneration and repair especially in elderly people. Therefore, it can be as a therapeutic approach to improve body composition and weight management and reduce risk factors in obesity men.

**Key words:** LCR, VO<sub>2</sub>max, Concurrent training, Bioimpedance

## References

Suzan A. Khodir, Marwa A. Al-Gholam, Heba R. Salem. 2020. L-Carnitine potentiates the anti-inflammatory and antinociceptive effects of diclofenac sodium in an experimentally-induced knee osteoarthritis rat model. *Iran J Basic Med Sci*, Vol. 23, No. 8.

Majid S. Koozehchian and et all. 2018. Effects of nine weeks of L-Carnitine supplementation on exercise performance, anaerobic power, and exercise-induced oxidative stress in resistance-trained males. *J Exercise Nutrition Biochem*.22(4):007-019.



# The analysis of the result differences in time segments of a handball match for senior female handball players

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## Introduction

The research has aimed to establish the differences between results in particular time segments of a handball match (15-minute quarters) by comparing the winning and the losing teams at the female WHA Meisterliga Austria 2021/22.

## Method

The sample consisted of 44 opponents in 22 matches played by team SC Ferlach/Feldkirchen. The variables sample is represented by partial result increase and result difference in quarters of the match. The teams were classified as winning or losing teams. The basic descriptive indicators of the variables were calculated. The Mann-Whitney U-test has been applied to determine differences in the segments of the match, comparing the winning and the losing teams.

## Results and discussion

The results point to statistically significant differences, considering the partial result increase in the first and fourth periods of the match. Targeted preparation for each match was reflected in the maximum engagement of the players both in the first and last part of the game. The discipline of respecting the tactically designed and agreed way of playing is obviously the characteristic of winning teams. Considering the result differences, all four periods proved to be statistically significant. That can be explained by the stable, mobile, and practiced defensive engagement, which resulted in safe and concrete attacking actions. Successful functioning in all game segments, from defense to transition and attack, will largely determine the engagement of all players as a team.

## Conclusion

Handball competition at the highest level, which takes place in highly stressful conditions, detects the expertise of the entire team as the key to success. The coach's expertise in planning and programming than properly controlling the volume of workload, technical, tactical, and psychological preparation for an individual match, with the maximum support of all club staff, brings the players to a state of the maximum readiness for competition.

**Key words:** situational efficiency, match periods, handball

## References

- Rogulj, N., Foretić, N., Burger, A. (2011). Differences in the course of result between the winning and losing teams in top handball. *Homo Sporticus*. 13(1), 28-33.
- Vuleta, D., Ohnjec K., Kanjugović I. (2013). The analysis of result differences in the time segments of a handball match for young female handball players. *Acta Kinesiologica* 7,1: 44-49

# Differences between lower limb explosive strength of men and women professional folk dancers

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## Introduction

Croatian dance folklore heritage is extremely rich and technically demanding. Choreographies are performed at the highest level, and high engagement of the cardiorespiratory and neuromuscular system is required (Mandarić, Jovančević, Đukić M. and Đukić M. 2018). A high correlation was established between coordination, rhythmic structures, balance, explosive strength and dance performance (Oreb, 1989). The research goal was to determine the differences in the explosive strength of the lower limbs depending on gender.

## Method

The sample consisted of professional dancers (n=36), female (n=21) and male dancers (n=15). Optojump measuring instrument was used. Data processing methods included: Analysis of descriptive statistical indicators and t-test for independent samples.

## Results and discussion

The results showed significant difference between the dancers, except for the unilateral explosiveness of the left leg. The body composition of male dancers defines the level of reflective abilities, which could make a difference. Dance choreographies dominantly placed on the right leg and bilateral deficit may be an indicator of an insignificant difference in left leg explosive strength.

## Conclusion

Dance performance requires technical, stage precision and a high level of explosive potential, as folkloric technique supports this. Continuous evaluation of the mentioned abilities is necessary in the context of injury prevention.

**Key words:** folklore dances, explosive potential, technique

## References

- Mandarić, S., Jovančević, V., Đukić, M., & Đukić, M. (2018). Differences in Fitness Components between Two Types of Dancers. Faculty of Education, 54
- Oreb, G., Vlašić, J., and Zagorc, M. (2011). The efficiency of a dance training on some motor abilities of folk dancers. Sport Science, 4(1), 96-100

# Importance of Leg Strength in Wrestling - mini review

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## Introduction

Success in wrestling depends on many different factors. A large number of wrestling coaches believe that strength is the most important, especially leg strength. Most points in a wrestling match are won using gut wrench and lifts from parterre (Dokmanac, M. & Slaćanac, K. (2018) and Rocikler, R. et. al (2020)). The study aim is to summarize the relevant literature in one place, including the studies that have analyzed leg strength in wrestlers, regardless of style (Greco-Roman and freestyle) and to determine which tests are most commonly used to assess different types of strength.

## Method

A literature search of 3 databases (Google Scholar, PubMed and Science Direct) was conducted. The identified studies had to meet the following criteria: year of publication (2010-2021), being published in English, wrestlers as sample of participants, who do not suffer from acute and chronic injuries.

## Results and discussion

A total of 22 studies were included, with a total of 1207 participants, both genders. Countermovement jump has been implemented in 8 studies, long jump and leg dynamometry in 6 studies, squad also in 6 studies. Followed by squat jump and vertical jump, which were used in 3 studies. Different methods of isokinetic testing were used in 4 studies. Drop jump and isometric strength of legs were also used in only 1 study.

## Conclusion

The most commonly used tests for evaluating different types of leg strength in wrestlers are countermovement jump, followed by leg dynamometry, squat and long jump. They are followed by vertical jump and long jump. We can conclude that additional testing equipment that requires certain financial resources from wrestling clubs or federations is not expensive and that most wrestling clubs or federations use this equipment. With these tests, it is possible to compare the achievements of wrestlers in clubs or national teams. Monitoring the results in tests for different types of leg strength is important because most of the points in a wrestling match are won with gut wrench and lifts from parterre and in both cases leg strength is extremely important. Norms in the tests for the assessment of leg strength could be a goal in future research on a population of wrestlers.

**Key words:** Greco-Roman, freestyle, exercise, leg strength, success in wrestling, physical fitness

## References

Dokmanac, M., Slaćanac, K. Analysis of the Most Important Parameters in Wrestling Matches from the Senior World Championship 2017, the Senior European Championship 2018 and the World Championship 2018. // 2018. International Journal of Wrestling Science, 8:2, 18-29.  
Roklicer, Roberto; Dokmanac Milorad; Curby, G. David; Lakicevic, Nemanja; Trivic, Tatjana; Slaćanac, Kristijan; Baic, Mario; Drid, Patrik Performance Data Analysis of Greco-Roman Wrestling Matches of the 2019 European Championships // International Journal of Wrestling Science, 10 (2021), 2; 1-10

# Kinesiological engagement of student smokers and no-smokers

Nikola Batistić<sup>1</sup>; Marijana Čavala<sup>1</sup>; Nenad Rogulj<sup>1</sup>; Petra Rajković Vuletić<sup>1</sup>; Željko Kovačević<sup>2</sup>

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## Introduction

Physical activity, of moderate or high intensity, is recommended daily for 60 minutes. The age of young smokers ranges from 19 to 24. Most of them do not know why they started smoking, while some give reasons such as social pressure and a sense of adulthood (Perković and Čivljak, 2016). The aim of this research is to determine the kinesiological engagement of students in relation to whether they consume tobacco products or not.

## Method

The respondent sample consists of 135 female students of the Department of Health Studies and the Faculty of Medicine of the University of Split. The sampling variables consists of answers to questions about the frequency of engaging in kinesiology activities and about tobacco consumption. Of the total number of non-smokers, percentages are calculated depending on recreational and sport engagement. Through the h<sup>2</sup>-test and Kruskal -Wallis, the analysis analyzed the link, i.e. the difference between the degree of kinesiological involvement of the student in relation to their consumption of tobacco products.

## Results and discussion

The results of the study indicated that most students are not prone to smoking, nor do they practice kinesiological activities. Smoking is one of the leading risk factors for many diseases, so this is a positive result of this population and suggests that health professionals are aware that smoking has a negative effect on health. However, the fact that students are minimally and insufficiently involved in kinesiological activities is of concern.

## Conclusion

This finding requires a kinesiologist to follow the course of research into more detailed insights into reasons, and conducting research on a larger sample of students so that the general conclusions can be drawn. Among the multiplicity of reasons for insufficient kinesiological involvement, however, the most important is lack of awareness of the importance of physical exercise for health. So, the task of our kinesiologists should be to instill a habit of physical exercise and education about the importance of physical exercise for the quality of human life.

**Key words:** physical activity, recreation, sport, differences.

## References

Perković, D., Čivljak, M. (2016). The attitudes of young users of Facebook from Croatia on smoking tobacco. *Sister's messenger*, 21 (2), 117-124. Jankovic, J. F. (1971). Sports Facilities. *The Serbian Journal of Sports Facilities*, 22, 1-19.

# Is there a relative age effect in Croatian gymnastics?

Sunčica Delaš Kalinski<sup>1</sup>; Ana Kezić<sup>1</sup>; Alen Miletić<sup>1</sup>

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

## Introduction

Favoritism towards the selection of athletes born at the beginning of a calendar year is called the relative age effect (RAE; Kirkendall, 2014). Accordingly, RAE refers to the specific selection and possession of certain advantages that occur as a result of physical and cognitive variability among peers (Musch & Grondin, 2001). Research on the influence of relative age in artistic gymnastics is very rare (Baxter-Jones, 1995; Baker, Janning, Wong, Cobley, & Schorer, 2014; Hancock, Starke, & Ste-Marie, 2015) and has been conducted predominantly at national levels. In general, the existence of the influence of relative age in male and female gymnasts was not found. Therefore, the aim of this research was to check for RAE in Croatian gymnasts.

## Method

The sample of respondents included male and female gymnasts (192 males and 651 females) who participated in the official national competitions organized by the Croatian Gymnastics Federation in 2019. The sample of variables was represented by the dates of birth of the competitors (they were collected from the official bulletins of the competition). In order to analyze the presence of the RAE effect, traditional data analysis was used: classification of birth dates into four quartiles/quarters of the calendar year. The Chi-square ( $\chi^2$ ) test was applied to identify differences between the frequencies of the gymnast's date of birth belonging to a certain quartile of the calendar year.

## Results and discussion

By analyzing the determined frequencies, no significant differences between quartiles were found for male gymnasts ( $p=0.91$ ), while significant differences were found for female gymnasts ( $p=0.00$ ). The mentioned significant differences (for female) are probably the result of higher frequencies of birth dates in the second quartile (Q2; birth period from 1.4. - 30.6.) compared to the frequencies of birth dates in the other quartiles. In general, RAE has not been established in Croatian male gymnasts, while the same is noticeable in Croatian female gymnasts. The obtained result for gymnasts is in contrast to the results of previous research conducted in different parts of the world, since they found either the absence of RAE among gymnasts (Hancock, Starke, & Ste-Marie, 2015) or they found a negative RAE (the highest frequencies of birth dates were determined in the last quartile of the calendar year).

## Conclusion

Due to non-determination of significant differences in frequencies between groups of differently ranked male and female competitors, at both regional and national championships, it was concluded that the relative age effect (RAE) is not present in Croatian gymnastics.

**Key words:** artistic gymnastics, quartiles, birth month, RAE

## References

- Baker, J., Janning, C., Wong, H., Cobley, S., & Schorer, J. (2014). Variations in relative age effects in individual sports: skiing, figure skating and gymnastics. *European Journal of Sport Science*, *14*(1), 183–190.
- Baxter-Jones, A.D. (1995). Growth and development of young athletes. Should competition levels be age related? *Sports Medicine*, *20*, 59–64.

**PHYSIOLOGY, SPORTS MEDICINE AND EXERCISE MEDICINE,  
BIOMECHANICS /  
FIZIOLOGIJA, SPORTSKA MEDICINA I MEDICINA VEŽBANJEM,  
BIOMEHANIKA**

## INTRODUCTORY LECTURE

### **Injuries sustained during sports activities as occupational injuries and their forensic expertise**

Aleksandra Popović<sup>1</sup>

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Various sports activities, whether it is a physical activity carried out with the aim of achieving health benefits or during the engagement in professional sports, are often associated with the occurrence of sports injuries. These injuries can lead to shorter or longer interruption of sports activities. They can affect the overall quality of life of the injured, as well as the ability to work and provide basic needs. Sports professionals who have sustained serious injuries during sports activities and are not protected by various forms of health insurance that would cover the costs of treatment and ensure minimum living conditions during the period of treatment and rehabilitation can be in serious trouble in terms of covering the costs. On the other hand, even sports professionals who are employed in various public and private institutions and businesses such as athletic trainers, coaches, physical education teachers, physiotherapists, fitness and military instructors, as well as people who organize recreational activities for workers in different small and big enterprises and companies may have difficulties in describing injuries occurred during their occupational activities as work-related injuries. According to the Serbian Law on Occupational Health and Safety, the employer is obliged to report an injury to an employee within 24 hours of the occurrence of the injury by filling out and submitting Injury Report list to the Insurance and Pension Commission. Such a report is not always sufficient for them to describe a sports injury as a work-related injury due to the lack of relevant documents and it may result in inadequate or no monetary compensation if the injured person is incapacitated for short or long period of time.

During this presentation, legislation relating to occupational injuries and the possibility of its application to sports injuries occurred as work-related injuries will also be presented together with basic principles of forensic medical examination of the non-material and material damage caused by sports injuries.

#### **References**

Kucera KL, Lipscomb HJ, Roos KG, Dement JM, Hootman JM. Work-related injury and management strategies among certified athletic trainers. *Journal of Athletic Training* 2018;53(6):606–618

Zlatanović M. Sportske povrede u svetu i kod nas. *Povrede u sportu kao predmet sudskomedicinskog veštačenja* UDK: 796/340.6.

Zakon o radu. „Službeni glasnik“ RS broj 24/2005, 61/2005, 54/2009, 32/2013, 75/2014, 13/2017.

## UVODNO PREDAVANJE

### **Povrede nastale tokom sportskih aktivnosti kao povrede na radu i njihovo veštačenje**

Aleksandra Popović<sup>1</sup>

Univerzitet u Beogradu, Fakultet sporta i fizičkog vaspitanja, Beograd, Srbija<sup>1</sup>

Bavljenje različitim sportskim aktivnostima, bilo da se radi o fizičkoj aktivnosti koja se sprovodi u cilju unapređenja i poboljšanja sopstvenog zdravlja ili u sklopu bavljenja profesionalnim sportom može izazvati nastanak različitih povreda koje mogu dovesti ne samo do kraćeg ili dužeg prekida sportskih aktivnosti već to može uticati na ukupni kvalitet života povređene osobe. Ona može biti u dužem vremenskom periodu onemogućena da radi što čak može ugroziti i egzistenciju te osobe. Poseban problem u tom smislu mogu predstavljati povrede osoba koje se profesionalno bave sportom i koje su nastale tokom njihove sportske aktivnosti a koje pri tom nisu zaštićene različitim oblicima zdravstvenog osiguranja kojima bi se pokrili troškovi lečenja i obezbedili minimalni egzistencijalni uslovi. Profesionalci u sportu koji su zaposleni u različitim državnim i privatnim institucijama i firmama kao što su treneri sporta, profesori fizičkog vaspitanja, fizioterapeuti, fitnes i vojni instruktori kao i osobe koje organizuju rekreativne aktivnosti radnika u fabrikama i kompanijama mogu takođe imati poteškoća prilikom priznavanja povreda nastalih tokom njihovih profesionalnih, sporskih aktivnosti kao povreda na radu. Poslodavci u skladu sa važećom zakonskom regulativom moraju da prijave svaku povredu svog zaposlenog nastalu na radnom mestu koja može da dovede do odsustva sa posla u trajanju od najmanje tri uzastopna dana u roku od 24 časa od trenutka nastanka povrede putem Prijave o povredi. Međutim, postojeći obrazac koji se primenjuje kod povreda u sportu koji često prati nedovoljna dokumentacija nije uvek dovoljan da bi se na osnovu njega sportska povreda tretirala kao povreda na radu o čemu odlučuje nadležna Komisija zdravstvenog i penzijsko – invalidskog osiguranja. To često povlači sa sobom i izostanak ili neadekvatnu nadoknadu štete ukoliko je kod povređene osobe nastupila kratkotrajna ili dugotrajna radna nesposobnost.

