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DEAR READER,

This issue contains scientific papers from 16 countries and 5 continents that are written by researchers who come from 16 countries and 5 continents.

Continuity in publishing scientific papers from the field of sports that promote new values and results is also maintained in this issue of the magazine, which is indicated by an overview of published papers in the following areas: two papers from sport psychology, six papers from transformation processes, two come from the field of sports management, five from sports medicine and three papers from kinesiological education.

Just as in previous issues, the research conducted by young scientists have been included in this issue, whereby we strive to promote their knowledge and quality through our magazine. We are thankful to our Editorial Board members for their devoted work, promptness and a responsible approach that demands originality and the quality of authored works thereby ensuring the magazine's value and recognition.

Our Editorial board deeply believes that the development of sports disciplines is only possible through the development of scientific achievements and their implementation in practice. The exchange of results, ideas and new scientific findings through our magazine contributes to an advancement of scientific thought, which results in indicators of shifting boundaries and creating new sports systems accompanied by the usage of advanced technology and its implementation in the field of sports.

Changing rules in sports disciplines, implementing and using new equipment, adapting the environment according to different needs of athletes, the appearance of new techniques that keep up with new technologies and many other factors impact the constant need for monitoring, researching and detecting obstacles that stand in the way of accomplishing the best results. Understanding new technologies in sports is no longer a privilege of major sports milieus, but

a need without which it is not possible to keep up with trends in sports and strive towards successful, top results. Promoting the results through papers in our magazine is not only the quickest way to reach our readers, but also an obligation to maintain trust and the quality that will satisfy the readers' needs and expectations. Our wish is to include an even wider auditorium and new authors in the following issues so as to publish more diverse, affluent, interesting and higher quality editions.

We invite you, readers, to become a part of our team and participate in our work so that, together, we could contribute to changes in the world of sports in a creative and innovative way.

Nihad Selimović, MD, MSc
Editor in chief



DRAGI ČITATELJU,

U ovom broju nalaze se naučni radovi iz 16 zemalja sa pet kontinenta, realiziranih od strane istraživača koji dolaze iz 16 zemalja i sa pet kontinenata.

Kontinuitet u objavljivanju naučnih radova iz oblasti sporta koji promovišu nove vrijednosti i rezultate zadržan je i u ovom broju časopisa što pokazuje pregled objavljenih radova po oblastima: dva rada iz sportske psihologije, šest radova iz transformacionih procesa, dva su iz sportskog menadžmenta, pet iz sportske medicine i tri rada iz kineziološke edukacije.

Kao i u prethodnim izdanjima, istraživanja mladih naučnika uključena su i u ovaj broj, čime nastojimo promovisati njihovo znanje i kvalitetu kroz naš časopis. Zahvalni smo članovima recenzentskog odbora na predanom radu, ažurnosti i odgovornom pristupu u kojem se zahtjeva originalnost i kvalitet autorskog djela čime se osigurava vrijednost časopisa i njegova priznatost.

Naš urednički odbor duboko je uvjeren da je razvoj sportskih disciplina jedino moguć kroz razvoj naučnih dostignuća i njihovu implementaciju u praksi. Razmjena rezultata, ideja i novih naučnih saznanja preko našeg časopisa doprinosi unaprjeđenju naučne misli što za rezultat ima pokazatelje o pomjeranju granica i stvaranja novih sportskih sistema uz korištenje napredne tehnologije i njene primjene u oblasti sporta.

Izmjene pravila u sportskim disciplinama, primjena i korištenje nove opreme, prilagođavanje okruženja prema različitim potrebama sportista, pojava novih tehnika koje prate nove tehnologije i mnogo drugih faktora, utiču na stalnu potrebu za praćenjem, istraživanjem i otkrivanjem prepreka koje stoje na putu ostvarivanja najboljih rezultata. Poznavanje novih tehnologija u sportu više nije privilegija velikih sportskih sredina već potreba bez koje nije moguće pratiti sportska kretanja i

težiti ka uspješnim, vrhunskim rezultatima. Promovisanje rezultata preko radova u našem časopisu je nabraži put do naših čitatelja ali i obaveza da održimo povjerenje i zadržimo kvalitet koji će zadovoljiti potrebe i očekivanja čitatelja. Naša je želja da u narednim izdanjima uključimo još širi auditorij i nove autore, kako bi svako sljedeće izdanje bilo raznoliko, bogatije, kvalitetnije i zanimljivije.

I Vas, čitatelje, pozivamo da budete dio našeg tima i da učestvujete u našem radu kako bi svi zajedno doprinosili promjenama u svijetu sporta na kreativan i inovativan način.

Mr. sci. dr. Nihad Selimović
Glavni urednik

THE EXPLOITATION OF EDUTOURISM IN EDUCATIONAL SOCIETY: A LEARNING EXPERIENCE NECESSITY THROUGH PHYSICAL ACTIVITY AND RECREATION

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ABSTRACT

Educational tourism or edutourism is the sector of the economy that is developing fast and is acquiring more popularity nowadays. Edutourism is a tourist activity of those who are undertaking an overnight vacation and those who are undertaking an excursion, for whom education and learning is a primary or secondary part of their trip. The increase in educational mobility is impressive and it's not just travel, it is a unique change for the children and the youth to enjoy nature and the outdoors and be physically active, engaging in sports. Furthermore, edutourism can also promote sustainability and transform the young tourists into responsible consumers and travellers of tomorrow, who respect and protect nature. Also, it would be a unique chance for students to discover what they would like to do in their future and edutourism seems to contribute to their decision in selecting a university. This paper is a literature review that focuses on educational trips based on sport and nature, and proposes technological innovations to reinforce the knowledge of students.

Keywords: Edutourism, school, recreation, sport, physical activity, university, nature.

INTRODUCTION

Edutourism is defined as an internationally impactful business with wide cross section components of activities such as transportation, accommodation, recreation, food and other related services (Anthony et. al, 2004). The concept and significance of Educational Tourism, as a subtype of tourism, has gained considerable attention and popularity in recent decades among researchers, tourism policy makers and also public and private sectors. Educational tourism occurs when an individual travels to somewhere and, during the trip, intentionally or unintentionally involves in the process of learning (Rezapouraghdam, Shahgerdi and Kahrizi, 2015). The engagement of a person's

learning process with a touristic context such as experiencing an unfamiliar culture is more effective than ordinary studying within a classroom (Werry, 2008). Since through travelling, the familiarization with new populations, landscapes, languages, cultures, and traditions occurs, every touristic trip epitomizes an act of acquiring knowledge which implies the meaning of educational tourism. Edutourism is defined as recreation-based in-situ learning. It blends education with tourism in a way that promotes lifelong learning. It promises an enjoyable learning experience while building new knowledge, new skills and a sense of expanded horizons in learners. Setiawan, Hussain, Hussin and Yann (2007) suggest that learner attention and rapport are core elements in the success of the programme and need to be emphasized in the instructional design of edutourism programmes.

Education tourism is beneficial in many ways for the society at large. Without any doubts, education tourism is a tool for providing development from the grass roots of any region, state and country. It is a medium through which the tourist destinations will be able to get an identity on the global level. In fact, education tourism is a niche to explore the hidden treasures of a place (Sharma, 2015). Edutourism is a combination of the two powerful industries of education and tourism, which, together, create a super-industry that has the potential to positively enrich the lives of all that are involved in it. Edutourism represents 20% of the global tourism and is expected to double its growth by 2020 (Ubbelohde, 2017).

Educational tourism goes beyond simple curiosity, interest or attraction for a particular subject. It includes a travel experience in which there is organized learning, either formal or experiential learning. The educational journey can serve many purposes, such as the satisfaction of curiosity for other people, their language and culture. Moreover, it serves to stimulate interest in music, art, architecture, or tradition, to be sensitised for the natural environment, landscapes, flora and fauna and to enhance the interest in cultural heritage and historical sites (Ritchie, Carr and Cooper, 2003).

PROBLEM AND AIM

Edu-tourism environments are made up of 5 components: the people who participate in learning activities; the attraction that offers activities for user involvement; services and facilities that supported the activities; transportation that moves the people to and within the destination; and the information that assisted the users to know, find and achieve his / her focus or aims of the trip (Bodger, 1998). The aim of this paper is to explore the educational trips based on sport and nature and to propose technological innovations to reinforce the knowledge of students. A literature review will be used for this purpose. This article gives a glance at new opportunities in education through tourism. The students will gain knowledge through tourist activities in cultural, environmental and historical issues and will be active through sport and recreational activities.

LITERATURE REVIEW SPORT FOR STUDENTS

Various social events provide opportunities to build a network with students and professors. It is a good practice to eliminate the distance between students and professors and to gain more understanding of each other. Such an event could be a culture dinner. The first night could help in gaining knowledge about the cultural backgrounds of different nationalities. Ice breaking and team building activities may facilitate mutual understanding among the students. Availability of entertainment and recreation services after the daily

tasks were reported as expected (Cui, 2015). Furthermore, McGladdery and Lubbe (2017) refer that one of the highest scoring categories of IET was international adventures. Adventures are characterised by some form of physical activity with an endurance element, consistent with being out of one's comfort zone. Often, they also include solitude time for reflection on the experience. The examples of the mentioned adventures included: sea kayaking trips around Madagascar and Mauritius, and a trip in Lesotho combining hiking, cycling, tubing and horse riding.

Physical activity and recreation face barriers because of the "lack of time", "lack of services/facilities", "economic reasons", "lack of interest", "lack of friendship", and "psychological/individual reasons" of students. These barriers reduce the participation of students in extracurricular recreational activities. The research results of Damianidis (2006) have shown that pupils who did not participate in extracurricular sporting leisure activities had more limitations than their other classmates, who participated rarely to systematically, with the systemic ones experiencing fewer obstacles. These results emphasize the need to create edutourism programs as a learning experience necessity through the provision of physical activity and recreation (Figure 1).



Figure 1: The Edutourism crossroads.

Edutourism products that have been developed by (Dick, Carey and Carey, 2005) were implemented on students who visited Taka Bonerate National Park (Hayati, 2017). Each student did the activities based on worksheets and learned the material from a booklet. Edutourism activities conducted with a scientific approach covered three topics; Marine Biota Diversity, Coral Reef Ecosystems, and Marine Biota Conservation. The tourist activities with refreshing aspects in the park are the following: a. Diving, b. Snorkelling, c. Photography below sea level, d. Canoeing, e. Boating and f. Swimming with baby sharks. The learning aspects of the park concerning education issues are: a. Observe diversity of marine biota, b.

Study diversity of marine biota, c. Study the importance of marine biota diversity, d. Study many cases of marine biota conservation in Taka Bonerate National Park, e. Study how to conserve the diversity of marine biota. The stages of edutourism with a scientific approach are observing, questioning, associating, experimenting, and networking. Each stage of learning in edutourism still included a fun or refreshing activity. Students learning outcomes focus on cognitive and psychomotor ones. Cognitive learning outcomes were measured by giving a pretest and a posttest to students, while psychomotor learning outcomes were observed with the observation sheet. Edutourism implementation results prove that there is an increase in students' cognitive learning outcomes. A calculation of gain scores was also conducted to determine whether there is an increase in the ability of students between the periods before and after learning through edutourism. The majority of students increased cognitive learning outcomes with a scientific approach. The results analysis of observation sheets explains that learning through edutourism can encourage students' psychomotor outcomes. Psychomotor learning outcomes were associated with achievement through manipulation skills that involve muscle and physical strength. Psychomotor learning outcomes focus was on moving, manipulating, communicating and creating ability. Psychomotor learning outcomes are a continuation of the cognitive and affective learning outcomes. The successful development of the cognitive aspects will positively affect the development of psychomotor aspects.

Students perceive recreational sports more intensely when they include outdoor activities. Most of the examples refer to "new, modern" activities, which are implemented in the countryside. All of these groups of people can participate in domestic sport tourism and create a continuous stream of tourists without seasonality (Chroni, 2001). The idea of creating tourist attractions which would combine fairly serious educational content with traditional recreational activities such as action sports, hiking, game viewing and visiting sites of historical significance emerged in Grahamstown in 2005 (Wells, 2016).

For these purposes, the Dunstan High School in Alexandra, New Zealand created the Learning Adventures brand for edutourism. Dunstan High School is a signatory of the "Code". The Code is a document that provides a framework for service delivery by educational providers and their agents to international students. The Code sets out the minimum standards of advice and care that are expected of educational providers with respect to international students. The Dunstan High School has agreed to observe and be bound by the Code of Practice for the Pastoral Care of International

Students published by the Ministry of Education of New Zealand (2017). The Code applies to pastoral care and provision of information only, and not to academic standards. Copies of the Code are available on request from this institution or from the New Zealand Ministry of Education website. Some of the activities that may be part of a learning adventures program are: Central Otago Rail Trail, Mount Aspiring Outdoor Education Centre, River Crossing, Kayaking, Windsurfing, Sailing, Gondola, Luge, White Water Rafting, Bungee Jumping, Jet Boating – Shotover Jet, Tandem Skydiving, and Glacier Walk – Alpine Guides Westland.

The potential for college sports events to generate tourist activity is largely unrecognized in the sport tourism literature. The findings of this study suggest that college sports events attract a significant proportion of fans from outside of the local community and as such, support the growing focus within the tourism literature that small-scale-sport tourism events may hold more benefit for a community than hosting mega events (Higham, 1999). Gibson, Willming and Holdnak (2003) report that the ability of college sports to produce tourist activity is not widely recognized in the tourist literature. Sport college events attract a large number of fans outside the local community and can generate more benefits than major sport events. While their results suggested that fans contribute economically to the host community through their use of food services, accommodations, and shopping related activities, it appears that further development as a tourist destination may lie in actively leveraging the opposing team's fans who travel to the host city.

NATURE APPROACH

Forest based educational tourism is one of the potential ways for diversifying child education. Large international organizations such as World Wildlife Fund and The Nature Conservancy have emphasised this learning system. Educational tourism is delivered through an educational program and seeks to change the learner's cognitive, participatory knowledge, skills and behaviour. Through educational tourism, the visitors travel to a location engaging learning experience directly related to tourism. This tourism is a component of human lifelong education. Again, forest conservation is also a useful part of the education system. Geological aspects, biodiversity, wildlife, mangroves, reef, food circle, ecology are included in the natural conservation of the forest areas. It gives us a complete idea about forest diversity, as well as natural environmental aspects. So, the main target of forest-based educational tourism is to ensure understanding and gather experience regarding forest conservation, while fulfilling the educational requirements (Bhuiyan, Islam, Siwar and Ismail, 2010). The child education diversification of forest conservation depends on proper implementation of educational tourism according to Bhuiyan, Islam, Siwar and Ismail (2010) (Table 1).

Table 1: Ways of implementing educational tourism

The planning team	It will be important to have a planning team of excellent communicators who can take the environmental awareness and education program forward. They can work together for a conservation awareness plan of action, with short and long-term targets and a budget estimate.
Development of educational materials	Information on forest conservation needs to be presented in various formats to ensure that it is relevant for the children. Useful materials include brochures, posters, maps, comic books, wildlife guides, videos, slide shows and interactive displays.
Exhibition and visiting activities	Traveling exhibition may be arranged to foster educational tourism. Some events such as videos, film shows, quizzes and other competitions can be included in this exhibition. The necessary and relevant government offices and institutions are also visited in this regard.
Local community involvement	One of the most important techniques is the involvement of local people in implementing educational tourism. They can influence the children to gather information and build their awareness to forest conservation.
Tour operator activities	Tour operators can arrange a special tour package for children on forest conservation. They can involve the residents for a proper implementation of this program. Open discussion meetings, workshops and field trips can be arranged in this regard.
The media	There is high public awareness of educational tourism; the national media can play an effective role. Newspapers, television and radio broadcasts are developing particularly strong public support for conservation education.
School curriculum	Schools can develop a special course and curriculum for the students, which can improve their knowledge regarding forest conservation.
Teachers	Teachers are also helping the children to achieve and foster their awareness of nature and conservation through their teaching and classroom activities.
Local and international organizations	Local and international organizations have a strong role in implementing educational tourism. They can support conservation education through their wide-ranging education programs and projects. Educational tourism can place an emphasis on the various environmental and conservation issues of forests for the children.

Furthermore, for a tourist consumer / student in a constant evolution, it does not just represent an escape from the crowdedness of the big cities and simply sitting in a quiet place in the rural area. The introduction of this type of recreational-educational rural tourism represents, at the same time, a cultural act, relaxation and, last but not least, an income source for the farmer. The consumer of rural and farm tourism has evolved towards the association of these two types of tourism with other educational and fun activities for spending his/her free time in a harmonious way.

Thus, the hybrid forms of rural tourisms combined with recreational-educational farming came into existence. For these reasons, the recreational-educational rural tourism, as a hybrid form of rural tourism, fulfils these principles: it is a small business, it is promoted through direct marketing, it is an agricultural event, it promotes rural farms and the culture of working the land, as well as the traditional occupation of raising animals and the occupations of the rural population (Petroman, Mirea, Lozici, Constantin, Marin and Merce, 2016). Edutourism is a mutually beneficial way for the learners and for the

society at large. In the present scenario, education tourism represents a need for the rural areas. Moreover, edutourism can work as a backbone for the survival of many people from the rural areas by generating employment sources in their places (villages). Today, the youth is running towards urbanization. This is, again, a problematic situation in terms of de-population in villages and over populated cities, high crime rates, unemployment etc. Edutourism is the source through which the youth may be attracted back to villages (Sharma, 2015) and it is the link for the enhancement of sustainable tourist development, as the students learn how to protect the natural resources through their tourist activity.

As an example, in Greece, Lifelong Learning Centres for the Environment and the Sustainability cooperate with schools and organize programs for tourism and environmental education. Edutourism is a different approach for sustainability that could be achieved in developing countries (Yfantidou and Matarazzo, 2017).

STUDENTS AND UNIVERSITY SELECTION

From childhood to youth, educational institutions have become tourist products branded for attracting international edu-tourists globally (Naido, 2007). Until now, research on the decision making process of international students in the choice of edutourism destination has centred on partial aspects of the process. The existing literature has concentrated on identifying those elements which play a part in the decision of the prospective international student on the choice of a university and establishing his/her priorities. The model presented in the study of Ojo and Yusofu (2013) showed the choice of Malaysian university as an independent variable dependent on four factors: institution reputation; the effect of cost and fees; degree of internalisation of the university; and social / geographical link.