Tokom ovog predavanja će biti opisana zakonska regulativa kod povreda na radu, ukazaće se na mogućnost njene primene na povrede u sportu koje se mogu tretirati kao povrede na radu a takođe će biti predstavljeni i osnovni principi sudskomedicinskog veštačenja štete nastale zbog sportskih povreda.

#### **Literatura**

Kucera KL, Lipscomb HJ, Roos KG, Dement JM, Hootman JM. Work-related injury and management strategies among certified athletic trainers. *Journal of Athletic Training* 2018;53(6):606–618

Zlatanović M. Sportske povrede u svetu i kod nas. Povrede u sportu kao predmet sudskomedicinskog veštačenja UDK: 796/340.6.

Zakon o radu. „Službeni glasnik“ RS broj 24/2005, 61/2005, 54/2009, 32/2013, 75/2014, 13/2017.



# **Electromyographic analysis of the latissimus dorsi and the posterior deltoid muscles during the rotational movement in the execution of the open stance forehand drive technique in tennis**

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## **Introduction**

The modern game of tennis is often associated with open stance forehands since they allow for more power and take less time to execute. The present study focused on the order in which and extent to what the two main muscles the latissimus dorsi and the posterior deltoid, are activated during the execution of the open stance forehand drive-in tennis.

## **Method**

Eleven (5 males, 6 females) right-handed young tennis players, aged 12-16 participated in this study. All subjects were proficient in executing the forehand drive with the open stance, and at least ten trials of each forehand were performed at the Neuromechanics Laboratory using Bio Ware<sup>®</sup> Software Type 2812A. The best performance was chosen based on the smooth curve of the electromyography.

## **Results and discussion**

The average of the maximum activation of the latissimus dorsi recorded with EMG, corresponds to  $4,15 \pm 1,137$  and for the posterior deltoid, the maximum activation was  $6,70 \pm 1,90$ . The t-test for dependent samples was used, and it was  $P = 0.000 < 0.05$ . The EMG results showed that the dorsal dorsum is activated first followed by the posterior deltoid. The degree of activation was almost twice the posterior deltoid level at the time of racket contact with the ball, compared to the wide dorsal. We found that the function of the motor chain follows the coordination of the involvement of the two muscles to perform the forehand drive with the open stance, which means that the rotational motion transfers significant energy which translates into speed and strength.

## **Conclusion**

Understanding when and how much shoulder muscles are active during the execution of the open stance forehand drive is very important to coaches, physical trainers and physiotherapists in providing appropriate treatment, training and rehabilitation protocols for young athletes.

**Key words:** Surface electromyography, latissimus dorsi, posterior deltoid, open stance forehand drive.

## **References**

- Reid M, Elliott B, Crespo M. Mechanics and learning practices associated with the tennis forehand: a review. *Journal of Sports Science and Medicine* (2013)12, 225-231.
- Rota, S., Hautier, C., Creveaux, T., Champely, S., Guillot, A. and Rogowski, I. (2012). Relationship between muscle coordination and forehand drive velocity in tennis. *Journal of Electromyography and Kinesiology* 22(2), 294-300.

# The acute effects of mindfulness practice on recovery of HRV in female basketball players

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Yalova University, Faculty of Sport Sciences<sup>2</sup>

## Introduction

Basketball players compete at an average physiological intensity above the lactate threshold and at 85% of the maximum heart rate (HRmax) during a 40-minute match (Stojanović et al., 2018). The aim of the present research was to understand the effects of using a mindfulness practice to eliminate the fatigue and to quicken the recovery of heart rate variability (HRV) in basketball players.

## Method

Nine professional female basketball players visited the facility twice. After having their pre-test measurements, they were exposed to 20 min of physical loading similar to the basketball game, and then they watched a 10-minute documentary in the first visit, and they performed a 10-min of mindfulness practice in the second visit. The HRV values were recorded during resting, right after 20-minute physical loading and at the end of 10-min documentary watching in the first, and 10-minute mindfulness practice in the second visit.

## Results and discussion

According to the results, participants had similar results. The time- and frequency-domain HRV parameters obtained from the participants did not change between the days of measurement. HRV values taken at rest, after physical loading and after implementation were significantly different for both groups. The Mean RR, SDNN, RMSSD, TINN, HF, and LF decreased and the Mean HR increased at the end of the physical loading. However, when the mean differences between physical loading and end-of-implementation HRV values were compared for both measurement days, no difference was found.

## Conclusion

These results show that HRV parameters impair depending on physical loading in basketball game as expected, but passive resting or mindfulness practice at half-time has similar effects on the recovery process of HRV.

**Key words:** basketball, HRV, mindfulness, recovery

## References

Stojanović, E., Stojiljković, N., Scanlan, A. T., Dalbo, V. J., Berkelmans, D. M., & Milanović, Z. (2018). The activity demands and physiological responses encountered during basketball match-play: a systematic review. *Sports Medicine*, 48(1), 111-135.

# Acute effects of myofascial roller massage, static and dynamic stretching on the vertical jump of young volleyball players

Nevena Vukadinović<sup>1</sup>; Anastasia Krejović<sup>1</sup>; Goran Nešić<sup>1</sup>; Nikola Majstorović<sup>1</sup>; Kristina Nikolić<sup>1</sup>

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## Introduction

Studies indicate that some form of stretching involving sport-specific movements can be included as part of the warm-up to achieve maximum exercise effect ( Faigenbaum et al., 2006). The aim of the research was to determine the acute effects of myofascial massage using rollers, static and dynamic stretching on the vertical jump of young volleyball players.

## Method

In this research, an experimental method was used, the sample of subjects consisted of 24 young volleyball players 13-15 years old, divided into four groups of 6 subjects each, who performed a different type of treatment on each experimental day, namely: dynamic stretching, static stretching, myofascial massage and one group was control (no treatment). The dependent variable that was observed was the height of the vertical jump, which was assessed using the Sargent test.

## Results and discussion

A two-factor analysis of variance (ANOVA) did not show a statistically significant difference after dynamic stretching ( $p=0.102$ ) and myofascial massage ( $p=0.718$ ) on the explosive strength of the lower extremities, while there was a statistically significant difference after applying the static stretching protocol ( $p=0.033$ ), where based on the obtained results, it is concluded that static stretching has a negative effect on the vertical jump of young volleyball players.

## Conclusion

The findings of this study show that there is no significant difference between dynamic stretching and myofascial massage, so it does not affect the increase in vertical jump height. However, a statistically significant difference was observed after the static stretch ( $p=0.033$ ), where the vertical jump height values decreased by (1.5 cm). For further research efforts, it is recommended that the testing and implementation of the treatment be carried out on more subjects, for a longer period of time, as well as with the presence of a greater number of exercises in the protocols, which would contribute to a more significant effect of the observed treatments.

**Key words:** dynamic stretching, static stretching, myofascial massage, Sargent test

## References

Faigenbaum, A.D., Kang, J., McFarland, J., Bloom, J.M., Magnatta, J., Ratamess, N.A., Hoffman, J.R. (2006). Acute effects of different warm-up protocols on anaerobic performance in teenage athletes. *Pediatr Exerc Sci* 18: 64–75.

# **Akutni efekti miofascijalne masaže rolerom, statičkog i dinamičkog rastezanja na vertikalni skok mladih odbojkašica**

Nevena Vukadinović<sup>1</sup>; Anastasija Krejović<sup>1</sup>; Goran Nešić<sup>1</sup>; Nikola Majstorović<sup>1</sup>; Kristina Nikolić<sup>1</sup>

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## **Uvod**

Studije navode da se primena određenog oblika rastezanja koji uključuje pokrete specifične za sport, može uključiti kao deo zagrevanja radi postizanja maksimalnog efekta vežbanja (Faigenbaum i sar., 2006). Cilj istraživanja bio je da se utvrde akutni uticaji miofascijalne masaže putem rolera, statičkog i dinamičkog rastezanja na vertikalni skok mladih odbojkašica.

## **Metod**

U ovom istraživanju je korišćen eksperimentalni metod, uzorak ispitanika činile su 24 mlade odbojkašice uzrasta (13-15 godina) podeljene u četiri grupe po 6 ispitanica, koje su svakog eksperimentalnog dana sprovodile drugu vrstu tretmana i to: dinamičko rastezanje, statičko rastezanje, miofascijalnu masažu i jedna grupa je bila kontrolna (bez tretmana). Zavisna varijabla koja je posmatrana jeste visina vertikalnog skoka, koja je procenjivana uz pomoć Sargent testa.

## **Rezultati sa diskusijom**

Dvofaktorskom analizom varijanse (ANOVA) nije zabeležena statistički značajna razlika između dinamičkog rastezanja ( $p=0.102$ ) i miofascijalne masaže ( $p=0.718$ ) na eksplozivnu snagu donjih ekstremiteta, dok postoji statistički značajna razlika nakon primene protokola statičkog rastezanja ( $p=0.033$ ), gde se na osnovu dobijenih rezultata zaključuje da statičko rastezanje utiče negativno na vertikalni skok mladih odbojkašica.

## **Zaključak**

Nalazi ove studije pokazuju da nema značajne razlike između dinamičkog rastezanja i miofascijalne masaže, dakle ne utiču na povećanje visine vertikalnog skoka. Međutim primećena je statistički značajna razlika nakon statičkog rastezanja ( $p=0.033$ ), gde su vrednosti visine vertikalnog skoka opale za (1.5 cm). Za dalje istraživačke napore, preporuke su da se testiranje i sprovođenje tretmana sprovodi na više ispitanika, duži vremenski period, kao i uz prisustvo većeg broja vežbi u protokolima, što bi doprinelo i značajnijem efektu posmatranih tretmana.

**Ključne reči:** dinamičko rastezanje, statičko rastezanje, miofascijalna masaža, Sargent test

## **Literatura**

Faigenbaum, A.D., Kang, J., McFarland, J., Bloom, J.M., Magnatta, J., Ratamess, N.A., Hoffman, J.R. (2006). Acute effects of different warm-up protocols on anaerobic performance in teenage athletes. *Pediatr Exerc Sci* 18: 64–75.

# The role of alexithymia and anxiety in sport injury recovery: a retrospective study

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## Introduction

Injuries are an integral part of doing sports. When an injury occurs, emphasis is often placed on its physical aspects and consequences, while neglecting the individual differences in both cognitive and emotional responses to injury that stem from various personal and situational influences. The goal of this study was to examine the influence of alexithymia and injury-related anxiety as personality traits on injury recovery via retrospective assessment of professional athletes who experienced significant injuries.

## Method

A sample of 40 competitive athletes (20 females) completed the Toronto Alexithymia Scale (TAS, Bagby, 1994) and Sport Injury Anxiety Scale (SIAS, Rex, 2016) to assess their trait alexithymia and anxiety respectively, and the Return to Sport After Serious Injury Questionnaire (RSSIQ, Podlog, 2005) to retrospectively evaluate the perceived recovery success with respect to their most serious injury so far. They additionally provided information about their professional status, financial dependence from doing sports, athletic experience, history of injuries, and the length of the recovery process.

## Results and discussion

Multiple regression analysis demonstrated that show that only higher scores on the Identifying feelings subscale of the TAS ( $\beta = 0.449$ ) predict an increased presence of RSSIQ-Return concerns ( $R = 0.73$ ,  $F(10, 29) = 3.39$ ,  $p < .01$ ,  $R^2_{adj} = 0.38$ ). On the other hand, no personality variable predicted the RSSIQ-Renewed perspective ( $R = 0.58$ ,  $F(10, 29) = 1.51$ ,  $R^2_{adj} = 0.11$ ). However, older, more experienced and more frequently injured athletes scored higher on the Renewed perspective subscale of the RSSIQ.

## Conclusion

This study suggests that athletes with difficulties in understanding their own emotional experiences and emotionally processing their injuries in general should especially be paid attention to during the rehabilitation process. Additionally, more studies are needed on the relationship of stable personality traits and injury recovery process, especially traits related to differences in emotional responses.

**Key words:** sport injury, alexithymia, anxiety

## References

- Podlog, L., & Eklund, R. C. (2005). Return to sport after serious injury: a retrospective examination of motivation and psychological outcomes. *Journal of sport rehabilitation*, 14(1), 20-34.
- Bagby, R. M., Parker, J. D., & Taylor, G. J. (1994). The twenty-item Toronto Alexithymia Scale—I. Item selection and cross-validation of the factor structure. *Journal of psychosomatic research*, 38(1), 23-32.

# Aleksitimija i anksioznost kao faktori oporavka od sportske povrede: retrospektivna studija

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## Uvod

Povrede su sastavni deo bavljenja sportom. Kada se dogodi povreda, naglasak se stavlja na njene fizičke aspekte i posledice, dok se individualne razlike u kognitivnim i emocionalnim odgovorima na povredu koje nastaju usled dejstva različitih ličnosnih i socijalnih uticaja najčešće zanemaruju. Cilj ovog istraživanja bio je da se ispita uticaj aleksitimije i anksioznosti u vezi sa povredom kao stabilnih odlika ličnosti na oporavak od povrede putem retrospektivnog ispitivanja profesionalnih sportista koji su doživeli značajne povrede.

## Metod

Na uzorku od 40 sportista takmičara (20 žena) primenjeni su sledeći upitnici: Toronto skala aleksitimije (*Toronto Alexithymia Scale*, TAS, Bagby, 1994) i Upitnik o anksioznosti u vezi sa povredom (*Sport Injury Anxiety Scale*, SIAS, Rex, 2016) za procenu ličnosnih odlika, i Upitnik o povratku u sport nakon ozbiljne povrede (*Return to Sport After Serious Injury Questionnaire*, RSSIQ, Podlog, 2005) za procenu uspešnosti oporavka od povrede, i to u odnosu na najozbiljniju dosadašnju povredu. Dodatno, sportisti su izvestili o svom profesionalnom statusu, materijalnoj zavisnosti od sporta, sportskom iskustvu, istoriji povreda i dužini perioda oporavka.

## Rezultati sa diskusijom

Multipla regresiona analiza je pokazala da jedino viši skorovi na subskali Identifikovanje osećanja (TAS) ( $\beta = 0.449$ ) predviđaju veće skorove na subskali Brige u vezi sa povratkom u sport (RSSIQ) ( $R = 0.73$ ,  $F(10, 29) = 3.39$ ,  $p < .01$ ,  $R^2_{adj} = 0.38$ ). S druge strane, nijedna varijabla ličnosti ne predviđa skorove na subskali Unapređena perspektiva ( $R = 0.58$ ,  $F(10, 29) = 1.51$ ,  $R^2_{adj} = 0.11$ ). Međutim, stariji, iskusniji, i češće povređivani sportisti ostvarili su više skorove na ovoj subskali.

## Zaključak

Ovo istraživanje ukazuje da je na sportiste sa poteškoćama u razumevanju sopstvenih emocionalnih iskustava i emocionalnoj obradi svojih povreda uopšte potrebno naročito obratiti pažnju tokom procesa rehabilitacije. Dodatno, potrebna su dalja istraživanja odnosa stabilnih odlika ličnosti i procesa oporavka od povrede, naročito onih crta koje su povezane sa razlikama u emocionalnim odgovorima.

**Ključne reči:** sportske povrede, aleksitimija i anksioznost

## References

- Podlog, L., & Eklund, R. C. (2005). Return to sport after serious injury: a retrospective examination of motivation and psychological outcomes. *Journal of sport rehabilitation*, 14(1), 20-34.
- Bagby, R. M., Parker, J. D., & Taylor, G. J. (1994). The twenty-item Toronto Alexithymia Scale—I. Item selection and cross-validation of the factor structure. *Journal of psychosomatic research*, 38(1), 23-32.

# Ultrasound estimation for knee intra-articular mechanical response at isometric stretching

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## Introduction

The present study aim is to evaluate the change in the distance between the bony cartilaginous surfaces of the tibia and femur inside the knee capsule under different loads with isometric stretching.

## Method

The experimental model includes an ultrasound examination of a knee joint after isometric stretching of healthy men (n=10). The changes (in millimeters) of the distances between the femur and tibia were measured with portable ultrasound system (Vinnco 6, China) at two different sitting positions and at three different upright positions – all with a knee angle of 140 degrees at rest. In two of the three upright positions, extra loads of 4 and 8 kg were applied vertically down to the lower right limb to induce isometric stretching. Three quantitative parameters - distance up (Dup), distance down (Ddown), and area (A) from ultrasound pictures were introduced. They define two displacements (mm) and area (mm<sup>2</sup>) between femur and tibia cartilage surfaces in the knee joint. The statistical analysis was conducted with Sigma Plot 10.

## Results and discussion

The results show that applying extra loads significantly increase Dup (at 4 and 8 kg), Ddown (only at 8 kg) and A (only at 8 kg). The obtained results for the change of the intra-articular geometry under load and stretching serve as a quantitative assessment of the internal joint kinematics and determination of the individual joint mobility of the participants in the experiment (Ranchev et al., 2019. Ranchev et al., 2020).

## Conclusion

Quantitative data will help to create a mathematical model for the mechanical effects during deformation of the knee joint capsule, as well as to prepare quantitative method with software program for automatic calculation of femur-tibia kinematics from ultrasound images (Stoychev et al., 2021). Future tasks: increasing mass of loading; improve data acquisition; enlarge participant groups; comparison men and women; study of cartilage deformation at stretching loading; looking for isometric stretching influence on knee hemorheology (Ivanov, I., 2022).

**Key words:** isometric stretching, knee biomechanics, ultrasound scanning

## Acknowledgement

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## References

- Ranchev, S., Ivanov, I., Stoichev, St., Iotov, I. (2019). On the biomechanical processes in human knee joint during active isometric stretching. Series on Biomechanics, Vol.33, No. 3(2019), 56 – 61.  
Ranchev, S., Ivanov, I.M., Iotov, I. and Stoytchev, S., (2020). STUDIES ON A PARADOX IN THE WORK OF THE UPPER LIMBS IN ISOMETRIC STRETCHING. Journal of Applied Sports Sciences, 2, pp. 80-90.

# Implementation of Telemetric Electrocardiography in sports cardiology

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## Introduction

Sudden cardiac death, defined as cessation of cardiac activity in a time period of up to 1 hour upon the showcase of first symptoms, represents quite a concern when it comes to its occurrence among athletes. Understanding the etiology and pathophysiology of such occurring conditions is crucial in order to properly advance in creating solutions related to reduction of the annual number of such cases. Implementation of online outdoors, cloud based telemetric devices capable of registering electrical activity of the heart during physical activity is hypothesized to give relevant information about the state of the heart, especially if the previous laboratory ECG and echocardiography screening indicated borderline interpretation results (Drezner et al., 2017).

## Method

Methodology of this paper is based on thorough review of scientific articles from the field of cardiac physiology, medicine, sports and bioengineering. All of them published within journals from the SCI list and acquired using a snowball effect.

## Results and discussion

"Savvy ECG sensor" represents the only feasible online telemetric device that is proven to provide quality outdoors ECG signals during physical activity with an acceptance rate of >99%. Devices such as "EQ02+" and "eMotion FAROS 180" represent most relevant tools for HRV monitoring during physical activity. Detrended fluctuation analysis within HRV measurement has shown the highest correlation with its short-term measurement and sudden cardiac death occurrence, while 1/f power-law slope mostly correlated with overall mortality (Mäkikallio et al., 2001).

## Conclusion

Strategy related to reduction of the sudden cardiac incidence should be aimed towards implementation of aforementioned devices, as well as HRV, within cases which represent borderline ECG interpretation results. That being said, further research requires practical implementation of aforementioned devices with a goal to determine whether their usage affects the long-term number of sudden cardiac deaths.

**Key words:** sudden cardiac death/prevention/sensors

## References

- Mäkikallio, T. H., Huikuri, H. V., Mäkikallio, A., Sourander, L. B., Mitrani, R. D., Castellanos, A., & Myerburg, R. J. (2001). Prediction of sudden cardiac death by fractal analysis of heart rate variability in elderly subjects. *Journal of the American College of Cardiology*, 37(5), 1395–1402.
- Drezner, J. A., Sharma, S., Baggish, A., Papadakis, M., Wilson, M. G., Prutkin, J. M., ... Corrado, D. (2017). International criteria for electrocardiographic interpretation in athletes: Consensus statement. *British Journal of Sports Medicine*, 51(9), 704–731.



# Primena telemetrijske elektrokardiografije u sportskoj kardiologiji

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## Uvod

Iznenadna srčana smrt, definisana kao prestanak srčanog rada u periodu od jednog sata nakon pojave prvih simptoma, predstavlja zabrinjavajuću pojavu ukoliko se zadesi kod sportista ili rekreativaca. Razumevanje etioloških i patofizioloških mehanizama koji dovode do iznenadne srčane smrti je ključno radi uspostavljanja napretka i rezultata u vidu smanjenog godišnjeg broja iznenadne srčane smrti. Upotreba telemetrijskih uređaja koji poseduju mogućnost pravovremenog transmitovanja i skladištenja podataka srčane električne aktivnosti tokom fizičke aktivnosti, predstavlja značajan alat za dublju interpretaciju kardiovaskularnog stanja samog korisnika, ukoliko su laboratorijski EKG i ultrazvuk nalazi pokazali parametre graničnih interpretacionih vrednosti (Drezner et al., 2017).

## Metod

Metodologija ovog rada je zasnovana na temeljnom pregledu naučne literature iz oblasti kardiofiziologije, medicine, sporta i bioinženjeringa. Svi uključeni radovi pripadaju časopisima koji se nalaze na SCI listi, selektirani putem sistema citiranja.

## Rezultati sa diskusijom

"Savvy ECG sensor" predstavlja jedini praktično primenljiv i onlajn uređaj koji je testirano dokazan da pruža kvalitetne EKG signale tokom fizičke aktivnosti izvan laboratorije, sa stepenom njihove prihvatljivosti od >99%. Uređaji kao što su "EQ02+" i "eMotion FAROS 180" predstavljaju najrelevantnija sredstva za monitoring varijabilnosti srčane frekvencije tokom fizičke aktivnosti. Detrendovana fluktuaciona analiza kratkoročne varijabilnosti srčane frekvencije pokazuje najveću korelaciju u okviru predikcije iznenadne srčane smrti, dok nagib spektralne regresije predstavlja najbolji prediktor sveopšte smrtnosti (Mäkikallio et al., 2001).

## Zaključak

Buduća stradegija na ovom polju zahteva implementaciju prethodno pomenutih uređaja u skladu sa navedenim specifikacijama, kao i implementaciju evaluacije varijabilnosti srčanog ritma upravo kod onih pojedinaca koji iskazuju granične interpretacione vrednosti na sportskom lekarskom pregledu. Buduća istraživanja je potrebno usmeriti ka praktičnoj primeni navedenih uređaja radi procene njihove efektivnosti na učestalost nastanka iznenadne srčane smrti.

**Ključne reči:** iznenadna srčana smrt/ prevencija/ senzor

## Literatura

Mäkikallio, T. H., Huikuri, H. V., Mäkikallio, A., Sourander, L. B., Mitrani, R. D., Castellanos, A., & Myerburg, R. J. (2001). Prediction of sudden cardiac death by fractal analysis of heart rate variability in elderly subjects. *Journal of the American College of Cardiology*, 37(5), 1395–1402.

Drezner, J. A., Sharma, S., Baggish, A., Papadakis, M., Wilson, M. G., Prutkin, J. M., ... Corrado, D. (2017). International criteria for electrocardiographic interpretation in athletes: Consensus statement. *British Journal of Sports Medicine*, 51(9), 704–731.

# The effects of equipment-based pilates and slow, controlled breathing exercises on heart rate variability in healthy women

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## Introduction

Heart rate variability (HRV) is a non-invasive method of studying changes in the autonomic nervous system (Berntson et al., 1997), and can be affected by many different parameters. The aim of the current research was to compare the chronic effects of equipment-based Pilates, slow breathing exercise, and a combination of equipment-based Pilates and slow breathing exercise on HRV in healthy women.

## Method

A total of 40 healthy women were divided into groups of 10 each, as the control group (CG), the Pilates group (PG), the slow breathing exercise group (SBG), and the Pilates + slow breathing exercise group (PSBG). While the PG did Pilates exercises twice a week and 50 minutes a day and SBG did slow-controlled breathing exercises for 15 minutes twice a week, the PSBG practiced 50 minutes of Pilates exercises two days a week and 15 minutes of breathing exercises once a week. After 10 weeks of implementation, time- and frequency-domain parameters of HRV were examined.

## Results and discussion

Root mean square of successive RR interval differences (RMSSD) was developed in the PSBG, the related standard deviation of successive RR interval differences (SDSD) and standard deviation of NN intervals (SDNN) were developed in PG, PSBG, and in SBG significantly. Similar changes were also observed in frequency-domain parameters. At the end of the study, the total power (TP) and low frequency (LF) were recorded higher in all groups, while the high frequency (HF) was higher in only PSBG and SBG, and very low frequency (VLF) was higher in only PSBG significantly. In intergroup comparisons, the highest increases on SDSD, SDNN, TP, HF, LF, and VLF were observed in PSGB.

## Conclusion

In accordance with the results, it could be seen that all of the implementations were successful in enhancing the HRV after 10 weeks. However, practicing equipment-based Pilates and slow, controlled breathing exercise together was more effective.

**Key words:** HRV, Pilates, Slow breathing

## References

Berntson, G. G., Bigger, J. T., Eckberg, D. L., Grossman, P., Kaufmann, P. G., Malik, M., Nagaraja, H. G., Porges S. W., Saul, J. P., Stone, P. H., van der Molen, M. W. (1997). Heart rate variability: origins, methods, and interpretive caveats. *Psychophysiology*, 34(6): 623-648.

\* This research was produced from Songül Adigüzel's doctoral thesis titled "The Effects of Equipment-Based Pilates and Slow Breathing Exercises on Heart Rate Variability, Respiration and Omega Parameters".

# Rehabilitation after anterior cruciate ligament injury of the knee: Etiology, loading criteria and return to sport

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## Introduction

The anterior cruciate ligament (ACL) is often injured during sports activities with a non-contact mechanism, while early diagnosis, treatment aimed at protecting the secondary structures of the knee and rehabilitation play an important role. It is important to start preoperative recovery whenever possible. Transition to a more advanced rehabilitation phase should begin after meeting certain criteria. The aim of this paper was to systematize knee loading during different phases of ACL rehabilitation by reviewing previous research.

## Method

For this paper empirical-bibliographic method was used. The literature review was performed using reference scientific databases (PubMed and Google Scholar). The search for papers was based on research of the mentioned sites using the following keywords: protocols, rehabilitation, anterior cruciate ligament, prevention, return to sport criteria.

## Results and discussion

After ACL reconstruction, achieving full range of motion in the knee should be achieved as soon as possible. Once the criteria of normal muscle activation and non-analgesic gait are met, closed kinetic chain exercises are introduced, as they have been shown to reduce stress on the ACL. Strength training alone does not reduce the number of ACL injuries, however when combined with plyometric training there is a significant reduction, especially in female athletes. In planning training cycles, you should leave enough space for skill training.

## Conclusion

Modifiable or non-modifiable risk factors predispose athletes (especially women) to ACL injuries. In addition to strength, enough space should be left for skill training, using neuromuscular training methods. After discharge from a formal rehabilitation program, it is necessary to change exposure to sports activities. Deficits in muscle strength, proprioception and balance are present 6 months to 2 years after reconstruction.

**Key words:** injury, knee, sport, rehabilitation

## References

Laskowski, E. R. (2014). ACL injury and rehabilitation. *Current Physical Medicine and Rehabilitation Reports*, 2(1), 35-40.  
Micheo, W., Hernández, L., & Seda, C. (2010). Evaluation, management, rehabilitation, and prevention of anterior cruciate ligament injury: current concepts. *PM&R*, 2(10), 935-944.

# Rehabilitacija nakon povrede prednjeg ukrštenog ligamenta kolena: Etiologija, kriterijumi za doziranje opterećenja i povratak sportu

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## Uvod

Prednji ukršteni ligament (ACL) se često povređuje tokom sportskih aktivnosti beskontaktnim mehanizmom, dok rana dijagnoza, lečenje usmereno na zaštitu sekundarnih struktura kolena i rehabilitacija igraju važnu ulogu. Preoperativni oporavak je značajno započeti kad god je to moguće. Sam prelazak u napredniju fazu rehabilitacije trebalo bi da započne nakon ispunjavanja određenih kriterijuma. Ovaj rad imao je za cilj da pregledom dosadašnjih istraživanja sistematizuje doziranje opterećenja tokom različitih faza rehabilitacije ACL-a.

## Metod

Za rad je korišćena empirijsko-bibliografska metoda. Pregled literature se izvršio korišćenjem referentnih naučnih baza (PubMed i Google Scholar). Pretraga radova bazirala se na pretraživanju pomenutih sajtova korišćenjem sledećih ključnih reči: protokoli, rehabilitacija, prednji ukršteni ligament, prevencija, kriterijumi za povratak sportu.

## Rezultati sa diskusijom

Nakon rekonstrukcije ACL-a, postizanje punog opsega pokreta u kolenu treba da se postigne što je pre moguće. Kada se ispune kriterijumi normalne aktivacije mišića i neantalgičnog hoda, uvode se vežbe zatvorenog kinetičkog lanca, jer se pokazalo da one smanjuju stres na ACL. Trening jačine sam po sebi ne smanjuje broj povreda ACL-a, međutim u kombinaciji sa pliometrijskim treningom postoji značajno smanjenje, naročito kod sportistkinja. U planiranju trenažnih ciklusa treba ostaviti dovoljno mesta i za trening veština.