Education serves as one of the bedrocks for any society to experience development. Oludeyi and Adekalu (2013) conducted a survey in Nigeria. They concluded that Nigeria as a nation can benefit from the local and international students if the government, stakeholders and policy makers begin, with immediate alacrity, to reshape, refocus, re-sharpen and reprioritize educational goals which will help gain the lost glory in the Nigerian educational system. Nigerian universities, in the struggle to meet up with the international standard and be among the top best universities in the world, should embark on the road to implement policies for curbing the brain drain and attracting international potentialities for brain gain. The authors give the following as recommendatory statements for their contention from the above findings. A rigorous overhauling and total restructuring of educational processes, systems and philosophies should be conducted, and curriculum contents and methods of deliveries should be revamped, revitalised and packaged for cultural diversity, while meeting up with the world class. Again teaching and research without the usage of technology is incomplete. The Nigerian government should invest heavily on technology to upgrade and update the educational sectors to meet world class standards. Efforts should be put in place to provide an attractive, well-equipped and learner-friendly environment in Nigerian tertiary institutions of learning. This will attract more local and international students to immigrate for studies at Nigerian universities and, subsequently, have an impact on expediting the developmental pace of the nation. Creation of more tourist centres in Nigeria should be highly encouraged. Such tourist centres should be designed especially to promote research and scholarship. This is because the current study, as well as studies of Adekalu, et al. (2013) have shown that sponsoring thousands of Nigerians to

study at local and international institutions of higher learning serves as one of the factors most international students considered in their decision making process of choosing a study destination.

Several underlying factors seem to contribute to the students' decision in selecting a university. Lam, Ariffin and Ahmad (2011) refer that students around the world have recognised Malaysia as the preferred choice for college and tertiary education because of its low cost of living and high quality education. They recognized that the pull factor such as "institution image" significantly influenced the satisfaction level of the international students to choose University Kebangsaan Malaysia. Meanwhile, the push factor of "job prospect" significantly influenced these students to recommend UKM as a study destination.

Global learning is positively correlated with international educational tourism "IET" and certain categories of IET are more conducive to global learning than others. The highest scoring categories of IET were academic competitions and leadership summits. However, these results may be biased owing to the fact that participants are usually high achievers and school-based academic achievement has been demonstrated to have a small but positive effect on global learning (McGladdery and Lubbe, 2017).

However, for this discussion, the study of Lam, Kai, Ooi and Goh (2011) narrows the scope and focuses more on the purposeful learning and travelling concept in educational tourism. This group is primarily motivated by education and learning, but may be classified as tourists, even if they are not perceived to be tourists or if tourism is not their primary motivation to come abroad. In other words, these individuals come to a host country for education (main purpose) and, during their free time, they only go for travelling and leisure activities. Nevertheless, even though they may not view themselves as tourists, they experience tourist impacts and regional development implications even if their motivation may be substantially education-related.

EDUTOURISM AND TECHNOLOGY

From the technological aspect, Ankomah and Larson (2004) presented an organizational framework for implementing education tourism. They proposed that the universities' collaboration with tourism stakeholders, will produce a workable education program. This program could be divided into two sections: a) classroom experience and b) on-site experience. The program schedule should specify the length of the classroom segment and the on-site practical experience. The governments, through their NTOs, will provide resources to set up Community Communication Centres (CCC) in the various attraction sites. These centres will have a resident expert on tourism attractions and subject matter in the curriculum to assist with the dissemination

of on- site instruction. In addition, these centres will have up-to-date technological links to the universities. Lessons in education tourism could be delivered through distance learning, the Internet and email. For the distance learning performance, Goulimaris (2015) referred that students' personal performance is influenced positively by self-determining forms of motivation and negatively by forms which are less self-determining. Ankomah and Larson (2004) proposed that learning can take place in two phases. In the first phase, participants will spend some time in the university classrooms that are linked to the community centres. This arrangement makes it possible to provide participants the knowledge-base and the perceptual view of what is involved in the next phase. The second phase is the on-site experience where participants travel to the attraction location to actively participate and acquire skills that will reinforce the knowledge acquired in the classroom.

Another interesting proposal is the Serious Game (Zarzuela, Pernas, Calzón, Ortega and Rodríguez, 2013) which allows enjoying an immersive experience in the virtual 3D Main Square of a city, where the user can learn about different data and aspects of the city. It is important to point out that the control of the game and the interaction with the virtual elements is done in a natural and non-intrusive way, meaning that it is not necessary to use any other marker or additional element of motion capture device.

Projecting the scene onto a wall, and enabling 3D vision, the feeling of realism is very high, giving the player the feeling of being in the Main Square. The developed system can be used as a new service to be offered by the Office of Information and Tourism of a city. It is a highly intuitive tool and it is easy to use for people of any age, no matter whether they are used to these new technologies or not. These offices will have contributed to transform the students into cultural tourists through the school environment and educational trips.

DISCUSSION AND CONCLUSIONS

To travel is still 'to become a man of the world' (Boorstin, 1964: 82) and is often associated with its educational

capacity to 'broaden the mind'. It would be a substantial advantage for students to gain a cultural exchange experience and build a network around the world (Cui, 2015). The development of Edu-tourism packages reveals the potential within the concept. By targeting young international students, the dynamics of the global new tourists come into play, inviting a level of complexity and diversity in presentation (Wells, 2016). The research proposal of Nikolaeva, Maslo and Pevzner (2011) proposed the creation of a competence profile for educational tourism for adult educators that should be included into a qualification frame. This could be supported by a formal documental support of adult educators' knowledge and competences, and a program for adult educators in the field of educational tourism.

Educational tourism may become a major educational paradigm in the near future, creating added value in the society, both in a form of increasing the education level and creating new economic opportunities as a result of gained knowledge due to travelling. Moreover, education tourism will provide a platform for lifelong learning education for all people without an age difference that gives additional opportunities in the ageing society. The content of educational trips and tours, thus, needs to be result-oriented, giving people a full knowledge-package, which they can use later and achieve certain results. The concept of education will gradually change with alternative education methods offered in the form of educational tourism (Akhmedova, 2016).

The market for Educational Tourism, in order to grow and be developed, needs, besides the contribution of successful promotional actions, strategic and sustainable bases of planning, management and development.

Future research could be applied to all educational levels to explore the needs, the psychological benefits and the knowledge gained due to edutourism. Also, research development could focus on designing such educational programs in accordance with each age, and with the physical activity and knowledge of students as the main target.

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ISKORIŠTAVANJE OBRAZOVNOG TURIZMA U OBRAZOVNOM DRUŠTVU: POTREBA ZA OBRAZOVNIM ISKUSTVOM KROZ FIZIČKU AKTIVNOST I REKREACIJU

Obrazovni turizam ili eduturizam je ekonomski sektor koji se brzo razvija, te danas sve više dobija na popularnosti. Obrazovni turizam je turistička aktivnost onih koji idu na jednodnevno putovanje i onih koji odlaze na ekskurziju, a za koje obrazovanje i učenje predstavlja primarni ili sekundarni dio putovanja. Povećanje obrazovne mobilnosti je impresivno, te ne predstavlja samo putovanje. To je jedinstvena šansa za djecu i omladinu da uživaju u prirodi i vanjskom prostoru, te da budu fizički aktivni učestvovanjem u sportovima. Nadalje, obrazovni turizam također može promovisati održivost i transformisati mlade turiste u odgovorne potrošače i putnike sutrašnjice koji poštuju i štite prirodu. Također, to bi bila i jedinstvena šansa za studente da otkriju šta bi voljeli raditi u budućnosti, a čini se da obrazovni turizam doprinosi i njihovoj odluci prilikom odabira univerziteta. Ovaj rad predstavlja pregled literature koja se fokusira na obrazovna putovanja zasnovana na sportu i prirodi, te predlaže tehnološke inovacije za jačanje znanja studenata.

Ključne riječi: Eduturizam, škola, rekreacija, sport, fizička aktivnost, univerzitet, priroda.

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CHANGES IN THE EXERCISE REGIME AFFECTED BY TEACHING THE MODULE "HEALTHY LIFESTYLE"

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ABSTRACT

The study has presented findings from the field of applied selected components in the content standard of the teaching module "Healthy Lifestyle" during the Physical and Sports Education lessons for the changes in the exercise regime of high school pupils ($n = 71$, age = 15.5 ± 0.5 years old). Application of an experimental agent in the form of a specific educational program, compiled of selected components, showed that a short period of theoretical impetus has proven to be satisfactory, by increasing the number of high school pupils with a dominating frequency of physical activity and changes in the amount of movement in their exercise regime. Both in boys and girls, we found a statistically significant difference between knowledge about the importance of physical activity and its realisation in the daily regime (girls input/output; $\chi^2 = 20.96/16.96$ $p \leq 0.01$; boys input/output $\chi^2 = 7.88$ $p \leq 0.05/12.71$ $p \leq 0.01$).

Keywords: Students, physical activity regime, teaching module "Healthy Lifestyle".

INTRODUCTION

Health and health protection represent a value that requires a life-long active approach. Social health and its improvement are based on an active participation of every individual. Individual health, as a form of the highest health potential and harmonious personality development, can be positively affected by a healthy lifestyle. Regular participation in physical activity is one of the basic conditions for a healthy lifestyle and active health in adulthood (Bendíková, 2014). Experts from various fields of sport and medicine science emphasize a decrease in physical activity of young people, followed by its negative effects on individual and the health of the entire population (Kurková et al., 2010). Current problems in physical inactivity of children and the youth and a related prevalence of disorders motivates researchers to review the results of unhealthy lifestyle in this age category. Physical and Sport Education is one of the intervening forms of stimulation and motivation for lifelong active participation in physical activity.

Regular, continuous theoretical instructions in the teaching module "Healthy Lifestyle", presented during Physical and Sport Education lessons at school, are suitable to increase the volume of information and knowledge about individual components of a healthy lifestyle (Antala, 2012; Holzweg et al., 2013; Soares et al., 2013; Rozim& Marko, 2015; Uvinha& Velardi 2014; Da Costa et al., 2015; Szókö, 2016; Hidvegi et al., 2017).

Regular, spontaneous physical activity, as a part of a daily routine, enables one to have genetically determined potential health (Ihász&Rikk, 2010). A daily regime has its own well-defined components. A child should be physically active in his/her spare time, if possible, in the most diverse ways. An exercise regime is a systematic arrangement of all the physical activities performed for a period of time and the sum of all the physical activities that occur in human life from the workload to the nature of the interest. Subjective and objective factors such as sex, age, education, health, previous physical activity, the level of motor skills, physical fitness, attitudes and social status affect the content, intensity, frequency and type of an exercise regime. Physical activity should be realized in terms of satisfaction, based on human needs.

Dobay (2015) highlights not only the importance of recreation or education, but also the need of compensation, contemplation, communication, integration and participation.

The World Health Organization (WHO) recommends participation in physical activities for at least 60 minutes a day (Move for health, 2013). High school pupils have free time in the range of 2-4 hours a day, which represents sufficient space for active participation in hobby activities. The differences are presented in the amount of pupils participating in a leisure physical activity, which is confirmed by 54.2% of respondents with regular hobby activities, while only 43.2% of them preferred physical and sports activities (Havizu&Rasimi, 2015). The frequency of physical activity in children and the youth age period is mostly presented as twice a week (Barnett et al., 2009; Silva et al., 2014).

An analysis of the daily sedentary activities made by Żukowska&Szark (2010) showed a slight increase in the number of hours spent inactive. 39.6% of high school students spend 3-4 hours on sedentary activities and an alarming 29.8% spend 5-6 hours per day on sedentary activities. As a reason for inactivity, the authors considered the prevalent focus on computer activities. Physical activity is absolutely natural and has a significant antidepressant effect. A child is feeling more self-confident and socially attractive. Production of endorphins affects good mood, subsequent relaxation, increases stress resistance, rest and serenity. Physical activity in adolescence supports the physiological development of the organism, improves motor performance and creates a positive attitude towards lifelong physical activity (Boreham&Riddoch, 2001; Broďáni, 2012; Aghyppo, Tkachow&Orlenko, 2016; Kurková&Nemček, 2016; Szark-Eckardt&Pasek, 2017).

Due to pubertal changes in body composition and internal environment of the organism, it is necessary to emphasise the individual development of a child to act intentionally by creating the need for physical exercise as a compensation to that on a daily basis. It is important to understand the specificities of each age period to select the right form of physical activity and sport. According to Łubkowska&Troszczyński (2011), the acquisition of motor skills and the level of motor abilities corresponding to the age are an important prerequisite for locomotor development. Each individual should have a specific regime that consists of physical activities designed to fulfil the task. The authors further state that proper development of motor skills affects the child's medical condition but also the intellect, mental state and general development of the child.

Inactivity, on the other side, negatively affects the cardiovascular system, demineralized bones, increases their fragility, and decreases the strength of the muscles, resulting in loss of muscle mass and muscle fatigue (Mitova, 2015; Petersen et al., 2006;

Hemmingsson&Ekelund, 2007; Cohen et al., 2010; Łubkowska et al., 2015). A weekly exercise regime complements, in the case of children and the youth, Physical and Sport Education at school, which represents the ideal environment to create a lasting relationship with regular lifelong physical activity. Physical and sport education has, according to Müller et al. (2008), an irreplaceable role in the education and training systems. Despite of this, a large amount of secondary and high school pupils are not participating actively in the lessons of physical and sport education (Labudová&Nemček, 2009).

Physical and Sport Education has undergone the process of innovation and transformation to improve the teaching and education of pupils at all school levels. The acquisition of theoretical knowledge as a basis for an individual exercise regime represents the educational area of "Health and movement", which actively and systematically allows schools to support primary health care. Physical Education and Sports is divided into four modules - Health and its Disorders, Physical Fitness and Physical Performance, Sporting Exercises in the Regime and Healthy Lifestyle whose application we used to gain the results of our study. The content of the "Healthy Lifestyle" teaching module constitutes an evidence-based exercise regimen, hygiene habits and basic concepts in nutrition, food composition and eating habits, as well as the knowledge about eating disorders. Furthermore, it constitutes the knowledge and skills about a health-oriented physical activity, importance of regeneration, relaxation, psychohygiene, Kalokagathia and Olympism (Bendíková, 2016).

The aim of the study was to extend the knowledge about the impact of applied selected components of the "Healthy Lifestyle" teaching module, during Physical and Sport Education lessons, to the changes in the exercise regime of high school pupils. We assumed that an application of the experimental agent in the form of a health-oriented theoretical program will positively affect the exercise regime of high school pupils and that there will be an increase in the volume of hours spent doing sport in the experimental selection.

MATERIAL AND METHODS

The pedagogical experiment was realized at a high school in the city of Nováky and lasted from 28th April 2017 to 27th June 2017. The experimental selection (ES) consisted of pupils attending comprehensive studies (eight-year-long grammar school) (n= 23 pupils), and the control selection (CS) was comprised of pupils attending comprehensive studies (four-year-long grammar school) (n= 26 pupils).

The participants were pupils (age=15.5 ± 0.5 years old), and the multiplicity of each sex was the following ES=17 boys, 6 girls; CS = 16 boys, 33 girls.

Table 1: Characteristics of the group (N = 72)

Factors	Experimental selection (n=23)		Control selection (n=49)	
	Body height	Body weight	Body height	Body weight
	173.8 ± 10.5 cm	62.2 ± 15.5 kg	170.9 ± 20.5 cm	62.5 ± 12.7 kg
Age	15.5 ± 0.5 years old		15.5 ± 0.5 years old	
BMI	20.5 ± 6.1		21.1 ± 5.7	

The experimental agent was a specific program based on selected components of the teaching module "Healthy Lifestyle", with a focus on theoretical and practical knowledge about healthy lifestyle, its characteristics, risks and exercise regime realization. The experimental program was implemented during the Physical and Sport Education (P.S.E.) lessons. Theoretical training during the experiment lasted 80 minutes in total, representing 11% of the total time spent for P.S.E. lessons in the second half of the school year.

During the experimental period, the control selection realized ongoing thematic units. To obtain the research data and results we applied several methods during the research. Before starting the experiment, we conducted an admission assessment (25th April 2017) of various indicators identifying the level of knowledge in the teaching module "Healthy Lifestyle" (ISCED 3), selected components and some other adequate support knowledge about the positive affect of physical activity. The same assessment was realised after the end of the experiment (27th June 2017). To obtain the necessary data, we used a non-standardised anonymous questionnaire consisting of the accompanying text, information about the intention, personal data (body height, body weight, sex, age, and health problems), questions about healthy lifestyle and the volume of physical activity in the pupils' regime.

The questionnaire was distributed and filled out in the whole research group (ES, CS) before and after the experiment. The obtained data were processed within the individual areas using mathematical statistics methods. The incidence of results was expressed using percentages and graphically, in the form of images in which we compared both input and output data, and, in some indicators, specifically for boys and girls. To obtain the basic information about the lifestyle of the experimental selection pupils, we used a "weekly exercise regime record". At first, the pupils recorded their physical activity during the

week before the application of the experimental agent in the period from 24th April 2017 to 28th April 2017, and then after the end of the experiment from 26th June 2017 to 30th June 2017. We managed to gather complete records from 20 pupils (8 female students and 12 male pupils) from ES. The exercise regime records have been processed in terms of the volume of physical activity for each day of the workweek (hours per day). The obtained data were assessed by a Chi-Square test of good correlation at 1% and 5% levels of statistical significance.

RESULTS AND DISCUSSION

We assumed that the experimental agent will contribute to the changes in the volume of weekly and daily physical activity of the experimental selection (ES). Already at the initial evaluation, we found that 17.7% (n = 23) of ES pupils took part in sporting activities "3 times a week" and 41.1% (n = 23) of them did it "4 or more times a week". After the experiment, the number of "4 or more times a week" physically active pupils didn't change, but the number of students who began to do sports "3 times a week" increased from 17.7% to 35.3%, which confirms the benefits of our experimental agent. In the control selection, the following changes (Table 2) occurred during the experimental period. The highest number of high school pupils took part in sporting activities "1-2 times a week". Activity increased in the group doing sport "3 times a week" from 20.8% to 29.2% of pupils and in a group doing sport "4 or more times a week" from 27.2% to 29.2%. An increase in physical activity could be affected by many factors, including the warmer summer weather which allows participation in popular outdoor activities.

Table 2: Changes in the volume of physical activity per week in experimental and control selections (n = 72)

Groups/factors	Experimental selection (n=23)		Control selection (n=49)	
	Input	Output	Input	Output
Volume of PA				
1-2 times a week	35.3%	33.3%	43.7%	33.3%
3 times a week	17.7%	35.3%	20.8%	29.2%
4 or more times a week	41.4%	41.4%	27.2%	29.2%
Inactive	5.9%	5.9%	8.3%	8.3%
SUM (Σ)	100%	100%	100%	100%

The initial evaluation demonstrated movement in the range of "3 times a week" only in 17.7% of ES students, compared with the CS (27.8% of students), at the end of the experiment, it was up, with 35.3% of ES, compared to 29.2% of CS. Sporting "4 or more times a week" was noted in 41.1% of ES students, but only in 29.2% of CS students.

The data above confirmed our hypothesis that positive changes in the volume of physical activity will occur in ES, compared to CS. We noticed similar findings in the analysis of changes in physical activity per day. We observed the highest increase in the volume of "two hours a day" (23.6% of ES pupils), compared to the input number (11.8%; $n = 23$). We can conclude that the experimental agent induced an increase of the daily physical activity of ES pupils. The amount of CS students (45.8%, $n = 46$) doing sport "one hour daily" was also increased, compared to the input data (37.5%). There was also an increase in the number of pupils in CS doing sport "two hours a day" (Table 3).

The comparison of the results after the experiment demonstrated that there were 94.1% of ES pupils, but only 70.8% of CS students doing sport "one or more hours per day", which confirms our hypothesis that a health-oriented theoretical program can positively affect the exercise regime of high school pupils. The fact that, after the experiment, there weren't ES pupils doing sport "1 hour a day", while in CS it was still 10.4% ($n = 49$) of pupils is also positive. Evaluation of output results in each research group, based on gender perspective, confirmed the increase in doing sport "three times a week" in the ES girls by 16.7% and in the CS girls by 12.5%. Similarly, there was a larger increase in ES boys by 18.2%, compared to the unchanged 43.8% in CS. We also observed an increase in ES girls doing sport "1 hour per day" by 33.3%, compared to CS where there was the increase in the number of pupils practicing sport "1 hour a day", presented by 12.5%. We have also recorded an increase in ES girls doing sport "2 hours per day" by 18.2%, compared to CS girls, where there was an increase presented by 6.3%.

Table 3: Changes in the volume of physical activity - hours per day, in experimental and control selections ($n = 72$)

Groups/factors	Experimental selection ($n=23$)		Control selection ($n=49$)	
	Input	Output	Input	Output
Volume of PA				
Less than 1 hour	11.8%	0%	20.8%	10.4%
1 hour	70.5%	70.5%	37.5%	45.8%
2 hours	11.8%	23.5%	22.9%	25.0%
More than 2 hours	0%	0%	10.4%	10.4%
Inactive	5.9%	5.9%	8.4%	8.4%
SUM (Σ)	100%	100%	100%	100%

An interesting finding brought us the analysis of the relationship between knowledge and the volume of physical activity in a research file (ES, CS). Girls said that physical activity is health-enhancing in the case that we take part in it "three times a week" (input 31.6%, output 23.7%). Boys have consistently said that the

health effects of physical activity manifest after a "3 times a week" physical activity (input 51.9%, output 33.3%). We observed a significant increase in the option "daily physical activity", in a group of girls from 21.1% to 44.7%, and in the group of boys from 14.8% to 33.3%.

Despite the fact that 33.3% of boys and 44.7% of girls had the output rating knowledge that daily physical activity is beneficial to health, 54.2% of boys and only 22.2% of girls are physically active "4 or more times a week". In the group of girls, we observed a statistically significant difference between knowledge about the required amount of physical activity and the real volume of physical activity, both in input and output ratings, at the 1% level of statistical significance (girls input: $\chi^2 = 20.96, p \leq 0.01$; girls output: $\chi^2 = 16.96, p \leq 0.01$). In the group of boys, a statistically significant difference wasn't observed ($\chi^2 = 0.693$). In order to make physical activity health-enhancing, we should, according to the opinion of the girls (ES,CS), actively participate in it for "45 minutes" and "60 minutes" (both 36.8%), and, according to the opinion of the boys (ES,CS), participate for "60 minutes" (66.7%). Output results presented the correct answer of daily physical activity by 47.4% of girls and 70.4% of boys. It is positive that knowledge about the need of active participation in physical activity for "60 minutes a day" cumulatively applies in practice, 65.7% of girls and 44% of boys belonging to the research group (ES, CS). The frequency of proper understanding of the participation in physical activity for "60 minutes a day" cumulatively increased in ES girls from 0% to 50%, and in ES boys from 81.8% to 90.9%. We found that there is a statistically significant difference between the knowledge about a daily exercise regimen and the real time of active participation in the group boys (ES, CS), in input ($\chi^2 = 7.879; p \leq 0.05$) and output ratings ($\chi^2 = 12.71; p \leq 0.01$). A statistically significant difference between the knowledge about a daily exercise regime and the real time of active participation in the group boys (ES, CS) was detected only in output ratings ($\chi^2 = 9.489; p \leq 0.05$). The research indicated that there is a positive parallel between the knowledge and active participation in physical activity, which confirms our hypothesis.

The experimental selection students recorded, in two periods of time (before and after the application of the experimental agent), the duration of physical activity in each day of the workweek. The analysis of the results in terms of the volume of physical activity showed a larger amount of physical activity in a group of boys, compared to girls (Figure 1). Physical activity in the group of boys also appears more regularly in terms of hours per day. Overall, the girls were physically active each day from 8 to 21.5 hours (mostly on Thursday), and boys from 24.4 to 42.6 hours (mostly on Monday).

Initial evaluation of ES had a range from 32.4 hours to 60 hours per day, which represented the average range from 1.7 hours/day to 3 hours/day for one student. However, the individual assessment highlighted the difference that boys were physically active from 1.9 hours per day to 3.5 hours, and girls from 1 hour per day to 2.7 hours per day. From this perspective, we can state that all the members of the ES presented, in the initial evaluation, the standard volume of physical activity required by WHO (Move for health, 2013).

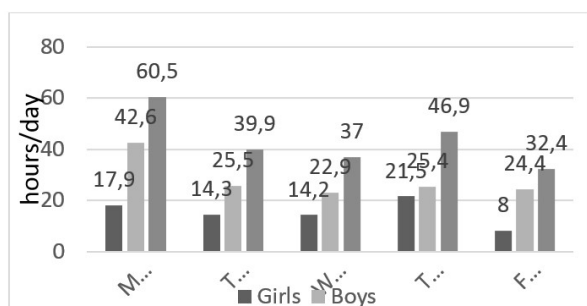


Figure 1: Physical activity volume in Experimental selection (input) (n = 23)

Table 4: Changes in the volume of physical activity in Experimental selection (n = 23)

Gender	Girls (n=6)		Boys (n=17)	
	Input [hours]	Output [hours]	Input [hours]	Output [hours]
Monday	17.9	22	42.6	40.3
Tuesday	14.3	15.3	25.5	27.2
Wednesday	14.2	12.8	22.9	22.1
Thursday	21.5	13.3	25.4	24.9
Friday	8	8.2	24.4	25.4
SUM	75.9	71.6	140.8	139.9
Hours/day	15.2	14.3	28.2	27.9

To assess the effectiveness of the realized experiment in relation to the changes in the exercise regime, we compared input and output data. An analysis in terms of the volume of physical activity in each day of the week also showed a greater amount of physical activity in the group of boys, compared to girls (Figure 2). A comparison of hours spent doing sports in the group of girls demonstrated an increase on Monday, from 17.9 hours to 22 hours, on Tuesday from 14.3 hours to 15.3 hours and on Friday from 8 am to 8.2 pm, but, at the same, a total increase in the number of

hours per day did not occur. While the initial analysis registered an average duration of physical activity to be 15.2 hours per week, the output analysis showed only an average of 14.3 hours per day. The hypothesis that there would be an increase in the volume of hours spent doing sport in the experimental selection can't be confirmed in the case of girls belonging to ES for this research because there was a reduction in the volume of physical activity. We've also recorded a downgrade of total hours of physical activity per week from 28.2 hours to 28 hours in the group of boys (Table 4). In terms of changes in the volume of physical activity per week, in the whole ES, we've recorded an average time of 42.3 hours, which presents a reduction of input data (43.3 hours), and negates our hypothesis.

Just like our study, Novotná&Slovaková (2016) also presented that pupils know the effect of intentional physical activity to health, and that the main motive for exercising is the need to be in the company of friends, which, in our opinion, as well as the opinion of other authors (Biddle &Asare, 2011), reflects a lack of "real" social contact and its incidence to the mental health of the child. Most children fail to engage in physical activity for the recommended 60 minutes or more each day, with as many as one-third reporting no physical activity in the preceding 5 days (CDC, 2012).

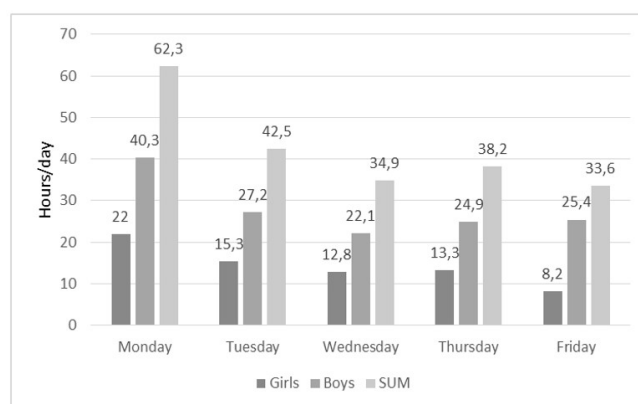


Figure 2: Physical activity volume in Experimental selection (output rating) (n = 23)

The results of HBSC Slovakia presented an implementation of daily physical activity only in 31% of male respondents (age 11 and 13), and only in 13% of female respondents (age 15). Moreover, according to the survey, 13-year-old girls had the highest numbers of passive leisure time (Bendíková&Uvinha, 2015). The most common reason why children discontinue exercising is that the activity is wearisome, especially presented by teachers who don't motivate them to do sports. Physical and Sport Education at school is, nowadays, oriented not only to optimize and ensure optimal physical development, but also based on knowledge about the importance of healthy lifestyle and individual lifelong

active participation in physical activities, and the teacher of P.E. should not only be the object of the educational process, but also a motivator and an example to pupils. Our results presented that the experimental agent in the form of a theoretical teaching programme contributes to changes in the volume of weekly and daily physical activity of pupils and, therefore, it confirms the importance of P.E. in primary prevention.

CONCLUSION

The aim of the research was to extend the knowledge about the impact of selected components in the content standard of the teaching module "Healthy Lifestyle" during the teaching process of Physical Education on the exercise regime of high school pupils. We observed changes in the indicator of pupils' daily participation in physical activity. The output rating showed, in the

"3 times per week" physically active pupils, an increase of 17.6%, in ES (input 17.7% output 35.3%), compared to the almost stable 29.8% of pupils from the control selection. The action of theoretical training as a form of experimental agent increased the number of high school pupils who take part in physical activity. Similarly, we've noticed an increase in the volume of daily physical activity. An analysis of the exercise regime output records in terms of the volume of physical activity per day showed a larger volume expressed as an increased frequency of physical activity each day in the experimental selection. At the same time, we have come to a finding that there wasn't an overall increase in the number of hours per day within ES. Based on our findings, we recommend enriching the content of Physical Education at school and emphasizing the need for applying new physical activities in the healthy mode of life "outside" of the school and educational process.

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PROMJENE U REŽIMU VJEŽBANJA POD UTICAJEM PODOČAVANJA MODULA "ZDRAVI STIL ŽIVOTA"

Istraživanje je donijelo rezultate iz područja primijenjenih odabranih komponenti u standardu sadržaja nastavnog modula "Zdravi stil života" tokom nastave iz predmeta fizičkog i sportskog obrazovanja za promjene u režimu vježbanja učenika srednjih škola ($n = 71$, $\text{dob} = 15,5 \pm 0,5$ godina). Primjena eksperimentalnog sredstva u obliku posebnog obrazovnog programa, sastavljenog od odabranih komponenti, prikazala je da se kratko razdoblje teorijskog poticaja pokazalo zadovoljavajućim, povećavajući broj učenika srednjih škola sa dominantnom učestalošću fizičke aktivnosti i promjenama u količini kretanja u vlastitom režimu vježbanja. Statistički značajna razlika između poznavanja važnosti fizičke aktivnosti i njene realizacije u dnevnom režimu je otkrivena i kod dječaka i kod djevojčica (djevojčice ulazni/izlazni podaci; $\text{Chi} = 20,96/16,96$ $p \leq 0,01$; dječaci ulazni/izlazni podaci $\text{Chi} = 7,88$ $p \leq 0,05/12,71$ $p \leq 0,01$).

Ključne riječi: Studenti, režim fizičke aktivnosti, nastavni modul "Zdravi stil života".

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THE STRUCTURE OF KARATE REPRESENTATIVES AND COMPETITORS' PSYCHOLOGICAL CHARACTERISTICS

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ABSTRACT

The survey was conducted on a deliberate sample of 32 respondents divided into two groups, 16 karate representatives and 16 karate competitors, males, seniors (according to WKF) from the Republic of Macedonia. The main goal of the research was to determine the structure of the psychological characteristics pertaining to the two groups of respondents (karate representatives and karate competitors), separately for each category. A total of 13 variables of psychological characteristics were used in the research: one variable for assessing general intellectual abilities, three variables for assessing specific intellectual abilities, six variables for assessing emotional characteristics, and three variables for assessing motivational dispositions. Factor analysis was used to determine the structure of psychological characteristics. The results of the factor analysis that were obtained in the study show the extraction of 5 significant latent dimensions in the category of competitors and 5 significant latent dimensions in the category of representatives.

Keywords: Psychological characteristics, karate competitors and representatives, factor analysis.

INTRODUCTION

The value of this type of research in the field of karate sports consists in finding and determining the most economical and the most effective factors that are important for achieving top results, by revealing the personality structure and finding appropriate measuring instruments.

In order to achieve the desired goal, there is a need of as many information as possible, which will be properly incorporated and used in the process of building the personality of the karate athlete. Therefore, determining the psychological characteristics is of great importance

in karate sports. Many authors speak about the specific psychological structure of the athlete's personality, implying the presence of relevant psychological traits in the structure of the athlete's personality, which leads to high sports results and significantly determines the success in sports.

Today, sport and personality represent an inseparable whole and receive a growing primacy in the overall preparation of the athletes. Therefore, there is a need for a scientific approach to psychology in sports, primarily for the purpose of improving the success and achieving cutting-edge sports results.

WORK METHODS

The survey was conducted on a deliberate sample of 32 respondents divided into two sub-samples consisting of 16 karate competitors and 16 karate representatives, males, seniors (according to WKF) from the Republic of Macedonia. In order to determine their psychological characteristics, the respondents were subjected to tests that were carried out at the clubs in which the competitors perform their training on a daily basis.

In the research, a total of 13 variables of psychological characteristics were applied (according to the dissertation of Aleksovska, V., L. 2002), divided into 4 areas, out of which:

- one variable was used for assessing general intellectual abilities - IQ test
- three variables were used for assessing specific intellectual abilities - F1, F2, S1
- six variables were used for the assessment of emotional characteristics - anxiety (TAI), aggressiveness (T-15), extroversion / introversion, neuroticism, psychoticism, social desire (EPQ)
- three variables were used for assessing the motivational dispositions - P2, F+, F- - Sports achievement motive (MSP).

The data obtained from this survey, according to the characteristics and the sizes of the selected sample, were processed with adequate statistical programs. For the purposes of this research, the following were calculated: Mean - arithmetic mean,

SD - standard deviation, Min., Max. - minimum and maximum result, Skew - results distribution symmetry, Kurt - uniformity of results in a certain variable, K-S - Kolmogorov - Smirnov method that determines the normal distribution of the results and factor analysis.

RESULTS AND DISCUSSION

The basic descriptive statistical parameters (competitor) are shown in table no. 1 from which it can be concluded that the standard deviation (Std. Dev.) in the applied variables is normal, i.e. it is less than 1/3 of the arithmetic means. The minimum and maximum values are logical and expected and do not indicate the existence of extreme values which indicate that the grouping of the results mainly moves around their own arithmetic environments. A statistically significant deviation of the asymmetry present in the values of Skew results is apparent only in two variables: progressive matrices (PM = 1.20) and conservation speed of perceptual structure (F2 = 1.39), while in the test (S1 = 1.01), which measures the ability to predict spatial relations, a value slightly above the boundary was obtained. In the remaining variables, the displayed results are within the limits of the recommended values. By analyzing the values of the degree of curvature pertaining to the Gaussian curve, we conclude that the majority of applied variables are distributed along the width of the horizontal axis. The normal distribution of the results obtained by the Kolmogorov-Smirnov method shows that there is no deviation in any of the psychological variables.

Table 1: Descriptive statistical parameters of the psychological characteristics of the respondents - competitors and representatives

COMPETITORS									REPRESENTATIVES								
	M	Std. Dev.	Min.	Max.	Skew.	Kurt.	K-S	Sig		M	Std. Dev.	Min.	Max.	Skew.	Kurt.	K-S	Sig
PM	51.56	1.75	50.00	56.00	1.20	1.26	0.76	0.62	PM	55.13	2.45	51.00	59.00	-0.04	-1.07	0.52	0.95
F1	28.81	2.23	25.00	33.00	0.06	-0.48	0.63	0.82	F1	31.94	1.65	30.00	34.00	0.21	-1.69	0.86	0.45
F2	17.00	1.93	15.00	22.00	1.39	1.84	1.00	0.27	F2	20.56	1.93	17.00	24.00	0.27	-0.59	0.96	0.32
S1	20.94	2.11	18.00	26.00	1.01	0.80	0.95	0.32	S1	26.63	1.82	24.00	29.00	0.11	-1.44	0.79	0.57
TAI	35.75	3.40	30.00	41.00	-0.39	-0.81	0.57	0.90	TAI	30.31	2.44	27.00	35.00	0.53	0.08	0.56	0.92
P	2.75	0.86	1.00	4.00	-0.18	-0.32	0.96	0.32	P	2.31	0.87	1.00	4.00	-0.02	-0.55	0.89	0.41
N	11.31	2.24	7.00	16.00	0.08	0.38	0.62	0.84	N	9.25	2.54	4.00	14.00	-0.46	0.42	0.84	0.48
E	11.00	2.13	7.00	15.00	0.05	-0.18	0.53	0.94	E	13.06	1.91	10.00	16.00	-0.23	-1.13	0.63	0.83
L	11.56	2.50	7.00	15.00	-0.30	-1.03	0.62	0.84	L	11.13	2.25	6.00	14.00	-0.74	0.15	0.86	0.46
P2	20.56	2.31	17.00	25.00	0.35	-0.74	0.75	0.62	P2	23.13	1.36	21.00	25.00	-0.07	-1.19	0.71	0.69
F+	3.94	1.29	2.00	6.00	0.34	-0.58	0.92	0.36	F+	3.00	1.10	1.00	5.00	0.00	-0.80	0.78	0.58
F-	7.13	1.20	5.00	9.00	0.25	-0.63	0.92	0.37	F-	8.63	1.15	7.00	11.00	0.56	-0.40	1.08	0.20
T-15	32.81	4.52	26.00	40.00	0.11	-1.25	0.54	0.93	T-15	27.63	4.27	21.00	38.00	0.94	1.15	0.73	0.66

In this table, the basic descriptive statistical parameters of the psychological variables among the representatives are also presented. It can be noted that, in all the applied variables, homogeneity of the results, as well as normal distribution (KS) was obtained without deviating from any of the psychological variables.