## Zaključak

Faktori rizika koji se mogu ili ne mogu modifikovati predisponiraju sportiste (posebno žene) na povrede ACL-a. Pored treninga snage, u planiranju trenažnih ciklusa treba ostaviti dovoljno mesta i za trening veština, koristeći se metodama neuromišićnog treninga, što pozitivno deluje na usvajanje kvalitetnih obrazaca kretanja koji čuvaju prednju ukrštenu vezu. Nakon otpuštanja iz formalnog programa rehabilitacije, potrebno je optimalno izmeniti obim izlaganja sportskim aktivnostima. Deficiti mišićne sile i snage, propiocepcije i ravnoteže prisutni su 6 meseci do 2 godine nakon rekonstrukcije.

**Ključne reči:** povreda, koleno, sport, rehabilitacija

## Literatura

Laskowski, E. R. (2014). ACL injury and rehabilitation. *Current Physical Medicine and Rehabilitation Reports*, 2(1), 35-40.  
Micheo, W., Hernández, L., & Seda, C. (2010). Evaluation, management, rehabilitation, and prevention of anterior cruciate ligament injury: current concepts. *PM&R*, 2(10), 935-944.

# Recovery after ACL reconstruction – the cost of non-clinical breaks during rehabilitation (case study report)

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## Introduction

Despite experts' efforts to bring attention to anterior cruciate injury (ACL) prevention, and milestone-based return to sport, rates of injury and re-injury are very high. Recovery depends on many factors (pre-rehabilitation, concomitant injuries, post-surgical complications, pain, fear of re-injury, and motivation (Knežević, 2020; Rice et al, 2014)). This is a case study of an athlete who had repeating non-clinical breaks in rehabilitation.

## Method

Nineteen-year-old football player (body height 1.82 m, body weight 74.4 kg) had ACL reconstruction using bone-patellar-tendon graft on the right knee 8.5 months prior to return-to-sport assessment. Donor-site morbidity i.e., patellar pain of low intensity is still present (rated 3/10). Athlete reported having four 7- and one 4-day leisure-time related breaks during rehabilitation. Return-to-sport assessment included evaluation of neuromuscular function and control (quadriceps and hamstrings maximum (MVC) and explosive isometric strength (RFD), jump, and hop performance, dynamic balance, and landing control). Data are presented as inter-limb asymmetry index expressed as percentage.

## Results and discussion

There was no asymmetry in dynamic balance, hamstrings MVC and one leg hop distance. Inter-limb asymmetries for quadriceps MVC and RFD were massive (44% and 59%, respectively), and large for cross-over triple jump (23%). There was a considerable limitation in knee flexion range of motion. Patellar pain has already been recognized as significant nuisance for recovery of muscle function (Knezevic, 2020; Rice et al, 2014), while non-clinical breaks may additionally delay advancement through strength and conditioning process and potentially be detrimental to athlete's recovery.

## Conclusion

Current recommendations for safe return-to-sport suggests athletes to wait 9-12 months following surgery,  $\leq 5\%$  difference between injured and non-injured leg for hop tests, with injured quadriceps having 105% strength of non-injured side. Every seemingly short and unarmful break may significantly hinder rehabilitation process thus should be avoided at any cost.

**Key words:** knee; anterior cruciate ligament; return-to-sport, muscle function; hop test

## References

- Knežević, O.M. (2020). Preduslovi bezbednog povratka sportskim aktivnostima nakon rekonstrukcije prednjeg ukrštenog ligamenta. Beograd. Univerzitet u Beogradu- Institut za medicinska istraživanja.
- Rice, D.A, McNair, P.J., Lewis, G.N., Dalbeth N. (2014). Quadriceps arthrogenic muscle inhibition: The effects of experimental knee joint effusion on motor cortex excitability. *Arthritis Res Ther.* 10;16(1)

# Oporavak nakon rekonstrukcije ACL – cena nekliničkih pauza tokom rehabilitacije (studija slučaja)

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## Uvod

Uprkos naporima stručnjaka da skrenu pažnju na prevenciju povreda prednjeg ukrštenog ligamenta (LCA) i povratku sportu zasnovanom na kriterijumima, stope povreda i ponovnih povreda su veoma visoke. Oporavak zavisi od brojnih faktora (pre-rehabilitacija, prateće povrede, post-hirurške komplikacije, bol, strah od ponovne povrede i motivacija (Knežević, 2020; Rice et al, 2014)). Ovo je prikaz studije slučaja sportiste koji je tokom rehabilitacije imao ponovljene nekliničke pauze.

## Metod

Devetnaestogodišnjem fudbaleru (visina tela 1,82 m; masa tela 74,4 kg) izvršena je rekonstrukcija LCA desnog kolena pomoću koštano-tetivnog grafta. Morbiditet donorske regije, tj. patelarni bol niskog intenziteta je i dalje prisutan (ocena 3/10). Sportista je tokom rehabilitacije napravio četiri sedmodnevne i jednu četvorodnevnu pauzu društveno-zabavnog karaktera. Spremnost za povratak sportskim aktivnostima procenjena je 8.5 meseci nakon operacije testiranjem neuromišićne funkcije i kontrole: izometrijska maksimalna (MVC) i eksplozivna jačina (RFD) ekstenzora i fleksora u kolenu, skok i troskok na jednoj nozi, dinamička ravnoteža. Rezultati testiranja predstavljeni su kao indeks asimetrije između povređene i nepovređene noge (izražen u procentima).

## Rezultati sa diskusijom

U dinamičkoj ravnoteži, MVC fleksora i skoku na jednoj nozi nema asimetrija. Zabeležena je izuzetno velika asimetrija u jačini ekstenzora (44% za MVC i RFD i 59%), i velike asimetrija u troskoku (23%). Obim pokreta fleksija u kolena još uvek je delimično ograničen. Patelarni bol je prepoznat kao značajna smetnja u oporavku mišićne funkcije (Knežević, 2020; Rice et al, 2014), a nekliničke pauze mogu dodatno poremetiti napredovanje kroz faze rehabilitacije pa čak i potencijalno biti štetne za potpuni oporavak sportiste.

## Zaključak

Prema trenutnim preporukama, sportistima se, radi bezbednog povratka sportskim aktivnostima, savetuje da sačekaju 9-12 meseci nakon operacije, ≤5% razlike između povređene i nepovređene noge u skokovima, i jačina ekstenzora 105% u odnosu na nepovređenu nogu. Svaka naizgled kratka i neškodljiva pauza može značajno otežati proces rehabilitacije, pa je po svaku cenu treba izbegavati.

**Ključne reči:** koleno, prednji ukršteni ligament, povratak sportu, mišićna funkcija; skokovi

## Literatura

Knežević, O.M. (2020). Preduslovi bezbednog povratka sportskim aktivnostima nakon rekonstrukcije prednjeg ukrštenog ligamenta. Beograd. Univerzitet u Beogradu- Institut za medicinska istraživanja.  
Rice, D.A, McNair, P.J., Lewis, G.N., Dalbeth N. (2014). Quadriceps arthrogenic muscle inhibition: The effects of experimental knee joint effusion on motor cortex excitability. *Arthritis Res Ther.* 10;16(1)

# Musculoskeletal testing in the function of injury prevention of Croatian female junior tennis player

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## Introduction

The use of musculoskeletal testing in sports medicine is a widespread practice with a dual goal intended for the application of findings, both for injury prevention and performance enhancement (Ellenbecker, 2009). The purpose of this article is to present the current methods and descriptive findings of a sport-specific musculoskeletal profile used for 17-year-old female elite junior tennis player from Croatia.

## Method

This abstract contains the results of a female elite tennis player from 2018, at two points. Key components of the testing programme were: 1. Tensiomyography (TMG) - measuring method for detecting skeletal muscles' contractile properties, lateral and functional symmetry; 2. Dynamometry - muscle strength was tested using manual dynamometry tests. 3. Flexibility - hip flexion, extension, and abduction were measured using a universal digital goniometer.

## Results and discussion

The results of the research indicate that on the initial measurement, the player achieved better average values in lateral symmetry (77.1>72.7) and functional symmetry (78.4>68.2). The test results in the second measurement point to an overtrained state of the organism. In the second measurement, there is a noticeable decrease in the level of strength in certain segments, i.e. the muscles of the hip joint and ankle joint compared to the first test. The comparison of measuring variables in flexibility shown better average values in initial measurement (70.8>65.0). In the final measurement, player achieved better average dynamometry values (174.5<224.2). The results in the second measurement indicate that attention should be paid to the strength level of the hip flexors of the left and right leg, left and right abductors legs.

## Conclusion

Based on the results presented, the player should continue with systematic strength training in order to raise the current values to a higher level and to avoid major asymmetries in strength.

**Key words:** tennis, TMG, flexibility, dynamometry, injuries

## References

Ellenbecker, T.S, Pluim, B., Vivier, S., Sniteman, C. (2009). Common injuries in tennis players: exercises to address muscular imbalances and reduce injury risk. *Strength Cond J* 2009;31: 50-58.

# Morphological and functional characteristics of the right heart in elite Serbian triathletes

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## Introduction

The majority of studies analyzed left ventricular cardiac characteristics, however recent data demonstrate equal importance of the right heart contribution in overall training status (Lazic et al., 2019). Many studies show that the most intense cardiac remodeling (“athlete’s heart”) can be seen in endurance athletes, but no studies have examined this in triathletes. The aim of the study was to examine the morphological and functional characteristics of the right heart in elite Serbian triathletes.

## Method

Cardiac ultrasound was performed following current recommendations, using a Philips IE33 device (Philips Medical Systems, Andover, MA). The right ventricular diameter (RVEDD) was measured from the parasternal cross-section, and the right atrial volume (RAvol) and the right ventricular wall thickness (RVWT) from the four-cavity cross-section. The M-mode method was used to measure the amplitude of movement of the right ventricular tricuspid annulus (TAPSE). The sample consisted of two groups: experimental – elite triathlete seniors from Serbia (n=17; age: 35.88±11.27) and control – healthy untrained adults (n=20; age: 21.35±2.08). One-way ANCOVA was used to explore differences between two groups, while statistically controlling for age variable. For the TAPSE variable only, the non-parametric Quade's ANOVA test was performed, because the control group was not homogeneous.

## Results and discussion

RVEDD, RAvol, and RVWT were significantly higher in the experimental group compared to the control group ( $p < 0.01$ ). No significant difference was observed between TAPSE in the experimental and control group ( $p = 0.653$ ). Also, RVEDD and RAvol show values higher than the reference values for the general population, while RVWT and TAPSE are within the reference values. As the number of people involved in triathlon is constantly growing, and the pathological condition of the heart can be hidden behind the “athlete’s heart” (Kochi et al., 2021), it is necessary to draw the attention of all coaches and athletes, to the importance of regular monitoring of every “athlete’s heart”.

## Conclusion

The obtained results indicate that there are signs of right heart remodeling in triathletes concerning reference values and compared with the untrained population.

**Key words:** endurance training, cardiac remodeling, athlete’s heart.

## References

- Kochi, A. N., Vettor, G., Dessanai, M. A., Pizzamiglio, F., & Tondo, C. (2021). Sudden Cardiac Death in Athletes: From the Basics to the Practical Work-Up. *Medicina (Kaunas)*, 57(2), 1–15.
- Lazic, J. S., Tadic, M., Antic, M., Radovanovic, D., Nesic, D., Rakocevic, R., & Mazic, S. (2019). The relationship between right heart and aerobic capacity in large cohort of young elite athletes. *The International Journal of Cardiovascular Imaging*, 35(6), 1027–1036.



# Morfološke i funkcionalne karakteristike desnog srca kod elitnih triatlonaca iz Srbije

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## Uvod

Većina studija analizirala je karakteristike leve srčane komore, međutim noviji podaci pokazuju jednak značaj doprinosa desnog srca u ukupnom trenažnom statusu (Lazić i sar., 2019). Mnoge studije pokazuju da se najintenzivnije remodelovanje srca („sportsko srce“) može videti kod sportista izdržljivosti, ali nijedna studija to nije ispitala kod triatlonaca. Cilj ovog rada je da se ispituju morfološke i funkcionalne karakteristike desnog srca kod elitnih triatlonaca iz Srbije.

## Metod

Da bi se procenile morfo-funkcionalne karakteristike desnog srca, urađen je ultrazvuk srca prema aktuelnim preporukama, koristeći uređaj Philips IE33 (Philips Medical Systems, Andover, MA). Dijametar desne komore (RVEDD) meren je iz poprečnog parasternalnog preseka, a volumen desne pretkomore (RAvol) i debljina zida desne komore (RVWT) iz četvorošupljinskog preseka. M-mod metod je korišćen za merenje amplitude pokreta trikuspidnog anulusa desne komore (TAPSE). Uzorak ispitanika su činile dve grupe: eksperimentalna – elitni triatlonci seniori iz Srbije (n=17; starosti: 35,88±11,27) i kontrolna – zdrave netrenirane odrasle osobe (n=20; starosti: 21,35±2,08). Jednosmerna ANCOVA je korišćena za ispitivanje razlika između dve grupe, dok je statistički kontrolisana varijabla starosti. Samo za TAPSE varijablu je urađen neparametarski test (Quade's ANOVA), jer kontrolna grupa nije bila homogena.

## Rezultati sa diskusijom

RVEDD, RAvol i RVWT bili su značajno veći u eksperimentalnoj grupi u poređenju sa kontrolnom grupom ( $p < 0.01$ ). Nije primećena značajna razlika između TAPSE u eksperimentalnoj i kontrolnoj grupi ( $p = 0,653$ ). Takođe, RVEDD i RAvol pokazuju vrednosti veće od referentnih vrednosti za opštu populaciju, dok su RVWT i TAPSE unutar referentnih vrednosti. S obzirom da broj ljudi koji se bave triatlonom konstantno raste, a patološko stanje srca može biti prikriveno iza „sportskog srca“ (Kochi i sar., 2021), potrebno je skrenuti pažnju svim trenerima i sportistima, na važnost redovnog praćenja svakog „sportskog srca“.

## Zaključak

Dobijeni rezultati ukazuju da kod osoba koje se bave triatlonom postoje znaci remodelovanja desnog srca u odnosu na referentne vrednosti i netrenirane osobe.

**Ključne reči:** trening izdržljivosti, remodelovanje srca, sportsko srce.

## Literatura

Kochi, A. N., Vettor, G., Dessanai, M. A., Pizzamiglio, F., & Tondo, C. (2021). Sudden Cardiac Death in Athletes: From the Basics to the Practical Work-Up. *Medicina (Kaunas)*, 57(2), 1–15.

Lazic, J. S., Tadic, M., Antic, M., Radovanovic, D., Nesic, D., Rakocevic, R., & Mazic, S. (2019). The relationship between right heart and aerobic capacity in large cohort of young elite athletes. *The International Journal of Cardiovascular Imaging*, 35(6), 1027–1036.

# Haemodynamic and metabolic determinants of maximal functional capacity in long-distance runners

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## Introduction

Cardiac function and oxygen extraction are important physiological determinants of maximal oxygen consumption and endurance performance. The aim of the present study was to assess the relationship between maximal O<sub>2</sub> consumption, haemodynamic and metabolic variables in long-distance runners.