The values of the standard deviation (Std. Dev.), in the psychoticism variables ($P = 0.87$) and the variable ($F + = 1.10$), which examines the level of positive emotional engagement and emotional self-control in situations of sports achievement, show very little deviation, while the remaining results of the standard deviation values are one third in relation to the arithmetic means, which indicates that the grouping of the results moves mainly around its own arithmetic means. The displayed values of the minimum and maximum results range within the expected span in relation to the treated variables. A statistically significant deviation of the asymmetry present in the values of the Skew results is not observed in any of the variables whose values are generally around zero, which tells us that this is a normal data distribution.

The degree of curvature pertaining to the Gaussian curves (Kurt.) is platykurtic, indicating that the distribution of the results is torn along the x axis. On the basis of the intercorrelation matrix of the applied manifest variables for the competitors' specific motor abilities, the characteristic roots (lambda) are obtained, which explain the common variance of each isolated main component in the area of the first row (Table no. 2).

Table 2: Extraction Method: Principal Component Analysis – competitors

Component	Principal component			Varimax		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.89	22.26	22.26	2.64	20.29	20.29
2	2.45	18.87	41.13	2.26	17.37	37.66
3	1.96	15.07	56.20	2.09	16.05	53.72
4	1.62	12.43	68.64	1.67	12.82	66.53
5	1.30	10.01	78.65	1.58	12.12	78.65*

For the explanation of the variability and covariability of the manifested variables applied to the sample of respondents – competitors, the Guttman-Kaiser criterion was used to extract 5 significant latent dimensions. The first one with its own value (total = 2.64) explains 20.29% of the total variance of the variables, the second one with the value (total = 2.26) explains 17.37% of the total variance, the third one with its own value of (total = 2.09), explains 16.05% of the total variability, the fourth one with a value (total = 1.67) explains 12.82% of the total variance and the fifth one with its own value of (total = 1.58), explains 12.12% of the total variability. The total explanation of the variance of the entire system by the extracted latent dimensions is 78.65%.

Table 3: Principal component and Varimax – competitors

	PC1	PC2	PC3	PC4	PC5	Com	V1	V2	V3	V4	V5
PM	0.76	0.21	-0.48	-0.07	-0.04	0.87	0.81	-0.17	-0.24	0.01	0.35
F1	0.67	-0.22	0.24	-0.38	0.17	0.72	0.55	-0.28	0.36	-0.46	-0.08
F2	0.68	0.42	0.05	-0.11	0.24	0.72	0.81	0.21	0.05	-0.11	-0.06
S1	0.63	-0.24	-0.42	0.36	0.36	0.88	0.62	-0.44	0.21	0.49	0.17
TAI	0.21	-0.23	0.80	0.20	0.13	0.79	-0.02	0.20	0.84	-0.17	-0.12
P	0.38	-0.61	0.49	0.38	-0.06	0.91	-0.02	-0.20	0.89	-0.01	0.27
N	0.06	0.74	0.16	-0.19	0.46	0.82	0.44	0.54	-0.20	-0.02	-0.54
E	0.35	0.40	0.22	0.61	0.13	0.72	0.39	0.52	0.34	0.39	0.15
L	0.02	0.54	0.51	0.14	-0.12	0.59	0.06	0.74	0.16	-0.14	-0.01
P2	0.46	-0.03	-0.17	0.39	-0.69	0.87	0.16	0.05	0.08	0.03	0.91
F+	0.40	-0.65	-0.16	-0.32	0.19	0.76	0.24	-0.78	0.22	-0.21	-0.04
F-	0.47	0.51	-0.04	-0.22	-0.47	0.76	0.45	0.35	-0.28	-0.41	0.43
T-15	-0.29	0.12	-0.48	0.64	0.31	0.83	-0.08	0.04	-0.19	0.89	-0.02

From the projection heights of the manifest variables for the first main component of the un-rotated factor matrix (Table no. 3), we can ascertain the division of the same from medium to the relatively high and high correlations. The system of factors defines the variability and covariability of the manifested variables relatively well, as can be seen from the high value of communalities.

The first latent factor (F1) defines medium to relatively high projections of the variable progressive matrix (PM) that denotes general intelligence and variables belonging to the area of sports intelligence (F1 - specific intellectual ability for perceptual reasoning, F2 - speed capability perception of perceptual structures, fine differentiation of perceptual locking of perceptual material and S1 - ability to perform spatial relations). Based on this structure, it can be referred to as a factor of general and sports intelligence. Many similar results were obtained by Aleksovska, L., (2002) in her research on karate athletes, in which the first factor is saturated with the same variables.

The second latent dimension (F2) consists of medium and moderately high projections of variables from the group of emotional characteristics: neuroticism, extroversion / introversion and social desire (E, N, L) and variable F+ which examines the degree of positive emotional engagement and emotional self-control in situations of sports achievement, but with the reverse sign. This engagement optimizes the organism for achieving motivational goals. The acquired factor can be named as a factor of emotional characteristics and positive emotional engagement. In comparison with the research of Kostovski, Z., et al. (2013), according to the influence of the predictor system of variables, only the variable "positive emotional reaction in sports performance conditions" had statistically significant influence on the criterion variable for competitive pointing with three points. The respondents with a higher degree of positive emotional reaction in conditions of sports performance achieved a higher number of sanbon (three) points.

The third latent dimension (F3) was represented by two variables with high projections: anxiety (TAI - treated as disposition, as a relatively permanent trait of a person which appears as a tendency to react with anxiety in situations that are considered threatening) and psychoticism (P - the basic dimension of a person which is only pathologically expressed in an extreme form) and the same can be defined as a factor of anxiety reactions and psychoticism. There are significant differences between the levels of somatic anxiety, cognitive anxiety and self-esteem between elite and non-elite karate competitors based on the used research instrument - inventory anxiety, according to a study by Soltani, H., and Reddy, K S. (2013).

The fourth latent factor (F4), dominantly with a positive sign, saturates the variable T-15, that is aggression, which is defined as affection for reactions of anger and destructive forms of behaviour in relation to other individuals and groups and a negative sign of the variable F- (which belongs to the sports achievement motive) and

examines the degree of a negative emotional reaction in situations of sports achievement that manifested itself in the uncertainty of the outcome, and, above all, because of possible failure and can be defined as a factor of competitive anxiety with low negative emotional commitment in terms of sports achievement. Anxiety is a psychological phenomenon that affects the overall behaviour of a person, and even sport success. This influence can be positive or incentive and negative or inhibitory (Paranosici Lazarevic, 1976), taken from Mikic, B., (1996). It is very interesting and important to point out that in most cases emotional instability is caused by anxiety. The state of anxiety in sport is most often experienced as a conflict between wishes, needs and aspirations to achieve a goal on the one hand, and on the other hand, trembling, discomfort, excitement, fear that the goal cannot be achieved, as well as fear of the consequences that come with failure.

The structure of the fifth latent factor (F5) can be named as a factor of the sports achievement motive in terms of negative emotional engagement and it is defined by a high value of the variable (P2) that examines the sporting motive of achievement through the desire to highlight, and achieve success in basic life occupations. A number of analyses in psychological and sports literature suggest that the examination of the motive for achieving is the most favorable point in studying the motivational bases of sports activity, which, together with emotional stability, are the main requirements that the athlete is set for as a systematic and qualitative requirement in sports (Aleksovska, V.L. 2002). As in the previous factor structures, there is also a presence with a much lower projection of the variable (F-), i.e. the degree of negative emotional reaction in situations of sports achievement, which is manifested through fear of uncertainty of the outcome, and, above all, because of the possible failure, it also participates in the structure of another factor. These two variables belong to the same area.

The common variance of each isolated main component in the first row area explains the characteristic roots of the applied manifest variables of the psychological characteristics presented in Table no. 4. For the explication of the variability and covariability of the manifested variables applied to the sample of respondents - representatives, the Guttman-Kaiser criterion was used, which extracted 5 significant latent dimensions that explain 84.19% of the common variance of the entire system.

Table 4: Extraction Method: Principal Component Analysis - Representatives

Component	Principal component			Varimax		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.66	35.86	35.86	2.76	21.26	21.26
2	2.44	18.81	54.67	2.38	18.30	39.56
3	1.51	11.61	66.28	2.08	16.02	55.58
4	1.26	9.66	75.94	1.90	14.60	70.18
5	1.07	8.25	84.19	1.82	14.01	84.19*

The first one with its own value (total = 2.76) explains 21.26% of the total variance of the variables, the second one with the value (total = 2.38) explains 18.30% of the total variance, the third one with its own value of (total = 2.08), explains 16.02% of the total variability, the fourth one with a value (total = 1.90) explains 14.60% of the total variance and the fifth one with its own value of (total = 1.82), explains 14.01% of the total variability.

Table 5: Principal component and Varimax – Representatives

	PC1	PC2	PC3	PC4	PC5	Com	V1	V2	V3	V4	V5
PM	-0.74	0.43	0.10	0.25	0.00	0.80	0.75	-0.45	0.04	-0.02	0.17
F1	-0.64	0.47	0.19	0.15	0.41	0.86	0.91	-0.05	-0.01	-0.10	0.14
F2	-0.67	0.17	0.47	0.17	0.42	0.90	0.89	-0.07	-0.09	-0.19	-0.26
S1	-0.66	0.59	-0.14	0.11	-0.17	0.84	0.58	-0.50	0.15	-0.03	0.48
TAI	0.68	0.57	0.29	-0.12	-0.08	0.88	-0.12	0.44	0.77	0.27	0.07
P	0.52	0.16	0.01	0.73	-0.23	0.88	-0.15	-0.01	0.17	0.91	-0.09
N	0.83	0.22	-0.07	0.07	0.26	0.80	-0.28	0.69	0.22	0.43	0.11
E	-0.07	0.59	-0.68	-0.28	0.02	0.90	0.02	0.04	0.09	-0.10	0.94
L	0.67	0.25	0.03	-0.38	0.56	0.97	-0.12	0.93	0.24	-0.06	0.14
P2	0.06	0.56	0.40	-0.28	-0.24	0.62	0.17	-0.01	0.75	-0.13	0.05
F+	0.36	0.46	-0.56	0.39	0.17	0.83	0.00	0.26	-0.05	0.62	0.62
F-	-0.75	0.17	-0.26	-0.35	-0.23	0.83	0.25	-0.55	-0.06	-0.54	0.42
T-15	0.52	0.54	0.36	-0.08	-0.36	0.83	-0.14	0.13	0.86	0.24	0.00

The division of the projection heights of the manifested variables for the first major component from medium to relatively high and high can be ascertained in Table no. 5, where the factor matrix is represented. The system of factors defines the variability and covariability of the manifested variables relatively well, as can be seen from the high value of communalities. The orthogonal varimax solution led to the creation of structures that satisfy the conditions of simplicity of the same. The obtained factors can be interpreted in the following directions:

The first latent factor (F1) can be defined as a factor of general and specific intellectual abilities. In its structure, with medium to very high projections, the variable progressive matrices (PM) are included, which denotes the general intelligence and the variables belonging to the area of sports intelligence (F1 - specific intellectual perceptual reasoning ability, F2 - ability for the speed of observing perceptual structures, fine differentiation of the lock of perceptual material and S1 - ability to perform spatial relations). Spirman's theory of two factors in the structure of intelligence is interesting, according to which, success in any activity depends on one basic or general factor and one or more specific factors. Active athletes have demonstrated a much higher degree of "crystallized intelligence", the power of ego, sharp character, convenience, self-confidence, serenity and association with a group. Top athletes were

cognitively more open and mature, emotionally more stable and self-confident (Havelka, N., Lazarević, Lj. 1981).

In the second latent dimension (F2), the social desire variable (L - measured to what extent the subjects deliberately attempted to control their results) participates with a very high projection, the variable neuroticism participates with a relatively high projection (N - characterized by high levels of negative effects such as depression and anxiety), as well as variable F- (the degree of negative emotional reaction in situations of sports achievement that is manifested in fear of uncertainty about the outcome, and above all because of possible failure) belonging to the sports achievement motive, which participates with medium inverse value. These three variables give the greatest information about the isolated dimension and, therefore, this factor can be defined as a factor of social desire and emotional stability with low negative emotional engagement in conditions of sports achievement. Emotional presence in competitive situations requires proper targeting and proper control of emotional reactions. It is known that emotional inequality can permanently deprive talented and well-prepared athletes from significant success (Havelka & Lazarevic, 1981).

Emotional stability - instability is a very important factor for sport success. Athletes will be successful in stressful competitive situations only if they can put the degree of expression of their emotional excitement under a conscious self-control and maintain it at an optimal level (Aleksavska, L., 2002).

The structure of the third latent factor (F3) is represented by three variables that participate in its definition and its projections. They are manifested by relatively high values: anxiety (TAI - treated as a disposition, as a relatively permanent trait of a person which appears as an inclination to react with anxiety in situations that are considered threatening), then the variable P2 (the sports achievement motive through the desire for highlights, success in the basic life occupations) and the variable T-15, i.e. aggressiveness (which is defined as affection for the reactions of anger and destructive forms of behaviour in relation to other individuals and groups). The same can be defined as a factor of the sports achievement motive with competitive aggressiveness and anxiety reactions. According to Aleksavska, V., L., (2002), the existence of higher anxiety and greater aggressiveness causes long-lasting and strong anxiety as an unpleasant situation which leads to discontent and frustration, and very often to aggressive reactions. Comparatively, we can perceive the theoretical arguments by Terry, CP, Slade, A. (1995) who examined the competition's anxiety inventory of the competition state and the profile mood about 40 minutes before the competition, according to which pre performing mood and anxiety results showed significant results between winning and losing of the competitors. The winners achieved higher results in energy, anger and self-esteem and reduced tension, depression, fatigue, confusion, cognitive and somatic anxiety.

The fourth latent factor (F4) shows medium to high projections of the three dimensions that enter into its definition, and belong to two different sub-areas. The variable psychoticism (P - the basic dimension of a person which expresses itself as pathological only in extreme form) belongs to the area of the personality's emotional characteristics, while the variables F + (which examines the degree of positive emotional engagement and emotional self-control in situations of sports achievement) and F- (the degree of negative emotional reaction in situations of sports achievement that manifests itself through fear of uncertainty of the outcome, and above all because of possible failure), which is with a negative sign, belong to area of the sports achievement motive. According to the previously analysed, this factor can be called the factor of positive and negative emotional engagement in conditions of sports achievement followed by impulsiveness and indecision.

The fifth latent dimension (F5) is represented by a very high value of the variable E (extraversion / introversion) belonging to the group of variables of emotional characteristics. According to Eysenck, extraversion has a biological basis. Athletes with a high degree of extraversion are not able to clutter their emotions and because of the high degree of excitement they are much more resilient. Since the research seeks to distinguish the variable which is the best representative of the isolated factor (Perić, D. 2001), the extracted dimension can be defined as a factor of extraversion with carelessness, with positive emotional engagement in conditions of sports achievement.

According the opinion of Aleksavska, V.L., and Kostovski, Z. (2008) on a previously made study, psychological factors, in addition to physical ones, have a major impact on achieving appropriate sport success. In general, they can relate to: the ability of the mental system to accept, evaluate and respond to information about strategic situations (tactics), the skill of motivation, self-esteem and focus, the ability to withstand high pressure, which are an inevitable part of top sports.

CONCLUSION

The research was conducted on a deliberate sample of 32 respondents, 16 karate representatives and 16 karate competitors, males, juniors and seniors (according to WKF) from the Republic of Macedonia. For the realization of this research, a total of 13 variables were used to assess the psychological characteristics of the karate athletes. The research yields results that lead to the following conclusions:

1. Five significant latent dimensions of psychological traits are isolated in the respondents - competitors:
 - the factor of general and sports intelligence
 - the factor of emotional characteristics and positive emotional engagement
 - the factor of anxiety reactions and psychoticism
 - the factor of competitive anxiety with low negative emotional engagement in conditions of sports achievement
 - the factor of sports achievement motive in conditions of negative emotional engagement
2. Five significant latent dimensions of psychological traits are isolated in the respondents - competitors:
 - the factor of general and specific intellectual abilities
 - the factor of social desire and emotional stability with low negative emotional engagement in conditions of sports achievement
 - the factor of the sports achievement motive with competitive aggressiveness and anxiety reactions
 - the factor of positive and negative emotional engagement in conditions of sports achievement followed by impulsiveness and indecision

- the factor of extraversion with carelessness, with positive emotional engagement in conditions of sports achievement.

The analysis of the obtained factor structure from this research leads to the conclusion that it is logical and expected. Comparatively with this research and the obtained structure, the theoretical arguments received by several authors in their research are also perceived (Chaabène, H., 2014, Terry, CP, Slade, A. 1995, Aleksovska, V., L., 2002, Havelka, N., Lazarević, Lj 1981, etc.) according to which pre performing mood and

anxiety results showed significant results between winning and losing competitors.

The winners achieved higher energy, anger and self-esteem results and reduced tension, depression, fatigue, confusion, cognitive and somatic anxiety. Also, top athletes were cognitively more open and mature, more emotionally stable and confident. Athletes will be successful in stressful competitive situations only if they can put the degree of expression of their emotional excitement under conscious self-control and maintain it at the optimum level.