## Method

In a prospective observational study, 29 long-distance male runners (age 32±9 years, body mass index 24±2 kg/m<sup>2</sup>), underwent metabolic and haemodynamic assessments during maximal graded cardiopulmonary exercise stress testing using a semi-recumbent, electromagnetically controlled cycle ergometer (Corival, Lode & Groningen, Netherland) with non-invasive gas exchange (Cortex Metalyzer 3B, Leipzig, Germany) and haemodynamic – bio reactance monitoring (NICOM®, Cheetah Medical, USA). Peak O<sub>2</sub> extraction (arterial-venous O<sub>2</sub> difference) was calculated as the ratio between maximal O<sub>2</sub> consumption and maximal cardiac output.

## Results and discussion

The mean values of the physiological variables at maximal exercise were: O<sub>2</sub> consumption, 4.02±0.50 L/min and 54.3±7.4 ml/kg/min; cardiac output, 19.3±3.2 L/min; stroke volume, 113±22 ml/beat; heart rate, 173±13 beats/min; mean arterial blood pressure, 123 ± 15 mmHg; cardiac power output, 5.27±1.02 watts, and arterial-venous O<sub>2</sub> difference 21.3 ± 3.9 mL/100 mL. There was a significant moderate relationship between maximal O<sub>2</sub> consumption and arterial-venous O<sub>2</sub> difference (r=0.42, R<sup>2</sup>=0.18, p=0.02). Non-significant relationship was observed between maximal O<sub>2</sub> consumption and measures of cardiac function (r<0.25, p>0.05). In addition to maximal O<sub>2</sub> consumption, arterial-venous O<sub>2</sub> difference was significantly correlated with cardiac output (r=-0.72, R<sup>2</sup>=0.52, p<0.01), stroke volume (r=-0.73, R<sup>2</sup>=0.53, p<0.01), cardiac power output (r=-0.60, R<sup>2</sup>=0.36, p<0.01), but not with heart rate (r=0.23, p<0.16). Our results are partially in agreement with previous literature (Jakovljević, et al., 2012; Bassett, & Howley, 2000).

## Conclusion

Based on a significant positive relationship between maximal oxygen consumption and arterial-venous O<sub>2</sub> difference, it can be suggested that the maximal functional capacity in long-distance runners is limited by the ability of skeletal muscles to extract delivered oxygen rather than cardiac function.

**Key words:** oxygen consumption, cardiac output, oxygen extraction, endurance athletes

## References

- Bassett, DR. & Howley, ET. (2000). Limiting factors for maximum oxygen uptake and determinants of endurance performance, *Medicine & Science in Sports & Exercise*, 32(1), 70.  
Jakovljević, Đ. et al. (2012). Relationship between peak cardiac pumping capability and indices of cardio-respiratory fitness in healthy individuals, *Clinical Physiology and Functional Imaging*, 32(5), 388-93.

# Hemodinamske i metaboličke determinante maksimalnog funkcionalnog kapaciteta kod trkača na duge staze

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## Uvod

Srčana funkcija i ekstrakcija kiseonika su važne fiziološke determinante maksimalne potrošnje kiseonika i performansi izdržljivosti. Cilj studije bio je da se utvrdi korelacija između maksimalne potrošnje O<sub>2</sub>, hemodinamskih i metaboličkih varijabli kod trkača na duge staze.

## Metod

U prospektivnoj opservacionoj studiji, 29 trkača na duge staze (starosti 32±9 godina, indeks telesne mase 24±2 kg/m<sup>2</sup>), podvrgnuto je metaboličkim i hemodinamskim merenjima tokom maksimalnog testa opterećenja na elektromagnetnom bicikl-ergometru (Corival, Lode & Groningen, Netherland) koristeći metabolički sistem (Cortex Metalyzer 3B, Leipzig, Germany) i metodu bioreaktance (NICOM®, Cheetah Medical, SAD). Ekstrakcija kiseonika (arterijsko-venska O<sub>2</sub> razlika) izračunata je kao količnik između potrošnje O<sub>2</sub> i minutnog volumena srca.

## Rezultati sa diskusijom

Srednje vrednosti fizioloških varijabli pri maksimalnom opterećenju bile su: potrošnja O<sub>2</sub>, 4.02±0.50 L/min i 54.3±7.4 ml/kg/min; minutni volumen srca, 19.3±3.2 L/min; udarni volumen srca, 113±22 ml/beat; srčana frekvencija, 173±13 beat/min; srednji arterijski krvni pritisak, 123 ± 15 mmHg; snaga minutnog volumena srca, 5.27±1.02 watts, i arterijsko-venska O<sub>2</sub> razlika 21.3 ± 3.9 mL/100 mL. Statističkom analizom utvrđena je umerena korelacija između maksimalne potrošnje O<sub>2</sub> i arterijsko-venske O<sub>2</sub> razlike (r=0.42, R<sup>2</sup>=0.18, p=0.02). Nije postojala statistički značajna korelacija između maksimalne potrošnje O<sub>2</sub> i varijabli srčane funkcije (r<0.25, p>0.05). Pored maksimalne potrošnje O<sub>2</sub>, arterijsko-venska O<sub>2</sub> razlika je statistički značajno povezana sa minutnim volumenom srca (r=-0.72, R<sup>2</sup>=0.52, p<0.01), udarnim volumenom srca (r=-0.73, R<sup>2</sup>=0.53, p<0.01), snagom minutnog volumena srca (r=-0.60, R<sup>2</sup>=0.36, p<0.01), kao i sa srčanom frekvencijom (r=0.23, p<0.16). Naši rezultati su u delimičnoj saglasnosti sa rezultatima prethodno objavljenih studija (Jakovljević, et al., 2012; Bassett, & Howley, 2000).

## Zaključak

Na osnovu statistički značajne pozitivne korelacije između maksimalne potrošnje kiseonika i arterijsko-venske kiseoničke razlike, može se sugerisati da je maksimalni funkcionalni kapacitet kod trkača na duge staze ograničen sposobnošću mišića da iskoriste dostavljeni kiseonik (ekstrakcijom kiseonika), a ne srčanom funkcijom.

**Ključne reči:** potrošnja kiseonika, minutni volumen srca, ekstrakcija kiseonika, trkači izdržljivosti

## Literatura

Bassett, DR. & Howley, ET. (2000). Limiting factors for maximum oxygen uptake and determinants of endurance performance, *Medicine & Science in Sports & Exercise*, 32(1), 70.  
Jakovljević, Đ. et al. (2012). Relationship between peak cardiac pumping capability and indices of cardio-respiratory fitness in healthy individuals, *Clinical Physiology and Functional Imaging*, 32(5), 388-93.

# Incidence and rate of injuries in crossfit - a systematic review

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## Introduction

CrossFit way of exercising is often associated with high-risk, and even extreme way of exercising, as well as high frequency of injuries. However, the incidence and rate of injuries during CrossFit training were poorly researched (Elkin et al., 2019). This study aims to review previous research about the Incidence and Rate of Injuries in CrossFit, as well as to compare them with other systematic review studies on the same topic.

## Method

Analysis of previous research and comparison of the obtained results with previous systematic reviews on injuries during the CrossFit training was performed, followed by the PRISMA protocols.

## Results and discussion

The average incidence of injuries in all studies was 42.08% and ranged from 14.9% to 81.5%. The average rate of injury in all studies is 5.87 per 1000 hours and ranges from 0.27 per 1000 hours to 18.9 per 1000 hours. It turned out that CrossFit has similar results in the incidence and rate of injuries to other sports (Feito et al., 2018). Previous systematic reviews have found that the results of most studies are not reliable. Due to the low reliability of previous research, it is necessary to increase control over groups in future research.

## Conclusion

The obtained results indicate that the results of most studies are not reliable. It is preferable to compare groups that have similar levels of technical performance. Another suggestion is to modify the comparisons of contact and non-contact sports.

**Key words:** reliable, performance, comparisons, sports.

## References

Elkin J.L., Kammerman J.S., Kunselman A.R., Gallo R.A. (2019). Likelihood of injury and medical care between CrossFit and traditional weightlifting participants. *Orthopedic Journal of Sports Medicine*, 7(5).

Feito Y, Burrows EK, Tabb LP. (2018). A 4-year analysis of the incidence of injuries among CrossFit-trained participants. *Orthopedic Journal of Sports Medicine*, 6(10).

# Učestalost i stopa povređivanja u krosfitu – sistematsko pregledno istraživanje

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## Uvod

Krosfit način vežbanja je često povezan sa visokim rizikom, ekstremnim načinom vežbanja, kao i velikom učestalošću povreda. Međutim, učestalost i stopa povreda tokom krosfit treninga su slabo istraženi (Elkin et al., 2019). Ova studija ima za cilj da pregleda prethodna istraživanja o učestalosti i stopi povređivanja u krosfitu, kao i da uporedi rezultate sa drugim sistematskim preglednim istraživanjima na istu temu.

## Metod

Urađena je analiza dosadašnjih istraživanja i poređenje dobijenih rezultata sa prethodnim sistematskim preglednim istraživanjima o povredama tokom krosfit treninga prateći PRISMA protokole.

## Rezultati sa diskusijom

Prosečna učestalost povreda u svim studijama iznosila je 42,08% i kretala se od 14,9% do 81,5%. Prosečna stopa povređivanja u svim studijama je 5,87 na 1000 sati i kreće se od 0,27 na 1000 sati do 18,9 na 1000 sati. Ispostavilo se da krosfit ima slične rezultate u učestalosti i stopi povređivanja sa drugim sportovima (Feito et al., 2018). Prethodna sistematska pregledna istraživanja su otkrila da rezultati većine studija nisu pouzdani. Zbog niske pouzdanosti dosadašnjih istraživanja, neophodno je povećati kontrolu nad grupama u budućim istraživanjima.

## Zaključak

Dobijeni rezultati ukazuju da rezultati većine studija nisu pouzdani. Poželjno je upoređivati grupe koje imaju slične nivoe tehničkih performansi. Drugi predlog je da se prilagodi poređenje kontaktnih i beskontaktnih sportova.

**Ključne reči:** pouzdanost, performanse, rizik, poređenje, sport.

## Literatura

Elkin J.L., Kammerman J.S., Kunselman A.R., Gallo R.A. (2019). Likelihood of injury and medical care between CrossFit and traditional weightlifting participants. *Orthopedic Journal of Sports Medicine*, 7(5).

Feito Y., Burrows E.K., Tabb L.P. (2018). A 4-year analysis of the incidence of injuries among CrossFit-trained participants. *Orthopedic Journal of Sports Medicine*, 6(10).

# The impact of "baby swimming" on the health and development of infants and babies

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## Introduction

The aim of this paper is to analyze previous research that has studied swimming of infants and babies and to show how staying in water affects their health, motor, social and cognitive development, i.e. development of movement, emotions and speech. Swimming significantly affects growth and early motor development of newborns and babies, their sleep pattern, communication with adults and other children.

## Method

The search was conducted in electronic databases: PubMed, Web of Science, KoBSON, SCIndeks, Google Scholar. The last search was conducted in September 2022. Search terms: baby swimming, health, growth, infant swimming, swimming benefits, etc. Titles and abstracts of papers that met the inclusion criteria were reviewed, and full-text articles that met the requirements were included in this review.

## Results and discussion

A search of the literature identified 455 potentially relevant papers. After reviewing the titles, 345 studies were excluded (based on titles, abstracts and duplicates), and the remaining 110 studies were analyzed. 96 were excluded based on the criteria, resulting in 14 included papers that were analyzed. Swimming for babies is thought to stimulate activity and contribute to healthy development, it is extremely important for brain development, reduces fear and strengthens self-confidence, improves socialization, provides strong vestibular stimulation, eye-hand coordination, maintaining balance (Sigmundsson, 2021; Martins, et al., 2020). The results can be used to determine the impact of early water activities on children's development and as a basis for a new intervention program for various developmental disorders.

## Conclusion

Based on the reviewed papers, it is concluded that swimming from an early age contributes to physical health and improved cognitive functioning of children. Water activity provides multi-sensory stimulation by combining three sensory systems: tactile, proprioceptive and vestibular, and thus, affects the baby's ability to motor and emotional link to people and objects.

**Key words:** infant swimming; baby swimming, swimming benefits

## References

Martins, M., Costa,A., Costa, MJ., Marinho, DA. and Barbosa, TM. (2020). Interactional Response During Infants' Aquatic Sessions. *Sports Med Int*, 4 (3).  
Sigmundsson, H. (2021). Specificity of learning, skill development and baby swimming in Iceland. *J. Phys. Educ. Sport*. 21, 549-552.

# Uticaj „plivanja za bebe“ na zdravlje i razvoj odojčadi i beba

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## Uvod

Cilj ovog rada je da se analizom dosadašnjih istraživanja koja su proučavala plivanje odojčadi i beba, prikaže na koji način boravak u vodi utiče na njihovo zdravlje, na motorički, socijalni i kognitivni razvoj, tj. razvoj pokreta, emocija i govora. Plivanje novorođenčadi i beba značajno utiče na njihov rast i rani motorički razvoj, obrazac spavanja, komunikaciju sa odraslima i drugom decom.

## Metod

Pretraživanje literature je sprovedeno u elektronskim bazama podataka: PubMed, Web of Science, KoBSON, SCIndeks, Google Scholar. Poslednje pretraživanje je obavljeno u septembru 2022. Termini za pretraživanje: plivanje za bebe, zdravlje, rast, infant swimming, baby swimming, swimming benefits i dr. Pregledani su naslovi i apstrakti radova koji su ispunili kriterijume za uključivanje, a članci sa punim tekstom koji su ispunili uslove su uključeni u ovaj pregled.

## Rezultati sa diskusijom

Pretraživanjem literature identifikovana su 455 potencijalno relevantna rada. Nakon pregleda naslova, 345 studija je isključeno (na osnovu naslova, sažetaka i duplikata), a analizirano je preostalih 110 studija. 96 je isključeno na osnovu kriterijuma, što je rezultiralo sa 14 uključenih radova koji su analizirani. Smatra se da plivanje za bebe stimuliše aktivnost i doprinosi zdravom razvoju, izuzetno je važno za razvoj mozga, smanjuje strah i jača samopouzdanje, poboljšava socijalizaciju, pruža snažnu vestibularnu stimulaciju, koordinaciju oko-ruka, održavanje ravnoteže (Sigmundsson, 2021; Martins, et al., 2020). Rezultati mogu poslužiti da se utvrdi uticaj ranih aktivnosti u vodi na razvoj dece i kao osnova za novi program intervencije za različite razvojne poremećaje.

## Zaključak

Na osnovu pregledanih radova se nameće zaključak da plivanje od najranijeg uzrasta doprinosi fizičkom zdravlju i poboljšanju kognitivnog funkcionisanja dece. Aktivnost u vodi obezbeđuje multi-senzornu stimulaciju kombinujući tri senzorna sistema: taktilni, proprioceptivni i vestibularni, a samim tim, utiče na sposobnost bebe da se motorički i emocionalno poveže sa ljudima i sa predmetima.

**Ključne reči:** plivanje za odojčad, plivanje za bebe, benefit

## Literatura

Martins, M., Costa, A., Costa, M.J., Marinho, D.A. and Barbosa, T.M. (2020). Interactional Response During Infants' Aquatic Sessions. *Sports Med Int*, 4 (3).  
Sigmundsson, H. (2021). Specificity of learning, skill development and baby swimming in Iceland. *J. Phys. Educ. Sport*. 21, 549-552.