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STRUKTURA PSIHOLOŠKIH KARAKTERISTIKA KARATE REPREZENTATIVACA I TAKMIČARA

Anketa je provedena na namjernom uzorku od 32 ispitanika, podijeljena u dvije grupe od 16 karate reprezentativaca i 16 karate takmičara, muškog spola, seniora (prema Svjetskoj karate federaciji WKF) iz Republike Makedonije. Glavni cilj istraživanja je bio utvrditi strukturu psiholoških karakteristika ovih dviju grupa ispitanika (karate reprezentativaca i karate takmičara), pojedinačno za svaku kategoriju. Ukupno 13 varijabli psiholoških karakteristika je korišteno u istraživanju: jedna varijabla za procjenu općih intelektualnih sposobnosti, tri varijable za procjenu specifičnih intelektualnih sposobnosti, šest varijabli za procjenu emotivnih karakteristika, i tri varijable za procjenu motivacijskih dispozicija. Za određivanje strukture psiholoških karakteristika koristila se faktorska analiza. Rezultati faktorske analize koji su dobiveni u istraživanju pokazuju da se izdvojilo 5 značajnih latentnih dimenzija u kategoriji takmičara, i 5 značajnih latentnih dimenzija u kategoriji reprezentativaca.

Ključne riječi: Psihološke karakteristike, karate takmičari i reprezentativci, faktorska analiza.

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COMPARISON OF OBESITY PREVALENCE ACROSS 28 WORLD MASTERS GAMES SPORTS

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ABSTRACT

Recognised by the International Olympic Committee, the WMG is the largest international sporting competition in terms of participant numbers. A total of 6,071 WMG athletes (51.9% male, 48.1% female) from 28 sports, aged from 25 to 91 years (mean 51.5, SD±9.7), completed a survey instrument indicating heights and weights required to calculate BMI. It was hypothesized that there would be significant differences in prevalence of obesity across the 28 sports due to their different physiological and anthropometric requirements. Statistically significant differences in BMI between different sports were identified. The highest percentages of obesity were found in archery (39.3% obese, $p<0.001$), shooting (37.84% obese, $p<0.001$), rugby union (34.72% obese, $p<0.001$) softball (32.50% obese, $p<0.001$) and baseball (25.56% obese, $p<0.001$). Athletics, cycling, canoeing/kayaking, rowing, orienteering, soccer, sailing, and swimming all demonstrated significantly lower obesity. These findings may indicate a higher risk for many diseases such as type 2 diabetes or heart disease in masters sports such as archery, baseball, hockey, rugby union, shooting, softball, water polo and weightlifting. It was deemed that coaches of those masters sports demonstrating increased obesity prevalence should consider additional weight management strategies in their training regimes, particularly if there is no sporting benefit from increased BMI.

Keywords: Quetelet Index, obesity, masters sport.

INTRODUCTION

The World Masters Games

The Sydney World Masters Games (WMG) attracted 28,089 competitors across 28 sports (1) from over 100 countries. Recognised by the International Olympic Committee, the WMG is the largest international sporting competition in terms of participant numbers.

Previous research on WMG athletes has examined injury incidence in the lead up to the tournament (2), motivation for competition (3-4), as well as the health of North American competitors (5). Provisional analysis of WMG athletes' BMI in the

context of national population statistics has shown promising trends (6-9). Despite encouraging provisional research findings, masters athletes, as a group of middle to older-aged adults, remain under investigated with regards to various measures of health.

Masters Athletes

Regular exercise across the lifespan has been shown and is recognized as beneficial for improved health and decreased prevalence of various chronic diseases and disorders (10-12).

Masters athletes may display an age-related increase to the range of pathologies present in this population, as well as age-related physiological changes (11,13,14).

These changes may be attributed to reduced physical activity, lower metabolic rates and thus an altered body mass index (BMI) (15). Research on obesity in other masters events has shown promising results, such as, for example, the Golden Oldies World Rugby Festival (16) and the Pan Pacific Masters Games (17).

The Obesity Pandemic

The number of obese individuals has reached pandemic proportions across the world. In 2008, globally, 1.5 billion adults over the age of 20 were overweight ($25\text{kg/m}^2 \leq \text{BMI} < 30\text{kg/m}^2$), with 200 million of these men and 300 million of these women being classified as obese ($\text{BMI} \geq 30\text{kg/m}^2$) (18). Excess body mass has been shown to be associated with increased risk of chronic diseases such as diabetes, cardiovascular disease, hypertension and hypercholesterolemia, as well as certain cancers (19).

Obesity in Australia

Relevance of the BMI of athletes competing at the WMG in Sydney Australia is particularly noteworthy for the Australian population, as the proportion of Australians classified as overweight or obese has been progressively increasing (20). From the Australian Bureau of Statistics National Health Survey 2007-2008 (21), the prevalence of BMI classification for overweight and obese was higher for males than for females, with 63% of Australian males classified as overweight or obese, compared to 48% for females (16).

As of the Australian 2014-2015 National Health Survey (21), these figures had risen to 70.8% of males being overweight or obese, whilst this number had risen to 56.3% for females. The 2014-2015 National Health Survey estimated 27.9% of Australian adults as obese (≈ 5 million people). A total of 14,561 Australian adults completed this survey run by the Australian Government, Australian Bureau of Statistics.

With a no response rate of 26.8% for the BMI data, they had a total of 10,659 completed responses (21). In Australia, high BMI has been shown to be responsible for 7.5% (males 53%, females 47%) of total disease and injury and only second to smoking as a cause of preventable death (22). The deleterious influence of a high BMI on the health of males was found to be greater than for females in Australia (22). It has also been shown that classification as overweight (as well as obese) enhanced the risk of adverse health conditions (22). Total deaths attributable to excess weight in Australia is rising, with an estimated figure of 9,500 in 2003 (22). With inclusion of the economic costs

of lost productivity, it was estimated that obesity resulted in a financial cost of \$21 billion to the Australian society in 2005 (23).

The effective management of the Australian obesity epidemic therefore is both a health and an economic priority. A consideration, which must apply similarly for many developed and developing countries alike, with most countries showing growing levels of obesity. In Australia, as per most other national populations, there is also a tendency for increased BMI with increasing age (6, 21).

Masters Sport Participation as a Potential Alleviating Factor in the Global Obesity Epidemic

With many factors contributing to the obesity epidemic, it is necessary to investigate various populations in order to develop a multi-faceted understanding and possible solutions (24) to the obesity epidemic. It may be possible to glean additional insight into the scope of and nature of the solutions for the obesity epidemic by consideration of special populations such as those that exercise competitively in later life.

On a population level, classification of obesity is a valuable tool for assessing excess body mass and inferred health. On an individual level and for certain specific populations, inaccuracies arise with correlating obesity with anthropometric body composition and thus health implications of relatively high fat mass. Due to high muscle mass, there are some limitations of BMI as an index for athletic populations (25), such as masters athletes. It should also be noted that BMI calculated from self-reported data may provide an under-estimate of true BMI (26).

Research Aim

To investigate differences in obesity prevalence in the 28 sports played at the Sydney WMG. It was hypothesized that there would be significant differences in prevalence of obesity in the various sports due to their different physiological and anthropometric requirements. This might assist promotion strategies for optimal health promotion via sport participation.

Hypotheses

It was hypothesised that the athletes participating in those sports where increased musculature was required such as rugby union would have a significantly higher prevalence of obesity than

those sports where this was not applicable. Specifically, in rugby union, absolute strength as opposed to just relative strength (strength proportional to body mass, also very important) is an advantage, particularly in certain positions (e.g. prop forwards).

The same advantage would not apply in sports with weight category restrictions such as rowing or weightlifting, except for the heavyweight category athletes (with no maximal weight limitations).

It was also hypothesised that those sports where the athletes needed to accelerate themselves, or maintain a velocity (and thus where relative strength is important) would have lower levels of obesity. Further to this, it was predicted the same trend would apply for sports where the athlete accelerated or maximised and held velocity when sitting on a vehicle (such as cycling or kayaking).

Similarly, for those sports that required higher degrees of movement or where aerobic capacity was a big component of the sport, a lower prevalence of obesity would be expected than for those where this was not the case.

Additionally, for those sports where significant time is spent standing still (such as archery or shooting), significantly higher prevalence of obesity was expected. For those sports with lower levels of obesity, this may be associated with the lower incidence of chronic disease in masters athletes (27), due to the enhanced risk of morbidity (22, 28) and mortality (22, 28) from elevated BMI.

Prior research has reported patterns of reduced prevalence of obesity in rugby union (7), soccer (7), swimming (29), basketball (8) and touch football (7) at the Sydney WMG compared to the Australian national population; however no research to date has examined the other 23 sports played at the games. In Australia (as mentioned in the introduction), 27.9% of Australian adults were classified as obese.

It was hypothesized that, whilst this paper focuses on differences between masters sports, due to physical activity, a lower prevalence of obesity (30) across the majority of sports would be apparent than for summary population data for the host nation, Australia. It was believed that the benefits of increased muscularity in a sporting population would not be enough to mitigate this trend.

MATERIALS AND METHODS

Institutional approval was attained from the Bond University Human Research Ethics Committee, and organizational approval was attained from the Sydney WMG's organizing committee. Competitors provided informed consent electronically prior to enabling them access to the online research survey. A cross-sectional, observational study was completed using an online web-based questionnaire (LimeSurvey, an open source survey application). Data collection included demographic data for participants such as height, body mass and age. BMI was derived from this self-reported data via calculation using the participants' height and body mass. The questionnaire was piloted on 70 non-participants following which only minor changes were made to terminology.

The survey was activated for a total of four months. All WMG competitors who provided a valid email address were sent an invitation to participate in the study. A total of 28,676 competitors representing 95 countries and competing in 28 sports took part in the WMG's. Of those who competed in the games, 24,528 electronically registered for the games. Those who electronically registered for the games were sent an invitation to participate in the study. A total of 8,072 consented to participate in the study and responded to the online survey; a response rate of 28.2%. Pearson chi-square tests were used to determine if statistical differences existed between sports in terms of the proportion of obese athletes. A p-value was set a priori at 0.05 to determine statistical significance. Analysis was conducted between different sports, but also with adjustments for gender differences in participation numbers between sports.

RESULTS

A total of 6,071 masters athletes (51.9% male, 48.1% female) from 28 sports completed the online survey, indicating heights and weights required for calculating obesity prevalence. The ages ranged from 25 to 91 years (mean 51.5, SD±9.7). The most represented nationality within the sample was the host nation Australia (n=4,450, 73.3%). Using chi squared tests, several sports were found to have significantly higher prevalence of obesity than the other masters sports.

The highest percentages of obesity were found in archery (39.3% obese, $p<0.001$), shooting (37.84% obese, $p<0.001$), rugby union (34.72% obese, $p<0.001$) softball (32.50% obese, $p<0.001$) and baseball (25.56% obese, $p<0.001$). Athletics, cycling, canoeing/kayaking, rowing, orienteering, soccer, sailing, and swimming all demonstrated significantly lower obesity prevalence than the model expected values. Statistical values and significant differences for the distribution of obesity across the 28 sports are displayed in Table 1.

Table 1: Statistical values and significant differences in the prevalence of obesity across the 28 sports. (Chi square test * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Chi squared statistics are computed for differences between sports, but also for differences accounting for gender balance. Whether the observed prevalence of obesity is higher or lower than the chi squared expected values is also indicated.

Sport	Male %	Obesity %	Chi Squared Statistic	Chi Squared Statistic adjusting for gender	Chi Squared Statistic significantly higher or lower than expectation
archery	78.3	39.13	43.02***	40.28***	Significantly higher
athletics	61.5	5.48	33.17***	34.43***	Significantly lower
badminton	52.1	10.43	0.80	0.81	
baseball	99.0	25.56	26.40***	21.84***	Significantly higher
basketball	55.7	13.24	0.08	0.06	
canoe/kayak	72.9	3.26	14.94***	15.78***	Significantly lower
cycling	81.3	2.68	20.49***	21.89***	Significantly lower
diving	61.9	10.53	0.09	0.09	
soccer	44.0	9.12	7.09**	6.63*	Significantly lower
golf	63.5	14.53	0.48	0.38	
hockey	24.3	17.51	6.78**	8.52**	Significantly higher
lawn bowls	60.2	17.54	1.16	1.07	
netball	0.50	9.87	2.37	1.19	
orienteering	65.4	2.51	18.80***	19.29***	Significantly lower
rowing	48.8	6.24	23.94***	23.66***	Significantly lower
rugby union	98.7	34.72	31.13***	27.35***	Significantly higher
sailing	76.4	3.49	6.65**	7.09**	Significantly lower
shooting	78.6	37.84	41.73***	38.98***	Significantly higher
softball	18.8	32.50	167.65***	184.19***	Significantly higher
squash	67.8	13.56	0.07	0.03	
surf lifesaving	71.2	7.27	2.99	3.32	
swimming	48.5	9.11	6.35*	6.24*	Significantly lower
table tennis	85.3	10.34	0.15	0.23	
tennis	50.0	14.47	0.39	0.39	
touch football	69.0	8.66	1.93	2.16	
volleyball	50.8	12.02	0.12	0.12	
water polo	69.7	22.22	4.33*	3.99*	Significantly higher
weightlifting	56.9	25.93	8.38**	8.21**	Significantly higher

DISCUSSION

An outcome of 6,071 responses from a highly specialised cohort, namely masters athletes at the Sydney World Masters Games was an exceedingly positive result. A good comparison to contextualise this sample size in terms of BMI data would be that it is more than half the 10,659 responses obtained by the Australian

Government Australian Bureau of Statistics 2014-2015 National Health Survey mentioned in the introduction(21), which was based on the Australian national population (in excess of 20 million people). Due to the large number ($n=6,071$) of respondents, this sub-sample of athletes can be considered as a representative sample of athletes at the Sydney WMG and a unique view into obesity prevalence in masters athletes.

Whilst this was a comparison between sports, the obtained results identified that the prevalence of obesity for many sports was less than reported in national populations, such as the 2014-2015 National Health Survey estimating 27.9% of Australian adults as obese. The lowest prevalence of obesity was in orienteering, with an obesity prevalence of 2.51%, less than 1/10th that of the National Health Survey data. This may indicate improved health outcomes in terms of one health risk factor (obesity) for these masters athletes compared to adult (age>18years) Australians. It was appropriate to examine the prevalence of obesity in context of the Australian population, with the majority of masters athletes identifying as Australian. As both methods relied upon self-administered questionnaire based data, using self-reported heights and mass, the comparison was deemed fitting.

It should be noted that the issue of causation must also be considered. Namely, the question of whether competing in masters sport promoted reduced obesity and lowered associated health risks or, alternatively, whether individuals with lower obesity participated in World Masters Games by preference (perhaps people with a certain anthropometric somatotypes are preferentially attracted to competing) or simply because (presumably due to improved health) they were still physically capable of competing as they aged. Future studies, including factor analysis using psychological data gathered, as well as the gathered injury medical history can be used to further investigate this concern of causation.

It should be noted that it may be inappropriate to draw meaningful conclusions given that prediction of body composition from BMI is reliable on a large scale, with a non-specialised random sample population, but in athletes with the possibility of enhanced muscle mass and on a small scale, this inference to health is unreliable as it may be due to increased muscularity. There may also be some causation by sports, for example athletes may be preferentially attracted to compete in a sport if they have a natural physiological advantage in it. This might for instance be a lower centre of mass and increased body mass in a contact sport such as rugby, increased height (basketball), lower centre of mass (weight lifting), increased height or buoyancy due to fat mass (swimming), or other attributes affecting height or mass. This may influence the utility of comparing BMI as a health indicator between sports, given the potential for the games being suited to athletes of different anthropometric ratios of body mass to height.

Statistically significant differences in obesity prevalence between different sports were identified. Participants in the sports archery, baseball,

hockey, rugby union, shooting, softball, water polo and weightlifting had significantly higher prevalence of obesity than expected (via chi squared tests). Participants in the sports athletics, canoeing/kayaking, cycling, soccer, rowing, orienteering, sailing and swimming demonstrated significantly lower prevalence of obesity than expected (via chi squared tests). It should be noted that some sports such as, for example, lawn bowls had a higher prevalence of obesity than would be expected, via the overall sample prevalence of obesity when looking at all sports, however without a large enough number of lawn bowls participants for the trend to be statistically significant.

The higher prevalence of obesity in rugby union compared to other sports supported hypotheses that the extra muscularity might be beneficial for rugby union players and would result in higher prevalence of obesity than the other sports. For archery and shooting, obesity prevalence was significantly higher in these sports and this may well be connected to the hypothesis given in the introduction, that this is related to the significant amount of time spent standing still. The higher obesity prevalence in water polo may be related to benefits from increased buoyancy from higher fat mass, though this was not apparent for swimmers. The different physiological demands of swimming and water polo, particularly the focus on optimising velocity in swimming may account for this difference. It was not expected to see masters hockey as a sport with a significantly higher prevalence of obesity than the other sports. Certainly some positions, such as, perhaps, the goal keeper, may be less aerobically demanding than other sports, however this might not apply to most positions. One explanation may be that there is some benefit for shorter athletes in hockey due to controlling a ball on the floor via the hockey stick whilst moving. This shorter stature would explain a higher BMI and greater prevalence of obesity in hockey players. For weight lifting, the increased obesity prevalence may be influenced by heavy weight category athletes skewing results and warrants further investigation. A likely explanation is that a smaller height in the lower weight classes is beneficial for lifts such as the clean and snatch.

The lower prevalence of obesity in canoeing/kayaking, cycling and sailing was, as hypothesised in the introduction, due to the improved economy of movement with less mass (due to lower body mass). A similar lower obesity prevalence was apparent in rowing, despite heavyweight rowing categories having no weight limit. This might be affected by the benefits of improved height on rowing stroke (as height squared is the denominator of the BMI equation). For athletics, soccer, orienteering and swimming that require higher degrees of movement and good aerobic capacity, the significantly lower prevalence of obesity was as hypothesised.

These findings may indicate a higher risk for many diseases such as type 2 diabetes or heart disease in masters sports such as archery, baseball, hockey, rugby

union, shooting, softball, water polo and weightlifting. However, it is clear that there are other complex differences between the sports, which would make it inappropriate to make recommendations of preferential participation solely on these provisional findings for one index associated with health.

Coaches of archery, baseball, shooting, softball and water polo should consider additional weight management strategies in their training regimes, particularly if there is no sporting benefit from increased body mass.

For rugby union, a similar approach should be taken into consideration, although there is the mitigating factor that increased muscle mass (and possibly low centre of gravity) is beneficial to the sport. In the case of weight lifting due to strict weight categories and for hockey with the possibility (purely hypothetical) that the increased obesity based on body mass index might be related to benefits from reduced player height, there is not enough evidence to make such recommendations solely based on these findings.