# Asymmetry of the contractile characteristics of the knee extensor and flexor muscles in elite badminton players

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## Introduction

Frequent repetition of unilateral movements puts the badminton athlete at risk of muscle asymmetry. Tensiomyography (TMG) is a non-invasive method for assessing muscle contractile characteristics, which enables the assessment of bilateral symmetry (Bs), i.e. ratio of knee muscles between left and right leg, and functional symmetry (Fs), i.e. ratio between knee extensors and flexors (Macgregor et al., 2018). This study aims to examine the bilateral and functional symmetry of knee muscle contractile characteristics in elite badminton players, assuming that asymmetry may occur due to specific movement techniques.

## Method

All 15 subjects were members of the male national badminton team of Serbia, age 19.5±3.3 years, with training experience longer than 8 years (with at least 4 training sessions per week) and no injuries. The following muscles of both legs were tested: *m.vastus lateralis* (VL), *m.vastus medialis* (VM), *m.rectus femoris* (RF), and *m.biceps femoris* (BF). The following variables were monitored: radial muscle deformation (Dm), delay time (Td), contraction time (Tc), maintenance time (Ts), and relaxation half-time (Tr). A two-way independent t-test with equal variances was used to assess the bilateral symmetry of single variables. We used automated TMG software calculation to monitor Bs and Fs for the knee joint.

## Results and discussion

Statistically significant bilateral differences were found for Dm for the VL, VM, and RF ( $p < 0.05$ ) and the tendency for statistical difference for BF ( $p = 0.07$ ). No statistically significant bilateral difference was observed for all tested muscles for time variables (Td, Tc, Ts, and Tr). For the extensor muscles, Bs in the knee joint was between 9.6% and 12%, while for BF, the value was 21.4%. The Fs values were 75.7% (dominant) and 74.8% (non-dominant leg), which is in the normal asymmetry range (>65%) recommended by some authors (García-García et al., 2019).

## Conclusion

The results of this research clearly show the influence of specific badminton movements on the occurrence of excessive bilateral asymmetry of the knee extensors and flexors.

**Key words:** tensiomyography, disbalance, sports technique

## References

- García-García, O., Cuba-Dorado, A., Álvarez-Yates, T., Carballo-López, J., & Iglesias-Caamaño, M. (2019). Clinical utility of tensiomyography for muscle function analysis in athletes. *Open Access Journal of Sports Medicine*, 10, 49.
- Macgregor, L. J., Hunter, A. M., Orizio, C., Fairweather, M. M., & Ditroilo, M. (2018). Assessment of skeletal muscle contractile properties by radial displacement: the case for tensiomyography. *Sports Medicine*, 48(7), 1607-1620.



# Asimetrija kontraktilnih karakteristika mišića opružaća i pregibača zgloba kolena kod elitnih badmintonaca

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## Uvod

Učestalo ponavljanje unilateralnih kretnji u badmintonu dovodi sportistu u rizik od pojave mišićne asimetrije. Tenziomiografija (TMG) je neinvazivna metoda procene kontraktilnih karakteristika mišića koja omogućava procenu bilateralne simetrije (Bs), tj. odnos mišića leve i desne noge, i funkcionalne simetrije (Fs), tj. odnos mišića pregibača i opružaća kolena (Macgregor et al., 2018). Cilj istraživanja je da se kod elitnih badmintonaca ispita bilateralna i funkcionalna simetrija kontraktilnih karakteristika opružaća i pregibača zgloba kolena, sa pretpostavkom da kod badmintonaca može nastati asimetrija kao posledica specifične tehnike kretanja.

## Metod

Uzorak ispitanika činilo je 15 takmičara nacionalnog badminton tima Srbije, muškog pola, uzrasta 19.5±3.3 godina, trenažnog staža dužeg od 8 godina (sa najmanje 4 treninga nedeljno) i bez povreda. Testirani su sledeći mišići obe noge: *m. vastus lateralis* (VL), *m. vastus medialis* (VM), *m. rectus femoris* (RF) i *m. biceps femoris* (BF). Praćene su sledeće varijable: radijalna deformacija mišića (Dm), vreme kašnjenja (Td), vreme kontrakcije (Tc), vreme održavanja (Ts) i poluvreme relaksacije (Tr). Za procenu Bs na nivou pojedinačnih varijabli korišćen je dvosmerni nezavisni t-test sa jednakim varijansama. Putem automatizovanog proračuna TMG softvera praćene su Bs i Fs na nivou zgloba kolena.

## Rezultati sa diskusijom

Za Dm su uočene statistički značajne bilateralne razlike za VL, VM i RF ( $p < 0.05$ ), a za BF je uočena tendencija ka statističkoj značajnosti ( $p = 0.07$ ). Za vremenske varijable (Td, Tc, Ts i Tr) nije bilo statističke značajnosti za sve ispitane mišiće. Vrednost Bs za mišiće opružaće u zglobu kolena je bila između 9.6% i 12%, dok je za BF vrednost Bs iznosila 21.4%. Vrednosti Fs su iznosile 75.7% (dominantna) i 74.8% (nedominantna noga), što je u zoni normalne asimetrije (>65%) koja je preporučena od nekih autora (García-García et al., 2019).

## Zaključak

Rezultati ovog istraživanja jasno pokazuju uticaj specifične tehnike kretanja u badmintonu na pojavu prekomerne bilateralne asimetrije kontraktilnih karakteristika mišića opružaća i pregibača u zglobu kolena.

**Ključne reči:** tenziomiografija, disbalans, sportska tehnika

## Literatura

García-García, O., Cuba-Dorado, A., Álvarez-Yates, T., Carballo-López, J., & Iglesias-Caamaño, M. (2019). Clinical utility of tensiomyography for muscle function analysis in athletes. *Open Access Journal of Sports Medicine*, 10, 49.  
Macgregor, L. J., Hunter, A. M., Orizio, C., Fairweather, M. M., & Ditroilo, M. (2018). Assessment of skeletal muscle contractile properties by radial displacement: the case for tensiomyography. *Sports Medicine*, 48(7), 1607-1620.

**SOCIAL SCIENCES AND HUMANITIES IN PHYSICAL EDUCATION  
AND SPORT**

**DRUŠTVENO-HUMANISTIČKE NAUKE U FIZIČKOM VASPITANJU  
I SPORTU**

# INTRODUCTORY LECTURE

## Main tendencies in the sociology of sport

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Sociology of sport is a special sociological discipline that focuses on the complex relationship between sport and society. Practically, the sociology of sport is most often focused on the research of the sports event, the characteristics of the elements of the sports event (athletes, mediators and the audience) and mutual interactions between the mentioned three elements of each sports event (Milovanović, 2017).

Tendencies in the development of the sociology of sport that can be observed both in the world and in the domestic intellectual and academic space relate to: 1. fragmentation of the sociology of sport and 2. approaching the sociology of sport to related disciplines. Regarding the fragmentation of the sociology of sport, let us mention the subdisciplines derived from the sociology of sport such as: sociology of football and sociology of Cristiano Ronaldo (Milovanović, Radenović, 2020). Approaching the sociology of sport to related disciplines refers primarily to common areas that are studied within the sociology of medicine and the sociology of the body, the sociology of morality, as well as within the ethics and bioethics of sports.

Let us mention some of the less researched topics that are beginning to intrigue sociologists of sport, both at the global and national level: the presence of technological doping in professional sports; sociological aspects of e-sports; the impact and consequences of the COVID-19 pandemic on sport and the organization of sports events; environmental footprint of a sports event; gender inequalities in sports; transgender athletes; cyborgized athletes; appearance and importance of ethics committees in sports, etc.

**Key words:** sociology of sport, fragmentation, related disciplines

### Literature

Milovanović, I. (2017). Uvod u sociologiju i sociologiju sporta. Novi Sad: Fakultet sporta i fizičkog vaspitanja.

Milovanović, I., Radenović, S. (2020). Savremene tendencije u sociologiji sporta: od konstituisanja do „razmrvljene” discipline. *Sociologija*, Vol LXII (2): 237-254.

# UVODNO PREDAVANJE

## Glavne tendencije u sociologiji sporta

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Sociologija sporta jeste posebna sociološka disciplina koja u fokusu istraživanja ima kompleksan odnos između sporta i društva. Praktično, sociologija sporta se najčešće usmerava na istraživanje sportskog događaja, karakteristika elemenata sportskog događaja (sportisti, posrednici i publika) i međusobnih interakcija između pomenuta tri elementa svakog sportskog događaja (Milovanović, 2017).

Tendencije u razvoju sociologije sporta koje se mogu uočiti kako u svetskom, tako i u domaćem intelektualnom i akademskom prostoru odnose se na: 1. fragmentaciju sociologije sporta i na 2. približavanje sociologije sporta srodnim disciplinama. Kada je reč o fragmentaciji sociologije sporta, mogu se uočiti subdiscipline proistekle iz sociologije sporta poput: sociologije fudbala i sociologije Kristijana Ronalda (Milovanović, Radenović, 2020). Približavanje sociologije sporta srodnim disciplinama odnosi se prevashodno na zajedničke oblasti koje se izučavaju i u okviru sociologije medicine i sociologije tela, sociologije morala, kao i u okviru etike i bioetike sporta.

Pomenimo neke od manje istraženih tema koje počinju da intrigiraju sociologe sporta, kako na globalnom, tako i na nacionalnom nivou: prisustvo tehnološkog dopinga u profesionalnom sportu; sociološki aspekti e-sporta; uticaj i posledice pandemije COVID-19 na sport i organizaciju sportskih događaja; ekološki otisak sportskog događaja; rodne nejednakosti u sportu; transrodni sportisti; kiborgizovani sportisti; pojava i značaj etičkih komiteta u sportu itd.

**Ključne reči:** sociologija sporta, fragmentacija, srodne discipline

### Literatura

Milovanović, I. (2017). Uvod u sociologiju i sociologiju sporta. Novi Sad: Fakultet sporta i fizičkog vaspitanja.

Milovanović, I., Radenović, S. (2020). Savremene tendencije u sociologiji sporta: od konstituisanja do „razmrvljene” discipline. *Sociologija*, Vol LXII (2): 237-254.

# Analysis of homophobia in Croatian soccer

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## Introduction

Top athletes and sports workers are undoubtedly at the centre of media attention and the sports public because of their sports results and general social issues (Milovanović, 2017: 194-196). In this paper, we analysed the attitudes and opinions of Croatian football players and football staff on the issue of homophobia. Specifically, through the statements of prominent football players and staff, we examined whether homophobia is an integral part of Croatian football.

## Method

The paper uses the method of discourse analysis (Savović, 2011). The content of newspaper texts, YouTube videos and texts on Croatian internet portals about the publicly expressed opinion of selected Croatian football players and football staff about homosexual football players was analysed.

## Results and discussion

The paper analyses several media-profiled statements of Croatian football players and football staff. Croats are among the three most homophobic nations in Europe, according to the results of the 2019 Eurobarometer survey. To the question, "Do you think that homosexuals should have the same rights as heterosexuals?", Fifty-one per cent of Croats answered negatively. Analysis of the media appearances of Croatian football players and football staff has shown that there is widespread homophobia in Croatian football at all levels, and there is no strongly expressed public condemnation of homophobic attitudes.

## Conclusion

Modern media contribute to the media star status of modern athletes, especially football players. Therefore, the attitudes of athletes often have a significant influence on media consumers, i.e. fans. For this reason, athletes should be aware of their responsibility for publicly expressing opinions on sensitive social topics that directly affect the issue of human rights and freedoms, such as the issue of the right of homosexual athletes to play sports, i.e. football. Therefore, it is necessary to educate everyone involved in sports at all levels about the inadmissibility of homophobia.

**Key words:** soccer, homophobia, Croatia

## References

- Milovanović, I. (2017). Introduction to sociology and sociology of sport. Novi Sad: Faculty of Sports and Physical Education.  
Savović, B. (2011): Discourse analysis. Belgrade: Andrejević Foundation.

# **The presence of violence among the fans at the football matches of FC Partizan and FC Red Star**

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## **Introduction**

In everyday use, the phrase 'football hooliganism' means something that dominates the field of crime, which is related to causing disorder by football fans, such as disturbing public order and peace, aggressive behaviour, possession of firearms, vandalism and conflict with the criminal law (Sloan 1990: 86, Koković, 2010: 160).

## **Method**

For the purposes of this research, the method of theoretical analysis and the classic historical method will be used. Due to the very subject of the research, relevant theoretical considerations about the history and reasons for fan conflicts, both in the broadest sense and at football matches between FC Partizan and FC Red Star, will be considered. With that, data will be collected about the history and the reasons for the conflicts between fans at football matches between FC Partizan and FC Red Star from the archives of SS Partizan and SS Red Star, reports from the matches themselves, web portals, literature etc.

## **Results and discussion**

As far as our country is concerned, the conflicts between extreme fan groups claimed ten human lives in the period from 1999 to 2009, which makes our country, according to that indicator, in the first place in Europe. In 2009, the Ministry of Youth and Sports of the Republic of Serbia, in cooperation with the Association of Sports Journalists of Serbia, conducted a study entitled 'Media, Sport, Violence', in which texts published in the Serbian median in 2008, which were devoted to violence, were analyzed on and around the sports field. This mentioned research indicated that every 136 days, one fan was killed in Serbia, and all the victims and attackers were between the ages of 17 and 25 (Milojević, 2013; Simonović, 2013).

## **Conclusion**

Solving the problem of hooliganism at sports events is not an easy or simple task at all. Through high-quality security assessments of the degree of risk of incidents, monitoring and prevention of the intentions of extreme fans, their isolation and effective intervention, with the participation and coordinated cooperation of competent state authorities, sports organizations and clubs, educational institutions and the media, hooliganism at sports events could be are reduced to socially acceptable frameworks (Milojević, 2013; Simonović, 2013).

**Key words:** football, fans, conflicts, violence, derby;

## **References**

Milojević S., Simonović B., Janković B., Otašević B., Turanjanin V. (2013). *Mladi i huliganizam na sportskim priredbama*. Beograd: OEBS.  
Koković, Dragan (2010). *Društvo, nasilje, sport*. Novi Sad: Mediterran Publishing.

# **Prisustvo nasilja među navijačima na fudbalskim utakmicama FK Partizan i FK Crvena Zvezda**

Filip Gvozdrenović<sup>1</sup>; Sandra Radenović<sup>1</sup>; Lazar Tomić<sup>1</sup>; Slađana Mijatović<sup>1</sup>

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## **Uvod**

Pod sintagmom fudbalski huliganizam se podrazumeva izazivanje nereda od strane fudbalskih navijača poput narušavanja javnog reda i mira, agresivnog ponašanja, posedovanja vatrenog oružja, vandalizma i sukobljavanja sa krivičnim zakonom (Koković, 2010: 160).

## **Metod**

Za potrebe ovog istraživanja korišćen je metod teorijske analize i klasičan istorijski metod. Analizirana su relevantna teorijska razmatranja o istoriji i razlozima sukoba navijača, kako u najširem smislu, tako i na fudbalskim utakmicama FK Partizan i FK Crvena zvezda. Podaci o sukobima među navijačima na fudbalskim utakmicama FK Partizan i FK Crvena zvezda prikupljeni su iz arhiva SD Partizan i SD Crvena zvezda, pregledom izveštaja sa samih utakmica, veb – portala, literature i sl.