CONCLUSION

Recognised by the International Olympic Committee, the World Masters Games (WMG) is the largest international sports competition in terms of participants. In context of the global obesity epidemic, this under-

investigated physically-active population may further the understanding of the nexus between aging, physical activity and obesity. Statistically significant differences in BMI between different sports were identified. These findings may indicate a higher risk for many diseases such as type 2 diabetes or heart disease in masters sports such as archery, baseball, hockey, rugby union, shooting, softball, water polo and weightlifting.

However, it is clear that there are other complex differences between the sports, which would make it inappropriate to make recommendations of preferential participation solely on these provisional findings for one index associated with health.

It was deemed that coaches of those masters sports demonstrating increased obesity prevalence should consider additional weight management strategies in their training regimes, particularly if there is no sporting benefit from increased BMI.

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POREĐENJE PREVALENCIJE PRETILOSTI U 28 SPORTOVA SVJETSKIH MASTERS IGARA

Priznate od strane Međunarodnog olimpijskog komiteta, WMG (engl. WMG - World Masters Games: Svjetske Masters igre) predstavljaju najveće međunarodno sportsko takmičenje po pitanju broja učesnika. Ukupno 6.071 WMG sportista (51,9% muškaraca, 48,1% žena) iz 28 sportova, dobi od 25 do 91 godine (srednja vrijednost 51,5, SD $\pm 9,7$) je ispunio anketu koja je predstavljala instrument istraživanja, te navelo visinu i težinu potrebnu za izračunavanje BMI-a. Postavljena je hipoteza da će postojati značajne razlike u prevalenciji pretilosti u 28 sportova zbog njihovih različitih fizioloških i antropometrijskih uslova. Utvrđene su statistički značajne razlike između različitih sportova kada je u pitanju BMI. Najveći postotak pretilosti je otkriven u streličarstvu (39,3% pretilih, $p < 0,001$), streljaštvu (37,84% pretilih, $p < 0,001$), ragbi uniji (34,72% pretilih, $p < 0,001$), softbolu (32,50% pretilih, $p < 0,001$) i bejzbolu (25,56% pretilih, $p < 0,001$). Atletika, biciklizam, vožnja kanuom/kajakom, veslanje, orijentacijski sport, fudbal, jedrenje i plivanje su dali znatno niži stepen pretilosti. Ova otkrića mogu ukazivati na veći rizik za mnoge bolesti poput dijabetesa tipa 2 ili srčanih bolesti u masters sportovima kao što su streličarstvo, bejzbol, hokej, ragbi unija, streljaštvo, softbol, vaterpolo i dizanje tegova. Smatra se da bi treneri onih masters sportova koji prikazuju povećanu prevalenciju pretilosti trebali razmotriti dodatne strategije za regulaciju tjelesne težine u režimima treninga, a osobito ukoliko ne postoji sportska korist od povećanog BMI-a.

Ključne riječi: Queteletov indeks, pretilost, masters sport.

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RELATIVE AGE EFFECT IN WOMEN'S SOCCER: AN ANALYSIS OF PLAYER NATIONALITY AND PLAYING POSITION AT THE RIO 2016 OLYMPIC GAMES

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ABSTRACT

The aim of this study was to investigate the occurrence of Relative Age Effects (RAEs) in national teams participating in the women's soccer competition at the Rio 2016 Olympic Games and, to analyse the relation between RAEs and playing position. The sample size of the study comprised the 216 female soccer players registered in women's soccer competition at the Rio 2016 Olympic Games. Birth dates, playing position and nationality were collected. The birth month of each player was classified into four quarters (Q). A chi-square test and odds ratios (OR) were used to assess the differences between the observed and expected birth months distributions. To assess the magnitude of the effect size for the chi-square analyses, Cramer's V was used. The results showed no significant RAEs in women's soccer players. The exceptions were China, which presented an overrepresentation of players born at Q1, and the USA, with an inverse RAE (overrepresentation of players born at Q3). The analysis by playing position showed large RAEs only in midfielders. Apparently, in female soccer, there is less competition and less selection for the entrance and development in the sport, which may explain the lower occurrence of RAEs.

Keywords: Birth date, female soccer, talent development, selection, playing position.

INTRODUCTION

The sport and educational systems put up all athletes and students in groups categorized by age, with specific cut-off dates. In international soccer, the categories comprise individuals born from January to December within a given year.

The aim of grouping is to promote the same level of performance among teams and to make the championships more competitive. However, this division can lead to an age difference of almost 12 months between the youngest and oldest athletes in the same category, known as Relative Age Effect (RAE) (Wiiumet

al., 2010; Williams, 2010; Lovellet al., 2015). In male soccer, there are studies since the 80s with athletes from different nationalities, such as Norway(Wiiumet al., 2010), England (Lovell et al., 2015), Germany(Augste & Lames, 2011), Portugal(Folgado et al., 2006), Spain(Del Campo et al., 2010), the USA (Vincent & Glamser, 2006), Australia (Van Den Honert, 2012) and Brazil (Costa et al., 2012). The phenomenon has also been studied in athletes of different competitive levels(Wiium et al., 2010; Williams, 2010; Augste & Lames, 2011; Sierra-Díaz et al., 2017)and playing positions (Folgado et al., 2006; Salinero et al., 2013). Different mechanisms have been proposed to explain the causes of RAEs in male soccer.

The main reasons are based on maturation, and consequently, physical differences among the players (Cobley et al. 2009). As consequence, younger athletes play at lower competitive levels and have less support and training (Romann & Fuchslocher, 2011) which may reflect in higher ratios of sport drop-out (Delorme, Boiché, & Raspud, 2010). Even knowing the negative consequences for athletes' development, after ten years of research, no change in the RAEs in male professional soccer was observed (Helsen et al., 2012). Despite the considerable amount of studies about RAEs in male soccer, there are a few studies investigating the same phenomenon in women's soccer. RAEs were observed in different age categories in female French Soccer Federation (Delorme, Boiché, & Raspud, 2010) and in Spanish female professional soccer players (Sedano, Vaeyens & Redondo, 2015). However, no RAEs were found in women's soccer in France (Delorme, Boiché, & Raspud, 2009) and Switzerland (Romann & Fuchslocher, 2011). The phenomenon of RAE in women's soccer should be deeply analysed due to the still contradictory findings with significant differences among the countries. The analysis by playing position showed significant RAEs in defenders and goalkeepers in the Swiss female national team (Romann & Fuchslocher, 2011). The same results were found for RAEs in goalkeepers and defenders from Europe and North and Central America in under-17 Women's FIFA World Cup (Romann & Fuchslocher, 2013) and from Spanish regional teams (Sedano, Vaeyens & Redondo, 2015). Coaches may tend to select older athletes in these positions looking for more mature and taller players (Romann & Fuchslocher, 2013). Although the RAEs by playing position in women's soccer have already been investigated in European and North American countries, it is still unknown if there is a pattern worldwide.

The analysis of international competitions allows the comparison of the same phenomenon in different countries, as well as the identification of a world trend. For that reason, it is worth to investigate RAEs in the most recent big event in the sport context, the Rio 2016 Olympic Games. The aim of this study was to investigate the occurrence of RAEs in national teams participating in the women's soccer competition at the Rio 2016 Olympic Games and, to analyse the relation between RAEs and playing position.

METHODS

Participants

Birth dates, playing position and nationality of all the players registered in the women's soccer competition at the Rio 2016 Olympic Games were

collected. All the data used in this study were obtained from the official website of the Federation Internationale de Football Association (www.fifa.com). There were twelve national teams participating in the competition: Australia, Brazil, Canada, China, Colombia, Germany, France, New Zealand, South Africa, United States, Sweden and Zimbabwe. Each team was composed of 18 athletes. The sample size of the study comprised 216 female soccer players. The participants' age that comprised the final sample ranged from 17 to 41 years with a mean age of 26.3 (SD = 3.7).

Procedures and data analyses

The birth month of each player was classified into four quarters. The cut-off date in FIFA championships is January 1st. The first quarter (Q1) represents January, February and March; the second quarter (Q2) represents April, May and June; the third quarter (Q3) represents July, August and September; and the last quarter (Q4) represents October, November and December. All the data were tabulated and arranged in a Microsoft Excel worksheet, followed by export to MATLAB® 2010 software (The MathWorks Inc., Massachusetts, USA) which was used for all the statistical analyses. Absolute and relative frequencies were used to summarize the collected data. A chi-square test and odds ratios (OR) were used to assess the differences between the observed and expected birth months distributions. The expected frequencies are based on the equally distributed birth rate over the year. This choice was made given the difficulty of accessing the birth statistics of each studied population (Cobley et al., 2009). To assess the magnitude of the effect size for the chi-square analyses, Cramer's V was used (Romann & Fuchslocher, 2011; 2013). For the interpretation of the results, V between 0.06 and 0.17 was considered a small effect, from 0.18 to 0.29 was considered a medium effect and above 0.30 was considered a large effect (Cohen, 1977).

RESULTS

No significant RAEs were found in women's soccer players at the Rio 2016 Olympic Games ($\chi^2 = 4.799$, Cramer's $V = 0.08$) (Figure 1). Close observed and expected frequencies were found in Q1, Q2 and Q3. The distribution showed a small but insignificant underrepresentation of Q4 for players compared to the expected frequency.

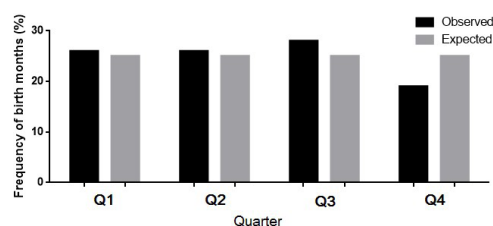


Figure 1: Birth month distribution of the women's soccer players at the Rio 2016 Olympic Games

Table 1 shows the birth month distribution subdivided by playing nationality. As can be seen, large RAEs were found only in China and the USA. In China, there was an overrepresentation of players born at Q1. However, the USA showed inverse RAEs with overrepresentation of players born at Q3. The other nationalities showed no significant RAEs.

Table 1: Birth month distribution subdivided by playing nationality at the Rio 2016 Olympic Games

Nationality	Q1	Q2	Q3	Q4	X ²	OR Q1/Q4	V	Effect
Australia	5 (28%)	4 (22%)	5 (28%)	4 (22%)	0.222	1.25	0.06	Small
Brazil	5 (28%)	5 (28%)	2 (11%)	6 (33%)	2.000	0.83	0.19	Medium
Canada	3 (17%)	8 (44%)	3 (17%)	4 (22%)	3.777	0.75	0.26	Medium
China	9 (50%)	1 (6%)	5 (28%)	3 (17%)	7.777	3.00	0.38	Large
Colombia	6 (33%)	5 (28%)	4 (22%)	3 (17%)	1.111	2.00	0.14	Small
France	6 (33%)	5 (28%)	5 (28%)	2 (11%)	2.000	3.00	0.19	Medium
Germany	5 (26%)	5 (26%)	6 (32%)	3 (16%)	1.000	1.67	0.14	Small
South Africa	4 (21%)	5 (26%)	7 (37%)	3 (15%)	1.842	1.33	0.18	Medium
Sweden	8 (42%)	5 (26%)	4 (21%)	2 (11%)	3.947	4.00	0.27	Medium
The USA	1 (6%)	6 (33%)	9 (50%)	2 (11%)	9.111*	0.5	0.41	Large
New Zealand	1 (6%)	6 (33%)	6 (33%)	5 (28%)	3.777	0.20	0.26	Medium
Zimbabwe	5 (31%)	2 (13%)	5 (31%)	4 (25%)	1.500	1.25	0.17	Medium

Legend: data presented as absolute (relative) frequencies; statistically significant, $p < 0.05$; OR = odds ratio; V = Cramer's V.

The analysis by playing position is shown in Table 3. With the exception of midfielders, no RAEs were observed by playing position. Midfielders showed an underrepresentation of players born at Q4.

Table 2: Birth month distribution subdivided by playing position at the Rio 2016 Olympic Games

Position	Q1	Q2	Q3	Q4	X ²	OR Q1/Q4	V	Effect
Goalkeeper	3 (13%)	8 (33%)	7 (29%)	6 (25%)	2.333	0.5	0.20	Medium
Defenders	17 (24%)	18 (25%)	22 (31%)	15 (21%)	1.444	1.13	0.16	Small
Midfielders	21 (31%)	15 (22%)	23 (34%)	9 (13%)	7.058	2.33	0.36	Large
Strikers	17 (31%)	17 (31%)	10 (18%)	11 (20%)	3.109	1.54	0.24	Medium

Legend: data presented as absolute (relative) frequencies; OR = odds ratio; V = Cramer's V

DISCUSSION

The aim of this study was to investigate the occurrence of RAEs in elite female soccer. No significant RAEs were found in women's soccer players at the Rio 2016 Olympic Games. Only China showed large RAEs, while the USA players presented inverse RAEs with overrepresentation of players born at Q3. The analysis by playing position showed large RAEs only in midfielders. The results of this study corroborate the previous findings of nonexistence of RAEs in women's elite national teams (Delorme et al., 2009; Vincent & Glamser, 2006; Romann & Fuchslocher, 2011; 2013). As a possible explanation, in female soccer, there is less competition and less selection for the entrance and development in the sport, compared to male (Delorme et al., 2009).

Although female soccer players have increased by 38% since 2000 (FIFA, 2014), this growth does not seem enough to increase the selection and, consequently, the RAEs in the sport. Moreover, the differences in physical performance among girls during maturation appear to be less consistent and/or influential on performance measurements (Cobley et al., 2009). In this way, the performance indicators seem to be less confounded by variable maturation in female sports (Cobley et al., 2011). Nevertheless, large RAEs were found in Chinese female players. Women's soccer is one of the fastest growing sports in China (Hong & Magan, 2003). The success in several international competitions led women's soccer in China to become a symbol of patriotism. For that reason, the regional, youth and junior competitions in China happen with the purpose of training female players for the successful participation in international competitions, such as World Cups and Olympic Games (Hong & Magan, 2003).

With the aim of achieving sport performance, clubs in China are recruiting teenage girls across the country based on their academic exams, football skill tests and fitness tests (Jinxia & Magan, 2002). This player selection process may explain the preference for older female footballers who present a physical advantage. The inverse RAEs found in the USA players were also reported in U-17 female soccer players in Africa (Romann & Fuchslocher, 2013). According to the authors, the phenomenon

in Africa could be explained by the errors in birth date certificates (Romann & Fuchslocher, 2013). However, the same explanation may not be reasonable for the USA context. In the same study, Romann & Fuchslocher (2013) found no RAEs in the USA U-17 national team.

The result of this study is contradictory with the previous work, indicating the need for more investigations to make conclusions about the real (non)existence of the inverse RAEs in female North-American soccer players. The analysis by playing position showed large RAEs only in midfielders with an underrepresentation of players born at Q4. The RAEs were already observed in midfield male players from Italy, Germany, France and Spain (Salinero et al., 2013). According to the authors, the early development of physical characteristics may be an advantage to defenders and midfielders. So far, in female soccer, RAEs were observed in goalkeepers and defenders in Switzerland (Romann & Fuchslocher, 2011), Spain (Sedano, Vaeyens & Redondo, 2015) and the Women's U-17 World Cup (Romann & Fuchslocher, 2013). The RAEs by position vary according to the championship (Salinero et al., 2013), which may explain the difference found in the previous studies. Although the Olympic Games are one of the most important sports competitions in the world and the results of this study are important to advance the knowledge of RAEs in women's soccer, it is important to recognize the limitations of the present work. The results obtained from only one championship cannot be generalized for other national and international competitions or for different categories. Moreover, the small samples size of the analysed teams makes the conclusions of the study difficult. For future studies, larger samples and the longitudinal investigation of RAEs in other important sport events such as the Women's Soccer World Cup are recommended.

CONCLUSIONS

Based on the obtained results, no significant RAEs were found in women's soccer players at the Rio 2016 Olympic Games. Exceptions were found in China, which showed large RAEs, and in the USA players who presented inverse RAEs with overrepresentation of athletes born at Q3. The analysis by playing position showed no RAEs, with the exception of the midfielders. Apparently, in female soccer, there is less competition and less selection for the entrance and development in the sport, which may explain the lower occurrence of RAEs.

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EFEKAT RELATIVNE DOBI U ŽENSKOM FUDBALU: ANALIZA NACIONALNOSTI IGRAČA I NJIHOVE POZICIJE U IGRI NA OLIMPIJSKIM IGRAMA RIO 2016.

Cilj ove studije je bio istražiti pojavu efekata relativne dobi (engl. RAEs - Relative Age Effects: efekti relativne dobi) u reprezentacijama koje su učestvovala na takmičenju u ženskom fudbalu na Olimpijskim igrama Rio 2016., te analizirati vezu između RAE-a i pozicije u igri. Veličina uzorka u istraživanju je iznosila 216 igračica fudbala, registrovanih na takmičenju u ženskom fudbalu na Olimpijskim igrama Rio 2016. Prikupljeni su njihovi datumi rođenja, pozicije u igri i nacionalnost. Mjesec rođenja svake igračice je klasifikovan u četiri četvrtine (Q). Za procjenu razlika između uočene i očekivane distribucije mjeseca rođenja korišteni su chi-square test i omjer izgleda (OR). Cramerov V-test se koristio za procjenu intenziteta veličine učinka za chi-square analize. Rezultati nisu pokazali značajne RAE-e za igračice fudbala. Izuzeci su bili Kina, koja je imala veliku zastupljenost igračica rođenih u Q1 i SAD sa suprotnim RAE-om (velika zastupljenost igračica rođenih u Q3). Analiza na osnovu pozicije u igri je prikazala velik RAE samo kod veznih igrača. Očigledno je da u ženskom fudbalu postoji manja konkurencija i manji odabir za ulazak i razvoj u sportu, što bi moglo objasniti manju pojavu RAE-a.

Ključne riječi: Datum rođenja, ženski fudbal, razvoj talenta, odabir, pozicija u igri.

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The knee angle at maximum foot speed is at least 72 degrees to a maximum of 116 degrees, with a mean value of 97.50 degrees.

Standard deviation is 15.21 degrees which departs from the frame of one standard deviation and shows that the knee angle at maximum speed is relatively different for different athletes, which is expected taking into consideration that karate athletes have different anthropometric characteristics. The knee angle results in foot strokes range from a minimum of 155 degrees to a maximum of 170 degrees. The mean value of the knee angle in all six karate athletes is 165.17 degrees. The value of the standard deviation is 5.71 degrees. The similarity of this angle comes due to the fact that all karate athletes tested in this research are top athletes and have perfected the performance of the strike Ashi Mawashi Geri. The hip angle at maximum foot speed is at least 117 degrees, with a maximum of 142 degrees (Table 1).

The mean value taken from the total number of karate athletes is 128 degrees. In a survey carried out by Alaa (2011), on the strike Mawashi Geri Cudan, he found that the speed of the strike increased with an increase in the hip angle and reached a maximum of 171 degrees. Standard deviation is within one standard deviation of 9.40 degrees.

The hip angle at a foot strike ranges from a minimum of 104 degrees to a maximum of 120 degrees, with a mean value of 110 degrees. And in this result, the standard deviation moves within one standard deviation around the centre and it is 6.23 degrees. Table no. 2 shows the results of the T-test for the variables showing the strike velocity and the achieved angles of the knee and the hip joints during the performance of both types of strike Ashi Mawashi Geri. The values of the arithmetic means in the time parameters for the execution of the leg kick Ashi Mawashi Geri in attack and Diae are of relatively same values, and therefore there is no statistically significant difference in any variables of this type.

Table 2: T-test between Ashi Mawashi Geri attack and Diae
1 – Ashi Mawashi Geri, attack / 2 – Ashi Mawashi Geri, Diae

	Var	N	Mean	St. dev	F	df	t	Sig.
MAX. F. S. (m.s-1)	1.00	6	12.58	2.10	2.79	10	-.139	.892
	2.00	6	12.82	3.78		7.82	-.139	.893
TIME. MAX. S. (sec)	1.00	6	.43	.13	.320	10	.276	.788
	2.00	6	.42	.10		9.62	.276	.789
TOTAL. TIME. (sec)	1.00	6	.54	.11	.558	10	.451	.662
	2.00	6	.52	.09		9.74	.451	.662
KNEE. ANG. DU. MAX. S (°)	1.00	6	82.17	25.79	1.227	10	-1.254	.238
	2.00	6	97.50	15.22		8.10	-1.254	.245
KNEE ANG. DU. ATT (°)	1.00	6	165.68	6.38	.186	10	.143	.889
	2.00	6	165.17	5.71		9.88	.143	.889
HIP. ANG. DU. MAX.S (°)	1.00	6	126.17	13.593	.668	10	-.272	.791
	2.00	6	128.00	9.40		8.10	-.272	.792
HIP ANG. DU. ATT.(°)	1.00	6	115.50	6.72	.008	10	1.471	.172
	2.00	6	110.00	6.23		9.94	1.471	.172

From this we can conclude that the already learned and automated movement, as a result of a large number of repetitions, in the karate athletes is performed at the same speed and time, regardless of the situation in which it is performed. The decision to strike is the crucial factor, while the subsequent movement is a result of automatism with a perfect motor stereotype.

Also, statistically significant differences haven't been noticed in the variables that define the goniometric parameters in the performance of the two variants of strike Ashi Mawashi Geri. In these variables, one can come to a similar conclusion that

a movement, once learned and formed, is performed along the same trajectory and thus the same sequence of muscle activation is responsible for it. All this leads to occupying the same angles in the joints.

CONCLUSION

A sample of six respondents, top athletes from karate sport who are seniors, was used to realize the purpose of the research. The sample in this study was the strike Ashi Mawashi Geri in two variants of the performance, Ashi Mawashi Geri in attack and Ashi Mawashi Geri in Diae.

The strike Ashi Mawashi geri is carried out at a high speed and it is of a ballistic character, that is, a strike in which, after the decision to perform and start the movement, it is not possible to correct the movement trajectory. With long-term training and a large number of repetitions, it is the already learned and automated movement the karate athletes perform at a relatively same speed, regardless of the situation in which the

strike is performed. The decision to perform the strike is a crucial factor for its effectiveness, in the conditions of a perfect motor stereotype and movement automatism. According to the set goal, statistically significant differences in the performance of the strike were not determined for all variables of the speed and goniometric parameters.

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KINEMATIČKI I GONIOMETARSKI PARAMETRI UDARCA NOGOM ASHI MAWASHI GERI

Ukoliko se izvrši brzo i ispravno, AshiMavashiGeri tehnika udarca nogom je jako korisna. Svrha ovog istraživanja je analiza i utvrđivanje parametara brzine i vremena, kao i kinematičkih i goniometarskih parametara šestorice vrhunskih sportista u uslovima kada karatista vrši udarac u napadu i kada karatista vrši udarac u Diae situaciji (kada ga protivnik napadne). Svaki udarac je pojedinačno zabilježen za svakog ispitanika uz pomoć tri digitalne kamere frekvencije 60 Hz. Ariel PerformanceAnalysis (APAS) sistem je korišten prilikom analize udarca. Prilikom izvođenja tehnike AshiMavashiGeri u prvoj verziji, prosječna vrijednost brzine stopala je bila 12,58 m/s, dok je vrijeme proteklo od zauzimanja početne pozicije to maksimalne brzine stopala iznosilo 0,43 sekunde. Vrijeme potrebno za udarac iz početne pozicije do završnog pokreta stopalom je iznosilo 0,54 sekunde. Ugao koljena tokom maksimalne brzine stopala je dostigao prosječnu vrijednost od 82,17 stepeni. U slučaju primjene tehnike AshiMavashiGeri prilikom Diae situacije, maksimalna brzina stopala je iznosila 12,82 m/s; vrijeme potrebno za udarac iz početne pozicije do dostizanja maksimalne brzine stopala je iznosilo 0,41 s, dok je ukupno vrijeme potrebno za izvođenje potpunog pokreta iznosilo 0,57 sekundi. Vrijednost ugla koljena tokom udarca u drugoj verziji je iznosila 97,50 stepeni. Vrijednosti svih parametara vremena u izvedbi udarca stopalom AshiMavashiGeri prilikom napada i Diae situacije su relativno iste, pa, prema tome, nije zabilježena statistički značajna razlika ($p < 0,05$) u bilo kojoj varijabli zato što je pokret rezultat automatizma sa savršenim motoričkim stereotipom.

Ključne riječi: AshiMavashiGeri, kinematika, brzina, ugao, vrijeme.

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SITUATION AWARENESS IN SPORTS SCIENCE: BEYOND THE COGNITIVE PARADIGM

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ABSTRACT

In sports, the awareness that cognitive-perceptual abilities, such as anticipation, decision-making, and awareness of the situation are prerequisites for excellent performance is increasingly spread. Experienced athletes develop, as a result of a long practice, sophisticated task-specific knowledge structures that enable them to deal with situations more effectively and efficiently than others. Elite athletes, for example, selectively perform a visual scan of the scene, focusing their attention on relevant sources and discarding irrelevant information at the same time. Additionally, experienced athletes are more aware of events that can be probabilistically occurring in a given situation and are able to capture contextual signals that can facilitate predicting future events. These skills act in complementarity with a vast repertoire of strategies and tactics available and with the knowledge of their rapid speediness in a given situation.

Keywords: Enactive, sensory-motor system, decision making, elite athletes.

INTRODUCTION

Enactive knowledge is not merely knowledge mediated by the sensory-motor system, but knowledge coded in the form of motor responses and acquired in action. For example, this type of knowledge is required in tasks such as driving a car, moulding clay, dancing, playing a musical instrument, and it is difficult to represent it in an iconic or symbolic form. The transmission of this type of knowledge is based on experience and on perceptual responses to motor acts (Morganti, Carassa, & Riva, 2008). In sports, the awareness that cognitive-perceptual abilities, such as anticipation, decision-making, and awareness of the situation are prerequisites for excellent performance is increasingly spread (P.A. Di Tore, Discepolo, & Di Tore, 2013). Experienced athletes develop, as a result of a long practice, sophisticated task-specific knowledge structures that enable them to deal with situations more effectively and efficiently than others. Elite athletes, for example, selectively perform a visual scan of the scene, focusing their attention on relevant sources and discarding irrelevant information at the same time (Altavilla

& Raiola, 2014; Raiola, Parisi, Giugno, & Di Tore, 2013). Additionally, experienced athletes are more aware of events that can be probabilistically occurring in a given situation and are able to capture contextual signals that can facilitate predicting future events. These skills act in complementarity with a vast repertoire of strategies and tactics available and with the knowledge of their rapid speediness in a given situation.

According to Aidan Moran, "the study of athletic expertise can shed light on the relationship between knowledge and skilled action in complex dynamic environments that are characterized by uncertainty and time constraints. Specifically, studies in this field can help to identify the cognitive processes and neural mechanisms that underlie expert and novice differences in pattern recognition, decision making (DM), and skilled performance (Tiziana et al. 2016, D'Isanto & Di Tore 2016, D'Isanto 2016, Gaetano, 2012 ab). For example, research shows that expert athletes are generally superior to novices in recognizing and recalling precise details of patterns of play in their specialist sport—a skill that enhances their "situational awareness" (SA) (or their general understanding of what is going on around them) and efficiency of performance" (Moran, 2014).

The concept of Situation Awareness is a key concept in activities in which «cognitive and physical tasks are being performed in a complex system consisting of multiple humans and artifacts, under quickly changing conditions» (Salmon, Stanton, Gibbon, Jenkins, & Walker, 2009). The concept of Situation Awareness (SA) was introduced by sport psychology in the 1970s, generally related to team sports. The scientific works produced during this period, predominantly of theoretical arguments, concern stimulus-response theory, perceptual signals and attentive style (Nideffer, 1976). In the sports field, the concept was resumed, at a later date, by Patrick, James, Ahmed, and Halliday, who, in a study on the assessment of Situation Awareness in team sports (Raiola 2014ab), have listed the essential dimensions of SA, identifying them in planning, problem solving, team coordination, attention, communication and knowledge (Patrick, James, Ahmed, & Halliday, 2006).

More recently, the concept of SA has been applied to a wide area of scientific domains (Hone, Martin, & Ayres, 2006). Situation Awareness, indeed, seems to be a theoretical meeting place for knowledge fields sometimes even distant from one another, from aeronautics to medicine, through the inevitable neuroscience and computer science (Di Tore & Raiola, 2012). "The importance of 'situation awareness' (SA) in assessing and predicting operator competence in complex environments has become increasingly apparent in recent years. It has been widely established that SA is a contributing factor to many commercial and military accidents and incidents" (Banbury & Tremblay, 2004).

This very peculiar nature, which eludes disciplinary fences, makes it difficult to define: "Yet determining exactly what constitutes SA is a very difficult task, given the complexity of the construct itself, and the many different processes involved with its acquisition and maintenance" (Banbury & Tremblay, 2004). By trying to narrow the field, we can state that Situation Awareness covers those activities in which cognitive and physical tasks are performed in a complex system in which individuals and objects interact in conditions of rapid change (Salmon et al., 2009).

Situation Awareness and complexity are, then, in a close relationship, at least as close as the relationship between complexity and unpredictability: "Weather is the classic example: many components interacting in complex ways, leading to notorious unpredictability. Ecosystems, for instance, economic entities, developing embryos, and the brain - each is an example of complex dynamics that defy mathematical analysis or simulation" (Lewin, 1999).

In school, SA has to be deepened for the implication about body and perception in physical education and the natural development of the pupils. There is no trace in preschool and primary school documents (Raiola 2011ab) despite the importance of the matter in order to train the teacher. This study would be a theoretical study based on reviewing specific literature and the aim is to direct the scholar on physical activities and sport in an educational praxis, alongside new interpretative keys. To speculate an innovative paradigm on motor learning and skill in sport according to new scientific evidence on brain function.

SITUATION AWARENESS AND COMPLEXITY

The universally accepted definition of SA is that provided by Endsley (Endsley, 1988). Endsley defines SA as «the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future» (Endsley, 1988). The definition of Endsley refers to a process articulated in the three stages of perception, comprehension, and projection. The perceptual level (1) concerns the collection of relevant environmental information, while the comprehension level (2) "encompasses how people combine, interpret, store, and retain information". Comprehension level "includes more than perceiving or attending to information, but also the integration of multiple pieces of information and a determination of their relevance to the person's goals" (Endsley, 1988). The last stage of the process, the Projection level (3), involves instead "the ability to project from current events and dynamics to anticipate future events (and their implications)" and then "allows for timely decision making" (Endsley, 1988). Endsley explicitly links awareness of the situation with the ability "to anticipate future events (and their implications)" (Endsley, 1988). Situation Awareness and decision making are strictly linked.

Awareness of the situation is crucial for timely decision-making, according to Endsley, when the complex nature of the situation does not allow a "linear" analysis. Antonio Damasio informs us, elsewhere, that different types of knowledge (declarative knowledge, enactive knowledge) work in additive and non-alternative ways, and rely on different neural systems:

"Deciding advantageously in a complex situation is thought to require overt reasoning on declarative knowledge, namely, on facts pertaining to premises, options for action, and outcomes of actions that embody the pertinent previous experience.[...] Overt reasoning is preceded by a nonconscious biasing step that uses neural systems other than those that support declarative knowledge" (Bechara, Damasio, Tranel, & Damasio, 1997).

However, the situation awareness-anticipation link seems to go far beyond the conceptual debt that Endsley pays to the cognitivist paradigm (the perception-comprehension-projection triad seems to faithfully reshape the IPO model - input-processing-output) to embrace a vision of the paradigm perception-action that has metabolized the contribution of neuroscience (Di Tore, 2015). Elite athletes, for example, in a situation sport, do not apply linear pre-processing-action schemes, but rely on instant synthesis that immediately selects, among the myriad of available data, those considered significant (Raiola 2017, Raiola & D'isanto, 2016ab).

We are faced with the "lightning recapitulation of rational processes rooted in the senses, the ability to go from the known to the unknown time on the basis of clues," as Carlo Ginzburg wrote, postulating a "circumstantial paradigm" (Ginzburg, 1979). If our brains were forced to process all the information that the perception of the outside world provides them to decide how to act in a certain situation, the task would be too costly and complex to allow for timely decision-making: we would be consistently late and we would not be able at the end to produce effective decisions (Rivoltella, 2014). Berthoz writes: "the brain solves the complexity of the outside world producing perceptions consistent with the intentions regarding the future, the memory of the past and the laws of the outside world that it has internalized" (Berthoz, 2011a). Faced with the complexity, in other words, the brain tries to be one step ahead. "The perception of a form or an object is never passive, it is always a decision. When I look at the objects and forms here, whether the room, your face, your body or objects, my brain does not just analyze it, he decides, he anticipates" (Berthoz, 2011a). The idea of the perception-action binomial, matured in the phenomenological reflection, consolidated in neuroscience research, thinks the two moments of perception and action are not as consecutive and discrete, but with a paradigm reversal, perception is the function of action (Carlomagno et al, 2013). "The perception

does not represent the world, but constitutes it as Umwelt. The action does not just react to the event, she precedes it with simulation or emulation[...] Our notion of action is much richer than current sensorimotor theories that continue to subordinate it to the category of movement" (Berthoz & Petit, 2006).

In this perspective, the human brain is not a processor, but an emulator: "Human brain is not an open system [...] that accepts inputs from the environment, processes them, and returns them to the world reflexively regardless of their complexity", but is a "closed system modulated by the senses [...] a self-activating system, whose organization is geared toward the generation of intrinsic images, capable of emulating reality (generating emulative representations or images) even in the absence of input from such reality, as occurs in dream states or daydreaming. From this, one may draw a very important conclusion. This intrinsic order of function represents the fundamental, core activity of the brain. This core activity may be modified (to a point!) through sensory experience and through the effects of motor activity" (Llinás, 2002).

CONCLUSIONS

From this point of view, SA has the function to decipher a complexity approachable in terms of data processing and a decision between alternative opportunities. The activity of the body, assumed as a complex system, is characterized by a significant reduction of any pre-established complexity and by the introduction of "simple" accessory complexity linked to the local situation. This "simple" complexity, reduced and recoded in function of action, in a form compatible with its own needs, is, in fact, Situation Awareness.

Consequently, the traditional vision of mind theories and motor learning should also be viewed in an opposite way - as referring to actual scientific, instead of ordinary reflections (Raiola, 2014). In this way, it needs a new vision for teaching physical education and sport at school, alongside the educational needs for everybody.

On the other hand, the competitive level does not have an exclusive solution for the cognitive approach because the technical and tactical aspects contain complex situations that cannot be predicted. The cognitive approach in the teaching/learning process has too much limits to become the unique teaching method; the prescriptive nature of cognitive approach doesn't help the athletes in the completion phenomenon because the environment cannot be built since it is, too often, unpredicted by the player before it happens.

Thus, heuristic learning, alongside prescriptive teaching, is the complementary way to follow and it is where the athlete is conscious of his/her own perspective. The parts of this article are attributed by the authors as following:

Di Tore Pio Alfredo has written the Abstract, Situation Awareness and Complexity

D'Isanto Tiziana has written the Introduction, Conclusion and References

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SITUACIJSKA SVIJEST U SPORTSKOJ NAUCI: VAN KOGNITIVNE PARADIGME

U sportu je sve više rasprostranjena svijest da su kognitivne i perceptualne sposobnosti poput iščekivanja, donošenja odluka i svijesti o situaciji preduslovi za odličnu izvedbu. Iskusni sportisti razvijaju, kao rezultat dugotrajne vježbe, sofisticirane strukture poznavanja specifičnih zadataka koje im omogućavaju da se efektivnije i efikasnije nose sa situacijama od drugih osoba. Elitni sportisti, na primjer, selektivno posmatraju mjesto, fokusirajući se na relevantne izvore, te istovremeno odbacujući nebitne informacije. Osim toga, iskusni sportisti su više svjesni događaja koji se vjerovatno mogu desiti u određenoj situaciji, te su sposobni da prepoznaju kontekstualne signale koji im mogu olakšati predviđanje budućih događaja. Ove vještine dopunjavaju širok repertoar dostupnih strategija i taktika, te poznavanje njihove brzine u određenoj situaciji.

Ključne riječi: Praktično znanje, senzomotorički sistem, donošenje odluka, elitni sportisti.