## **Rezultati sa diskusijom**

Formiranje agresivne potkulture nasilnih navijačkih grupa uslovalo je smanjenje interesovanja ljubitelja sporta za posetu fudbalskim manifestacijama. Prema dostupnim podacima, naša država je na prvom mestu u Evropi po broju nastradalih osoba kao posledica sukoba navijačkih grupa. Rezultati istraživanja Ministarstvo omladine i sporta Republike Srbije su pokazali da je na svakih 136 dana ubijen po jedan navijač u Srbiji, a sve žrtve i napadači starosti su od 17. do 25. godina (Milojević i sar., 2013)

## **Zaključak**

Kvalitetnim bezbednosnim procenama stepena rizika od nastajanja incidenata, praćenjem i predupređivanjem namera ekstremnih navijača, njihovom izolacijom i efikasnom intervencijom, uz učešće i koordiniranu saradnju nadležnih državnih organa, sportskih organizacija i klubova, vaspitno-obrazovanih ustanova i medija, huliganizam na sportskim priredbama bi mogao da se svede u društveno prihvatljive okvire.

**Ključne reči:** fudbal, navijači, sukobi, nasilje, večiti derbi

## **Literatura**

Koković, D. (2010). Društvo, nasilje, sport. Novi Sad: Mediterran Publishing.  
Milojević, S., Simonović, B., Janković, B., Otašević, B., & Turanjanin, V. (2013). Mladi i huliganizam na sportskim priredbama. Beograd: OEBS.

# **Socioeconomic characteristics and success of European countries at the Olympic Games, World and European Championships in rhythmic gymnastics (1992 – 2021)**

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## **Introduction**

Although rhythmic gymnastics has long crossed the borders of Eastern Europe, success still remains in the Eastern bloc. Therefore, the issue of socioeconomic influence on the dominance of the same in this sport is mentioned. The aim of this paper is to compare the influence of socioeconomic characteristics of European countries with success in major competitions and to see if there is a connection between their success with some of the characteristics.

## **Method**

The research was conducted on a sample of 17 European countries that have won at least one medal in major competitions in the period from 1992 – 2021. The results were processed in the SPSS 26 program.

## **Results and discussion**

There is a significant relationship between the total number of medals won by a country, the surface area and the number of inhabitants. However, the relationship between the GDP per capita and the total number of won medals is not statistically significant. The obtained positive correlation is explained by the fact that the leading countries cherish their traditions and national sports, such as rhythmic gymnastics, more than Western European countries.

## **Conclusion**

According to their sport success, the four dominant countries are far below the overall GDP average, which means that it does not significantly affect the success. Both rich and poor countries have an equal chance for success in rhythmic gymnastics.

**Key words:** economy, rhythmic gymnastics

## **References**

Čustonja, Z. i Škorić, S. (2011). Winning medals at the Olympic games – does Croatia have any chance? *Kinesiology*, 43. (1.), 107-114.



# Sports spirituality as educational innovation

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## Introduction

The phenomenon of sports spirituality as a process of introducing to spiritual values through physical culture and sports is investigated. Priority areas of scientific research and implementation: sports relaxation; socialization, cohesion of social groups with general ideas and practitioners; searching ways of mediation, personal interaction, decrease in conflict; identification of group and personal value guidance. Sports ascesis of sports spirituality is designated as a physical education worldview, which is based on existential and phenomenological philosophy and Christian theology.

## Method

Additional information was confirmed by questionnaires and conversations with physical education teachers, administrative-pedagogical teams of educational organizations, as well as parents. Empirical knowledge methods used in this study are as follows: 1) observation; 2) interviews; 3) survey; 4) testing; 5) method of expert assessments.

## Results and discussion

The study makes contribution to the methodology for implementation of spiritual and moral development in sports. It can be considered as extracurricular activity on the basis of dialogical culture used in general educational institutions, socially active and healthy. Experimental activities showed the need for further advancement in this direction, displaying the experience gained by a special methodological manual for teachers.

## Conclusion

Thus, sports activity is not only a healing function and improvement of the body, but also intellectual activity that forms and develops a variety of intellectual and mental skills. The results can be extrapolating on future research and development of innovative educational programs, strategies and educational techniques based on sports spirituality, especially for children and adolescents of deviant behavior.

**Key words:** sports spirituality, cohesion, group

## References

- Bryukhova, V.P. (2017). The educational potential of the folk game in the spiritual and moral development of younger students. / *Modern approaches to the organization of the educational process in conditions of standardization of education*, 245–248.
- Olenich, T.S.; Terarakelyants, V.; Shestopalova, O.A.; Biryukov, I. (2020). Sport Spirituality as an Educational Innovation (Evidenced-Based Study). *Innovative Technologies in Science and Education (ITSE - 2020)*.

# **Abuse and instigation of conflicts between MMA fighters: the case of Nurmagomedov and McGregor**

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## **Introduction**

In the relevant literature, there are papers that deal with conflicts in the field of sports in the context of verbal aggression (Dixon, 2007; Omine, 2017), but less known papers deal with the issue of promoting MMA fights, more precisely, conflicts that arise before the fight itself, during promotion of the fight and after the fight itself. This paper deals with the case of conflict between two MMA fighters, Khabib Nurmagomedov and Conor McGregor, the evolution from verbal to religious, social, family, and physical conflict. The role of the UFC promotion company in inciting and abusing their conflict in order to promote the fight and make a profit is discussed.

## **Method**

The method of theoretical analysis and the classic historical method were used in the paper.

## **Results and discussion**

By organizing the promotion of a fight between two of the most popular fighters at the peak of their careers and with mutual animosities, the UFC came to the conclusion that it would be the biggest fight in MMA history that would bring huge profits. The specific characters of these two fighters, their cultural and religious differences, views on sport and life in general, were used for promotional purposes, with or without their knowledge. Conor McGregor is an example of a fighter who went the furthest with his unsportsmanlike actions and was completely amnestied by his employer, the UFC promoter. The UFC is most responsible for the riots after the fight due to the accumulated frustration of Nurmagomedov, by not responding with an adequate punishment policy and by not taking a firmer stance towards McGregor's exaggerations and outbursts during the promotion. By tracking the viewing numbers of the promotional interviews, the UFC saw the effectiveness of its own marketing campaign and continued to increase the conflict.

## **Conclusion**

MMA is a recent, contemporary sport whose fighters are often the personification of modern gladiators, and in the context of the entertainment industry, it does not always provide space for values and ethical principles such as justice, equality, honesty, mutual respect. Currently, the most responsible for the state and future of MMA is the UFC. The case of development and instigation of the conflict between Nurmagomedov and McGregor indicates the fact that this promotion company does not choose means for the sake of extra profit. The question remains whether and when the UFC will turn to creating a sport that rests on the foundations of valid sports ethics for the development of this modern sport in the direction of long-term positive changes.

**Key words:** violence, sports, ethics

## **References**

Dixon, N. (2007). Trash talking, respect for opponents and good competition. *Sport, ethics and philosophy*, 1 (1), 96-106.  
Omine, M. (2017). Ethics of Trash Talking in Soccer. *International Journal of Sport and Health Science*, 15, 120-125.

# Zloupotreba i podstrekivanje konflikata između MMA boraca: slučaj Nurmagomedov i Mek Gregor

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## Uvod

U relevantnoj literaturi mogu se naći radovi koji obrađuju konflikte u oblasti sporta u kontekstu verbalne agresije (Dixon, 2007; Omine, 2017), ali su manje poznati radovi koji se bave problematikom promocije MMA borbi, tačnije, konfliktima koji nastaju pre same borbe, tokom promocije borbe i nakon same borbe. U ovom radu je obrađen slučaj konflikta između dvojice MMA boraca, Habiba Nurmagomedova i Konora Mek Gregora, prerastanje ovog konflikta iz verbalnog u verski, socijalni, porodični, fizički. Obradena je uloga promoterske kuće UFC u podstrekivanju i zloupotrebi njihovog konflikta u cilju promovisanja borbe i ostvarivanja profita.

## Metod

U radu je korišćen metod teorijske analize i klasičan istorijski metod.

## Rezultati sa diskusijom

Organizujući promociju borbe između dvojice najpopularnijih boraca na vrhuncu karijera i sa međusobnim animozitetima, UFC je došao do zaključka da će se raditi o najvećoj borbi u MMA istoriji koja će doneti ogromnu zaradu. Specifični karakteri ova dva borca, njihove kulturološke i verske razlike, pogledi na sport i uopšte na život, iskorišćeni su u promotivne svrhe, sa ili bez njihovog znanja. Konor Mek Gregor je primer borca koji je otišao najdalje sa svojim nesportskim postupcima i ostao potpuno amnestiran od strane poslodavca, promoterske kuće UFC. UFC je naodgovorniji i za nered nakon borbe usled nagomilane frustracije Nurmagomedova, nereagovanjem adekvatnom kaznenom politikom i nezauzimanjem čvršćeg stava prema MekGregorovim preterivanjima i ispadima tokom promocije. Prateći brojeve pregleda promotivnih intervjua, UFC je uvideo efektivnost sopstvene marketing kampanje i nastavio je sa pojačavanjem konflikta.

## Zaključak

MMA je mlad, savremen sport u kome su borci često personifikacija modernih gladijatora, a u kontekstu industrije zabave, u ovom sportu nema uvek mesta za vrednosti i etičke principe poput pravde, jednakosti, poštenja, uzajamnog poštovanja. Trenutno najodgovorniji za stanje i budućnost MMA jeste UFC. Slučaj razvijanja i podstrekivanja konflikta između Nurmagomedova i Mek Gregora ukazuje na činjenicu da ova promoterska kuća ne bira sredstva zarad ekstra profita. Ostaje pitanje da li će se i kada UFC okrenuti stvaranju sporta koji počiva na temeljima valjane etike sporta radi napredovanja ovog mladog sporta u smeru pozitivnih promena na duže staze.

**Ključne reči:** nasilje, sport, etika

## Literatura

Dixon, N. (2007). Trash talking, respect for opponents and good competition. *Sport, ethics and philosophy*, 1 (1), 96-106.  
Omine, M. (2017). Ethics of Trash Talking in Soccer. *International Journal of Sport and Health Science*, 15, 120-125.

# **The social impact of a sports event through the example of the organization of the "European Youth Table Tennis Championship 2022"**

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## **Introduction**

Sports events are considered to be one of the oldest organized manifestations and events in the history of mankind, which originate from ancient Greece, ie the Olympic Games. By organizing sports events, significant benefits are realized in the area of promotion of sports organizations, the sport itself and all actors of the sports event, but also the state, local and self-government, as well as the entire social community. The goal of this paper is a comprehensive analysis of the entire process of planning, preparation, selection of leaders and immediate executors, as well as the immediate realization of the European Championship for youth in table tennis

## **Method**

The paper used the observation method i.e., the descriptive method.

## **Results and discussion**

Respecting the experience and organizational skills of the leaders and managers of the Table Tennis Association of Serbia, the European Table Tennis Federation (ETTU) awarded Serbia the organization of the European Youth Championship, with the aim of further affirming and promoting this sport in Serbia and the region, which is considered one of the most widespread sports in the whole world. The Championship was attended by 525 competitors in the male and female categories from 41 countries, 74 judges, 120 delegates, 30 representatives from the world and European table tennis federations, as well as 52 engaged volunteers. 50 hours of broadcasting on television were also provided, and the fact that everything went smoothly confirms that the entire project was well organized and managed.

## **Conclusion**

The organization of the European Table Tennis Youth Championship contributed to the significant promotion of table tennis in Serbia and the entire region, its further development at all levels from local to national, as well as to the strengthening of the National and City Associations, and the clubs that, together with these two associations, form one governing body system in this sport.

**Key words:** sports event, table tennis, sports event management.

## **References**

- Ilić, R., Bošković, B., Radovanović, G. (2013). Upravljanje rizicima na sportskim događajima. Sport, nauka i praksa, Vol.3., 43-58.
- Nešić, M. (2006). Menadžent sportskih događaja. Novi Sad: TIMS.

# **Društveni učinak sportskog događaja kroz primer organizacije „Evropskog prvenstva za mlade u stonom tenisu 2022“**

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## **Uvod**

Sportski događaji se smatraju jednim od najstarijih organizovanih manifestacija i priredbi u istoriji čovečanstva, koje potiču još iz antičke Grčke odnosno Olimpijskih igara. Organizacijom sportskih događaja ostvaruju se značajni benefiti u oblasti promocije sportskih organizacija, samog sporta i svih aktera sportskog događaja, ali i državne i lokalne i samouprave, kao i cele društvene zajednice. Cilj ovoga rada je sveobuhvatna analiza celog procesa planiranja, pripremanja, odabira lidera i neposrednih izvršilaca, kao i neposredne realizacije Prvenstva Evrope za mlade u stonom tenisu.

## **Metod**

U radu je korišćena metoda opservacije, odnosno deskriptivna metoda.

## **Rezultati sa diskusijom**

Uvažavajući iskustvo i organizacione sposobnosti lidera i rukovodilaca Stonotenskog saveza Srbije, Evropska stonoteniska federacija (ETTU) dodelila je Srbiji organizaciju Prvenstva Evrope za mlade, sa ciljem dalje afirmacije i promocije ovog sporta u Srbiji i regionu, koji se smatra jednim od najrasprostranjenijih sportova u celom svetu. Na Prvenstvu je učestvovalo 525 takmičara u muškoj i ženskoj kategoriji iz 41 zemlje, 74 sudije, 120 delegata, 30 predstavnika iz svetske i evropske stonoteniske federacije, kao i 52 angažovana volontera. Obezbeđeno je i 50 sati emitovanja na televiziji, a činjenica da je sve proteklo u najboljem redu potvrđuje da je ceo projekat dobro organizovan i vođen.

## **Zaključak**

Organizacija Evropskog prvenstva za mlade u stonom tenisu doprinela je značajnoj promociju stonog tenisa u Srbiji i celom regionu, njegovom daljem razvoju na svim nivoima od lokalnog do nacionalnog, kao i osnaživanju Nacionalnog i Gradskog saveza, te klubova koji zajedno sa ova dva saveza čine jedan upravljački sistem u ovom sportu.

**Ključne reči:** sportski događaj, stoni tenis, menadžment sportskog događaja.

## **Literatura**

Ilić, R., Bošković, B., Radovanović, G. (2013). Upravljanje rizicima na sportskim događajima. Sport, nauka i praksa, Vol.3., 43-58.

Nešić, M. (2006). Menadžent sportskih događaja. Novi Sad: TIMS.

# Football: from global phenomenon to literary texts

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## Introduction

In recent years football has transformed from being the globally number-one-followed sport into not just a profitable business and mass media phenomenon (Vrcan, 1990; Vrcan, 1971) but also into various non-sports-related contexts, such as literary texts. This study is based on two hypotheses: firstly, the presence of football in literary texts as a non-sports context contributes, changes and breaks the boundaries of thinking about sport simply as a phenomenon that combines entertainment and profit; secondly, through mass media, sport can serve as a basis for numerous discussions in other contexts, such as literature and culture.

## Method

The two methods used in this research are: the explicative method of analysis used in analyzing the space and role of sport (football) in society and mass-media and also in analyzing the way in which football has found its place in literary texts; an inductive approach used in making general conclusions and attitudes about the way, role, reasons and consequences of reading literary texts with football as its topic within contemporary non-sports context.

## Results and discussion

Based on different multidisciplinary scholarly discussions on the topic, the results confirm the transformation process of football as a global game and sport into the phenomenon of popular culture and mass media. Throughout the analyses of Nick Horby's novel *Football Fever* (1992), as one of the examples of the most read novels written on and around football, the results also emphasize and expose the presence of football as a topic outside the sporting context. Therefore, the study points out how football has become a valuable subject and topic of many studies throughout different contexts as well as in various fields of interest: from literary texts, films and theatre plays to newspaper columns, TV shows and other.

## Conclusion

The study concludes that football stands and deserves a valuable topic of numerous socio-cultural dialogues and, as such, it should be addressed and researched by other future multidisciplinary studies.

**Key words:** culture, literature, sport

## References

- Boyle, R. (2009). *Books on Google Play Power Play: Sport, the Media and Popular Culture: Sport, the Media and Popular Culture*. UK: Edinburgh University Press.
- Crawford, G. (2004). *Consuming Sport: Fans, Sport and Culture*. UK: Routledge.

# Has top team sport become just a business or not?

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## Introduction

Sport, especially team sports, is becoming an increasingly interesting place for investing financial resources, and thus making money. The aim of this paper is to examine the key concepts of the most popular team sports as they relate to their financial operations. The great power of club fans is reflected in the amounts that clubs and sports organizations provide today through media rights. All these data lead to a key question: is the top team sport becoming just a business or the existing regulatory instruments preserve its primordial social role?

## Method

In the research part of the work, the effect of financial restrictions on the business of sports clubs is analyzed. First, there is financial fair play in European football and Formula 1, and the salary cap in American sports. Data were collected from official and publicly available announcements of umbrella sports organizations. The collected data were processed using various statistical methods of analysis and synthesis to show the levels to which sports organizations respect the prescribed financial frameworks.

## Results and discussion

Research based on available data shows that clubs often go beyond the prescribed frameworks, which results in the payment of fines, while expulsion from the competition is less common. Certain examples point to the great indebtedness of clubs, as club revenues and the value of player transfers have never been higher. A limiting factor for the accuracy of the data is related to covert financing through third-party companies such as, for example, sponsors. It is very important to continue to insist on financial discipline and adherence to financial frameworks, because this is the only way to ensure equality of the team on the field. Future research should analyze other "financially less attractive" sports and determine the relationship between the size of the club's budget and sports results.

## Conclusion

Team sports attract more and more money, and these facts will not change. From the earnings of players, clubs, sports associations, or the earnings of managing sports arenas. Despite the financial framework, clubs are trying to find a way out of them, which only speaks to the importance of the existence of these instruments. It is precisely the task of umbrella sports organizations to answer questions about the future of sports and the role of money in it.

**Key words:** sport management, financial fair-play, investing in sport, salary cap, media rights in sport

## References

Beech, J. i Chadwick, S. (2010). *Sportski Manadžment*. Zagreb: Mate d.o.o.  
Tomic, M. (2003). *Management in sport*. Belgrade: Astimbo.

# Draft of action research of the course of Bioethics of sport

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## Introduction

Since the academic year 2022/23 a new course is taught at the Faculty of Sport and Physical Education: Bioethics of sport from the perspectives of ethics, sociology and (for the first time) pedagogical bioethics. The aim of Bioethics of sport is to provide knowledge on a complex and very important field through the concept of bioethics as an interdisciplinary, intellectual and academic field. It is a new course that was so far taught only at the Faculty of Medicine as Medicine, sport, bioethics and focused on specific medical cases. The course will be taught through an innovative didactical – methodological way, by use of circular action research.

## Method

The aim of this paper is to present the draft of the designed action research, focused on circular and continuous awareness raising and improvement of preset, framework syllabus through reflexive questioning of practice. By analyzing the contents of the relevant, methodology –research references, a model of the action research has been outlined with all stages included: planning, action, evaluation, reflexing (in the course and after each stage), planning of a new cycle.

## Results and discussion

During the initial stage of action research realization and planning, methodologic approaches were elaborated for data collection (both qualitative and quantitative). The details will be further explained in the paper. Quantitative ones include also the construction of the battery of instruments which among other encompassed investigation of opinions and attitudes of students about the issues of doping, gender and sport, aggressiveness, fair play, relations to E-sport and modern upbringing of the youth. This battery, after reflecting, will be applied in the second stage of action research. After the evaluation of all the gathered results and the stage of final reflecting of them to practice, the teachers – researchers will plan a new research cycle.

## Conclusion

Action research is a pedagogically desirable approach of constituting the educational practice, with a change of the traditional role of a teacher into a reflexive practitioner. By applying the action research at the course Bioethics of sport, we expect to achieve an effect of circular improvement of the course. Additionally, future teachers and coaches in physical education are being trained to constantly enlighten the problem and role of reflexive practitioners in their future practice.

**Key words:** bioethics of sport, curriculum, action research, battery of instruments.

## References

- Marković, M. 2019. Fizička kultura i etika. Beograd: Zadužbina Andrejević.  
Škerbić, M.M., Radenović, S. 2018. Bioetika sporta: prisutnost bioetičkih tema na području filozofije i etike sporta u Hrvatskoj i Srbiji. *JARR - European Journal of Bioethics*. 9(2): 159-184.



# Nacrt akcionog istraživanja na predmetu Bioetika sporta

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## Uvod

Na Fakultetu sporta i fizičkog vaspitanja Univerziteta u Beogradu se od akademske 2022/23. godine realizuje novi predmet, Bioetika sporta, sa stanovišta etike, sociologije i (po prvi put) pedagoške bioetike. Cilj Bioetike sporta je sticanje znanja o složenoj i veoma važnoj oblasti kroz koncepcije bioetike kao interdisciplinarnog intelektualnog i akademskog polja. Predmet je nov, do sada je sličan predmet realizovan samo na Medicinskom fakultetu pod nazivom *Medicina, sport, bioetika* uz proučavanje specifičnih medicinskih slučajeva. Predmet će se realizovati didaktičko – metodološki inovativnim putem, cirkularnim akcionim istraživanjem.

## Metod

Cilj ovog rada je prikazati nacrt osmišljenog akcionog istraživanja, fokusiranog na cirkularno i kontinuirano osveščivanje problema i usavršavanje unapred datog, okvirno struktuiranog kurikuluma kroz reflektivno preispitivanje prakse. Analizom sadržaja relevantne, metodološko – istraživačke literature, skiciran je model akcionog istraživanja u koji su uključene sve etape: planiranje, akcija, evaluacija, refleksija (tokom i nakon svake etape), planiranje novog ciklusa.

## Rezultati sa diskusijom

Tokom početne etape realizacije akcionog istraživanja, planiranja, razrađeni su metodološki pristupi početnog prikupljanja podataka, kako kvalitativni tako i kvantitativni, o čemu će više reći biti u radu. Jedan od kvantitativnih je konstruisanje baterije instrumenata kojom su, između ostalog, obuhvaćena ispitivanja mišljenja i stavova studenata prema problemima dopinga, pola i sporta, agresivnosti, fer-pleja, odnosa prema E-sportu i savremenog vaspitanja mladih. Ova baterija će, nakon refleksije, biti primenjena tokom druge faze istraživanja, akcije. Nakon evaluiranja svih prikupljenih rezultata i faze konačne refleksije istih na praksu, nastavnici – istraživači planiraće nov ciklus istraživanja.

## Zaključak

Akciono istraživanje je pedagoški poželjan pristup konstruisanja nastavne prakse, uz menjanje klasične uloge nastavnika u reflektivne praktičare. Primenom akcionog istraživanja na predmetu Bioetika sporta očekuje se efekat cirkularnog usavršavanja kurikuluma predmeta. Pri tom, budući nastavnici i treneri fizičkog vaspitanja obučavaju se za permanentno osveščivanje problema i ulogu reflektivnih praktičara svoje buduće prakse.

**Ključne reči:** bioetika sporta, kurikulum, akciono istraživanje, baterija instrumenata.

## Literatura

Marković, M. 2019. Fizička kultura i etika. Beograd: Zadužbina Andrejević.  
Škerbić, M.M., Radenović, S. 2018. Bioetika sporta: prisutnost bioetičkih tema na području filozofije i etike sporta u Hrvatskoj i Srbiji. *JHR - European Journal of Bioethics*. 9(2): 159-184.

# **Life-coaching: putting the science and education of movement where it belongs**

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## **Introduction**

In our body of knowledge framed within the kinesiology, sport sciences and physical education the understanding of movement is conceptualized and interpreted to a large degree within the limits of materialism. The current trends in life-coaching domain are demanding a much more sophisticated approach that includes the dynamic system and holistic view that is represented by emerging noetic sciences.

## **Method**

With the support of phenomenological analysis, short deconstruction of ideological grounding of kinesiology, and apologetic argumentation of understanding the scientific blindfolds, we are aiming towards more dynamic and experientially based recognition of the importance of movement.

## **Results and discussion**

The qualia of movement as a lived concept will take our body of knowledge from kinetic to kinaesthetic; from biomechanics to psychosomatics; from physical to metaphysical; from skillset to mindset; from integrity to tensegrity; from attention to intention; from ethics to aesthetics; from spacious to gracious; from doing to being; from illusion to ludus, etc.

## **Conclusion**

Life-coaching as a service and industry is rapidly growing. By deeper understanding of core pillars of the phenomenology the movement (Sheets-Johnstone, 2009, 2011) as applied in kinesiology, physical education and sport sciences, we can foresee the opportunity to provide curricular incentives to open the job market for our students into direction of life-coaching certification. Simply because there is no life without movement.

**Key words:** movement, life-coaching, psychosomatic, feelings, noetic science

## **References**

Sheets-Johnstone, M. (2011). *The Primacy of Movement* 2nd ed. Amsterdam: John Benjamins B.V.  
Sheets-Johnstone, M. (2009). *The Corporeal Turn*. Exeter UK: Imprint Academic

# Improvement of the organization of Balkan shipping schools' competition

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## Introduction

There are ten shipping schools with a long and rich tradition in the local and wider region (<https://www.brodarska.edu.rs>). Competitions between shipping schools have existed for many years, and are organized through rowing in cutters (Ljubičić, 1968). Cutters are boats which are rowed without a movable seat, using a specific technique that has a long tradition. For many centuries, cutters have been the basis of lifeboats since the time of cargo and passenger sailing ships until modern times (Simović, 1996). The problem of the work represents the importance of the organization of rowing competitions in boats between shipping schools of the Balkans with proposals for measures for improvement.

## Method

The paper uses the bibliographic and comparative method, as well as the inductive and deductive method of reasoning with the author's practical experience in attending and teaching at the School of Shipping, Shipbuilding and Hydro-Engineering in Belgrade, as well as in the organization of the rowing competitions.

## Results and discussion

Meetings of shipping schools from the region represent a valuable opportunity for the exchange of knowledge, skills and experiences, both among students and their teachers. The aforementioned competitions involve the possession of expensive and complex equipment, long-term learning of rowing techniques, conditioning, as well as rowing in special conditions. Large material resources, numerous human resources and significant time spent were not fully utilized. Competitions of shipping schools can and should include specific theoretical knowledge through the organization of specialized quizzes, knowledge of specific maritime - sailor skills of a wide scope, as well as participation in competitions that deal with swimming, other forms and types of paddling, as well as rescue procedures. All of the above should enable greater comprehensiveness of students included in the preparation and competition process with significantly greater acquired knowledge as the final product.

## Conclusion

For many years, the potentials of the organized competitions of the Balkan Boating Schools in rowing have not been fully utilized. Modern trends in teaching include competitions and preparations for competitions as one of the forms of teaching aids. As the competition can represent the crown of the teaching process, it is primarily necessary to consider the teaching process itself and its contents in the shipping schools of the region. The further area of research lies in, first of all, the cooperation of the Maritime Schools of the Balkans in the study of the teaching process, then the organization of parallel experimental forms of teaching and competitions in different schools in the region with a comparison of the obtained effects.

**Key words:** nautics, teaching, programs, rowing

## References

Ljubičić N. (1968). Pravilo za veslanje i jedrenje u čamcima ratne mornarice, Državni sekretarijat za narodnu odbranu, Split.

# Unapređenje organizacije takmičenja brodarskih škola Balkana

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## Uvod

U užem i širem regionu postoji desetak brodarskih škola sa dugom i bogatom tradicijom (<https://www.brodarska.edu.rs>). Takmičenja između brodarskih škola postoje dugi niz godina, i organizuju se kroz veslanje u kuterima (Љубичић, 1968). Kuteri su čamci u kojima se vesla bez pokretnog sedišta, specifičnom tehnikom koja ima dugu tradiciju. Više vekova kuteri su predstavljali osnovu spasilačkih čamaca još od vremena teretnih i putničkih jedrenjaka pa do savremenog doba (Simović, 1996). Problem rada predstavlja značaj organizacije veslačkih takmičenja u kuterima između brodarskih škola Balkana sa predlozima mera za poboljšanje.

## Metod

U radu je primenjena bibliografska i komparativna metoda, kao i induktivni i deduktivni metod zaključivanja uz praktično iskustvo autora u pohađanju i vođenju nastave u Školi za brodarstvo, brodogradnju i hidrogradnju u Beogradu, kao i u organizaciji veslačkih takmičenja.

## Rezultati sa diskusijom

Susreti brodarskih škola iz regiona predstavljaju dragocenu mogućnost za razmenu znanja, umenja i iskustava, kako učenika tako i njihovih nastavnika. Navedena takmičenja podrazumevaju posedovanje skupe i složene opreme, dugoročno učenje tehnike veslanja, kondicione pripreme, kao i veslanje u specijalnim uslovima. Velika materijalna sredstva, brojni ljudski resursi i značajno potrošeno vreme nisu iskorišćeni u potpunosti. Takmičenja brodarskih škola mogu i treba da obuhvate i specifična teorijska znanja kroz organizovanje specijalizovanih kvizova, poznavanje specifičnih pomorskih – mornarskih veština širokog obima, kao i učestvovanje u takmičenjima koja obrađuju plivanje, ostale oblike i tipove veslanja kao i spasilačke procedure. Sve navedeno trebalo bi da omogući veći sveobuhvat učenika obuhvaćenih procesom priprema i takmičenja sa značajno većim usvojenim znanjima kao krajnjim proizvodom.

## Zaključak

Potencijali dugo godina organizovanih takmičenja Brodarskih škola Balkana u veslanju kuterima nisu iskorišćeni u potpunosti. Savremeni trendovi u nastavi uključuju i takmičenja i pripreme za takmičenja kao jedan od oblika nastavnih sredstava. Kako takmičenje može predstavljati krunu nastavnog procesa, tako je prevashodno potrebno razmotriti i sam proces nastave i njegove sadržaje u brodarskim školama regiona. Dalji prostor istraživanja leži u pre svega saradnji Brodarskih škola Balkana u proučavanju nastavnog procesa, potom organizaciji paralelnih eksperimentalnih oblika nastave i takmičenja u različitim školama u regionu sa poredjenjem dobijenih efekata.

**Ključne reči:** nautika, nastava, programi, veslanje

## Literatura

Ljubičić N. (1968). Pravilo za veslanje i jedrenje u čamcima ratne mornarice, Državni sekretarijat za narodnu odbranu, Split.

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