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ISOLATED PROXIMAL ILIOTIBIAL MUSCLE STRAIN IN A PROFESSIONAL SOCCER PLAYER: CASE REPORT

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ABSTRACT

Muscle strain is the most common cause of muscle injuries, resulting from a high force lengthening contraction. Hip muscle injuries are often linked to participation in sports that require sudden hip movements. The iliotibial muscle is among those structures biomechanically exposed to these problems. However, to the best of our knowledge, no case of isolated iliotibial muscle strain has been reported until now. A 25-year-old male professional soccer player presented with sudden, mild onset of right hip pain during a training session when jumping hurdles. The pain was associated with impaired ipsilateral limb function. MRI examination showed fluid collection in iliotibial muscle belly, along with a partial tear, but no complete disruption of the muscle. The patient's return-to-play progression included physical modalities, swimming, biking, and progressive running, along with hip strengthening, core stability and plyometric exercises. The patient was symptom-free 10 days later, playing competitive professional soccer and did not report recurrence in the following 10 months. Isolated proximal iliotibial (PI) muscle strain is a rare pathology affecting elite soccer players that requires proper characterization and management to promote full recovery. An early, multimodal intervention allows an immediate return to competitive activity, avoiding prolonged or incomplete recovery. Level of Evidence: 4

Keywords: Hip, Tensor Fasciae Latae, Muscle Injury, Magnetic Resonance Imaging.

BACKGROUND AND PURPOSE

Muscle injuries constitute almost one third of all time-loss injuries in men's professional soccer, and 92% of all injuries affect the four big muscle groups in the lower limbs: hamstrings, adductors, quadriceps, and calves (Ekstrand, Hägglund, & Waldén, 2011). Muscle strain is the most common cause of muscle injuries, resulting from a high force lengthening contraction (Garrett, 1996).

By definition, we are against an indirect injury of muscle caused by excessive stretch. Muscle strains are most commonly encountered in sports that imply sudden acceleration tasks such as soccer, rugby, basketball, and track and field activities, and are more prone to occur in the gastrocnemius, hamstrings, quadriceps, and adductor longus muscles. Hip muscle injuries are often linked to participation in sports that require sudden hip

movements, both in coronal and sagittal planes, both open and closed-kinetic chain solicitations, such as American football, tennis, or soccer. Rectus femoris, adductor longus, psoas major and sartorius muscles are more often injured than iliotibial muscle; together, these muscles form a complex that controls hip movements. The tensor fasciae latae (TFL) muscle plays an important role as hip stabilizer (J. W. Orchard, Fricker, Abud, & Mason, 1996). Strain injuries affecting iliotibial muscle insertion were first highlighted by Sher et al., who described a distinct entity at the iliac tubercle enthesis called "Proximal Iliotibial Band Syndrome". However, muscle belly abnormalities of this muscle are not considered to be part of this syndrome (Huang et al., 2013). To the best of our knowledge, no case of isolated iliotibial muscle strain has been reported until now. The purpose of this report is to describe a case of acute strain of the proximal iliotibial muscle in a professional soccer player.

CASE REPORT

A 25-year-old Caucasian male, international professional soccer player, in otherwise good general health presented with right hip pain right immediately after soccer training, without any prior history of similar signs. He described a minimal resistance force in a jumping-hurdle exercise causing sudden, opposite gesture -hip extension- during the required hip flexion action. Only describing minimal discomfort and no apparent effusion, he continued to play on. The discomfort progressed over the session in spite of changing tasks. Despite this event, he was able to complete the session to its end.

Clinical examination of the hip revealed a mild effusion and non-specific anterolateral tenderness with full active flexion and abduction, as well as internal rotation, and also experienced pain upon hip flexion resistance on the affected side. There was no further evidence of articular injury. Costal and pelvic examination, abdominal and visceral palpation were within normal limits. No abnormalities in static inspection of the pelvis and right hip were elicited. The patient's pain worsened with squatting, and palpation revealed iliotibial muscle pain under ASIS and also in Ober's manoeuvre. Iliotibial muscle contraction from a neutral hip position was painless and the specific Flexion – ABDuction – Internal Rotation manoeuvre with previous TFL stretch evoked minor discomfort. A bruise appeared 24 hours after injury, and a 2-cm deep tumefaction indicated a hematoma.

Magnetic resonance imaging (MRI) was performed on a 3 Tesla Unit, 48 hours after the initial episode. MRI study highlighted fluid collection in iliotibial muscle belly – lower third – suggesting an acute, isolated injury of this structure (Figures 1 and 2), with swelling, oedema and a partial tear, but no complete disruption of the muscle. The proximal muscle and its tendon insertion remained intact. The rest of the MRI examination was not relevant, with no further evidence of bone marrow oedema or fractures in the pelvic ring. No further acute muscle injuries were identified. There were no signs of pelvic ring fracture on X-rays, as expected.

Analgesic treatment (level 1, paracetamol) and

local icing did not relieve this mechanical pain, which was present in activities of daily living like walking, or sitting with a flexed hip. A program of 10-min local icing and compression every hour was implemented during the acute phase (days 1-3).

Hyperthermia (R200, 3Instrumentacion®, Vitoria, Spain) was applied on the area, adapted to the patient's tolerability. The patient was advised not to participate in any activity for the first 48 hours. Consequently, symptomatic soft tissue treatment of the stiff hip flexor – abductor – and gluteal muscles was implemented to promote faster healing. The patient was able to ride a bike and swim on the third day after the injury episode, to run on the fifth day, to play soccer on the eighth day, and to compete on the tenth day. Hip strengthening exercises were resumed on day 6, along with core stability exercises. The final stage of rehabilitation emphasized eccentric exercises and plyometrics.

A follow-up MRI examination on day 8 revealed progressive, acceptable healing of the injury. Ten days after the onset of pain, a competition was scheduled and the player was feeling ready to participate. The patient was symptom-free 10 days later, playing competitive professional soccer and did not report recurrence in the following 10 months.

DISCUSSION

To our knowledge, no case of isolated iliotibial muscle strain has been reported until now in association with soccer practice or any other activity. Hip flexors injuries are most often reported in athletes who participate in sports that involve kicking, slipping, or sudden and sharp changes of direction.

Muscle strains are most commonly encountered in sports that imply sudden acceleration tasks such as soccer, rugby, basketball, and track and field activities, and are more prone to occur in the gastrocnemius, hamstrings, quadriceps, and adductor longus muscles, affecting athletes involved in high-speed activities.

Literature discussing the involvement of the proximal iliotibial (PI) muscle in male athletes is scarce. Those cases reported involve female runners or obese elderly women (Guadagnini Falotico, Aramaki Yanagishita, Neves Wever, Pecci Neto, & Takata, 2013; Posadzy-Dziedzic & Vanhoenacker, 2012). All these papers described a non-typical form of enthesopathy

that shows an increased signal along the lower border of the iliac tubercle in T2-weighted MRI studies, an overuse condition affecting the enthesis of the iliotibial band (ITB) and characterized by pain and swelling in the pelvic region (Posadzy-Dziedzic & Vanhoenacker, 2012). Sher et al. described the fascia lata insertion along the entire lower border of the iliac crest. A thickening of the fascia lata at the iliac tubercle occurs, eliciting the formation of the ITB. This band constitutes a fibrous, longitudinally-oriented structure that receives contributions from tendons arising from gluteus maximus and tensor fasciae latae muscle. No reference was identified by our research group regarding isolated, incomplete, intra-substance tears of the iliotibial muscle among soccer players nor any other sportsmen. It is uncertain if the injury is uncommon or common and seldom imaged or reported. Despite the infrequent occurrence of this injury, we are reminded that specific imaging examination of the muscle tissue with MRI to assess structural implication is a relevant resource for the characterization of this condition. Biomechanically, it has been postulated that a greater hip adductor movement and a consequent overload in the lateral muscles – trying to maintain pelvic balance – exist among female population, due to their pelvic width/femoral length greater ratio (Phinyomark, Hettinga, Osis, & Ferber, 2014), and should be distinguished from ASIS avulsion injuries. They present with minimal effusion and anterolateral hip pain.

MRI emerges as a crucial technique for the diagnosis of PI muscle strain, which, due to this clinical condition, can be confounded with several other injuries, i.e. both intra and extra-articular diseases of the hip. MRI can offer a precise diagnosis of the lesion, the examination providing information on any associated pathology, allowing the differential diagnoses of an articular or abarticular origin to be excluded (Omar & Blount, 2015). Muscle strain can be revealed by a high signal intensity on conventional and fat-suppressed T2-weighted studies according to its pathogenesis. Making a differential diagnosis between an ASIS avulsion and a small myotendinous lesion of the rectus femoris may be subtle in MRI. Additionally, muscle strain on this location should be differentiated from muscle bruise because both entities are characterized by similar findings on MRI. These differences can be clinically elucidated because muscle bruise is usually caused by direct damage/injury, e.g. impact, contusion. Our case showed a high signal intensity in the muscle belly, but no contusion was reported. Moreover, MRI studies help

in investigating not only the hip region, but also to cover the entire pelvis as well (Agten, Sutter, Buck, & Pfirrmann, 2016).

Clinical examination tries to reproduce the pain through the Ober's test (Wang, Jan, Lin, & Wang, 2006), and often allows diagnosis before the imaging examination. The role of this manoeuvre in assessing ITB tightness has been recently questioned (Willett, Keim, Shostrom, & Lomneth, 2016). The clinical presentation of an acute muscle lesion of the psoas or the deep muscles of the hip might be similar and interfere with proper diagnosis (Johnston, Wiley, Lindsay, & Wiseman, 1998). MRI exploration of the region confirms the diagnosis. Unrecognized PI muscle strain may lead to unsolved anterolateral hip pain with consequent loss of function and pain. The literature supports the conservative treatment of muscle tears (De Carli et al., 2009; Garrett, 1996; Guillodo & Sarau, 2009; J. Orchard & Best, 2002). However, several approaches have been proposed by sports medicine practitioners in an attempt to shorten the recovery periods from muscle injury. Initial management of lower limb muscle strain ranges from oral medication, rest, icing, compression, and elevation (RICE) to prolonged immobilization in cases of severe muscle injury. Recovery programs usually include muscle strengthening exercises, indirect solicitation of affected muscles, (e.g. cycling on an exercise bike) and guidance on resuming sport (J. Orchard, Best, & Verrall, 2005).

This clinical report describes a rare case of PI muscle injury in a professional soccer player. The PI muscle strain is a limiting hip condition that, although infrequent, needs to be correctly dealt with by clinical practitioners. Its identification should be initially obtained through the clinical presentation and should be confirmed by means of a properly requested MRI. Differential diagnosis, among hip injuries in athletes, should include the strain of the hip abductors, including the iliotibial muscle. An early, properly designed intervention based upon cryotherapy and compression, radiofrequency, swimming, progressive running, hip and core strengthening exercises and plyometrics allows an immediate return to competitive activity, avoiding prolonged or incomplete recovery. Further clinical research is needed to corroborate the findings of this case report.



Figure 1: T2 weighting and FAST SPIN ECHO coronal MR image of the pelvis. Iliotibial muscle injury indicated on the right (arrows), and normal appearance on the left (arrowheads).

Figure 2: T1 weighting and SE axial MR image of the pelvis. Iliotibial muscle injury indicated on the right (arrows), and normal appearance on the left (arrowheads).

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IZOLIRANO PROKSIMALNO ILIOTIBIJALNO ISTEGNUĆE MIŠIĆA KOD PROFESIONALNOG IGRAČA FUDBALA: PRIKAZ SLUČAJA

Istegnuća mišića su najčešći uzroci povreda mišića koje nastaju usljed snažnog istezanja kontrahovanog mišića. Povrede mišića kuka se često vežu za učešće u sportovima koji zahtijevaju nagle pokrete kukova. Iliotibijalni mišić pripada onim strukturama koje su biomehanički izložene ovim problemima. Međutim, prema dosadašnjim saznanjima, do sada nije prijavljen slučaj izoliranog iliotibijalnog istegnuća mišića. Dvadesetpetogodišnji profesionalni igrač fudbala je zadobio iznenadni, blagi napad boli u desnom kuku tokom treninga prelaska preko prepona. Bol je bila povezana sa smanjenom ipsilateralnom funkcijom udova. Pregled putem magnetne rezonance (MRI) je pokazao sakupljanje tečnosti u iliotibijalnim mišićnim vlaknima uz djelimično napuknuće, ali bez potpunog puknuća mišića. Napredak pacijenta za povratak u igru je uključivao fizičke modalitete, plivanje, biciklizam i progresivno trčanje uz vježbe za jačanje kuka, stabilizaciju trupa i eksplozivnu snagu. Pacijent nije pokazivao simptome nakon 10 dana, te je učestvovao u takmičarskom, profesionalnom fudbalu i nije zapazio povratak simptoma u narednih 10 mjeseci. Izolirano proksimalno iliotibijalno (PI) istegnuće mišića je rijetka patologija koja pogađa elitne igrače fudbala, te zahtjeva pravilnu karakterizaciju i upravljanje kako bi se promovisao potpuni oporavak. Rana, kombinovana intervencija omogućava skori povratak bavljenu takmičarskim aktivnostima izbjegavajući prolongirani ili nepotpuni oporavak.

Ključne riječi: Kuk, tensor fasciae latae, povreda mišića, magnetna rezonanca.

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DIFFERENCES IN FITNESS COMPONENTS BETWEEN TWO TYPES OF DANCERS

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ABSTRACT

The aim of this research is to determine the differences in fitness components between two types of dancers. 80 male dancers in total participated in the research: 35 dancesport and 45 folk dancers from the territory of the Autonomous Province of Vojvodina, in the age range of 18 to 22. Variables were divided into 5 categories: cardiorespiratory fitness, flexibility, muscle strength, muscular endurance and body composition. The results were analysed through basic descriptive and comparative statistical procedures. Statistically significant differences of arithmetic means between these two groups of dancers may be observed in the following tests: anaerobic threshold of running speed, resting heart rate, maximum strength trunk flexor, body mass index and bone tissue percentage, while high statistically significant differences are observed on maximum heart rate, shoulder flexibility, supine straight leg raise tests. The reason probably lies in different technical requirements, i.e. dancers partaking in different types of dance possess elements that essentially differ in motion characteristics.

Keywords: Body composition, endurance; flexibility, strength, VO_{2max} .

INTRODUCTION

Dance is an art that, like all other arts, originated from the life itself and, thus, represents one of the oldest social phenomena. Along with the development of a society, dance has been changing through historical epochs, evolving in character and style. The basis of all dances is an expression of emotions and emotional states through movement. Dance may be defined as a form of musical experience, which, through rhythmic movements and steps, contributes to the artistic expression of a man's spiritual state of mind (Mandarić and Jovančević, 2017). In dance, a man expresses his body through movement that is spatially, dynamically and temporally shaped. Every nation has its own folk dance that originated in line with the way of life and its culture. The value of folk dance is enormous since tradition and culture

of every nation is cherished in such a way. The main characteristic of Serbian folk dances is represented by simultaneous participation of a larger number of dancers, i.e. a group dance.

Serbian folk dances are very numerous and different. Mixed gender "kolo" is most often danced; male and female dancers are alternately arranged in "kolo", while, in particular geographical areas, male and female dancers dance in a separate "kolo" or in one "kolo", but arranged in opposite parts. Dancesport is a sports discipline originating in the separation of particular dances from their original context with targeted, remodelled dance steps and a performance technique, uniformity, introduction of rules and elements of holding the partner and, thus, creating a pair and the dancers' pathways in space. There are four competition disciplines in the official world competition of the dancesport programme: standard dances,

Latin-American dances, combination (ten dances) and formations. When dance is considered at the sports level and as a sport achievement, then the following could be said: With regards to the sports result, it is of very high importance that the conditioning training of a sportsman is monitored in every moment, along with adequate conditioning related to the competition cycle and calendar. Conditioning training is a good indicator of a trained sportsman and of essential importance for reaching the greatest sporting accomplishments.

As for the dancesport, competition on the stage is the ultimate goal of every dancing pair, i.e. a place where they can show their acquired dancing skill. Success in performing a dancing skill does not only depend on aesthetic movement, but also on the motor ability (Liiv et al., 2014; Li et al., 2015; Franklin, 2003; Koutedakis et al., 2007; Srhoj et al., 2006; Watson, 2017; Wyon et al., 2007), specific features (sense of rhythm, spatial orientation, spatial coordination ability), musical interpretation and team work (Kattenstroth et al., 2011; Štrbová, 2002). Research in the area of functional abilities (Liv et al., 2013; Liiv et al., 2014; Vaczi et al., 2016) shows a significant influence of the abilities on success in dancing, while the absolute and relative consumption of oxygen increases by applying a precisely defined training programme for dancers. Furthermore, the research was conducted and monitored in terms of functional abilities and their effects, along with the cardiorespiratory status (Bria et al., 2011). The authors agree in their assessment, while the results prove that dance is very good for the improvement of cardiorespiratory characteristics (Gomes Neto et al., 2014). It is an indisputable fact that the impact on the development of motor abilities is directly connected to the level of a dancer's success. All these factors, as a whole, produce a complete dancer (Jovančević, 2016).

Based on the aforementioned, the subject of this research are fitness components of the dancers partaking in different types of dance, while the aim of the research is to establish fitness abilities of dancesport and folk dancers. Emphasis is placed on establishing fitness components of the dancers and their differences that may be associated with a particular type of dance.

THE METHOD

The sample of participants

The research was conducted on a sample of 80 male dancers from the territory of the Autonomous Province of Vojvodina, aged 18 to 22, which were divided into two groups. The first group consisted of dancesport dancers

(N=35). The second group consisted of folk dancers (N=45). On average, they were training for 8 to 10 years, for two hours, five times a week. The subjects were participants in numerous competitions and national championships, as well as numerous folklore concerts. All subjects gave their consent for the testing.

The sample variable

Starting from the subject and goal of the research, the variables that could be divided in five groups were examined. The following tests were used for the purpose of cardiorespiratory fitness: relative oxygen consumption (ml/min/kg) - (VO_{2max}), anaerobic threshold expressed through heart rate value, anaerobic threshold expressed through the running speed value (km/h), heart rate max (HRmax), resting heart rate. For flexibility assessment: shoulder flexibility, deep forward bend, supine sideways leg splits, supine straight leg raise. For muscle strength assessment: trunk flexors, trunk extensors absolute, leg extensors, maximum strength jump. For muscular endurance: maximum strength trunk flexors, maximum strength trunk extensors, endurance jump. For body composition assessment: body mass index (BMI), muscle mass percentage, adipose tissue mass percentage, bone mass percentage. In order to assess the subjects' body characteristics, their body height was determined and measured using a Martin anthropometer. The results were read with precision of 1 mm. Body weight was measured by means of bioelectrical impedance (Biospace Inbody 230).

Testing protocol

Testing was conducted in the Regional Institute for Sport and Sports Medicine (RISSM) in Novi Sad from 9 am to 12 pm. All measurers are physical education teachers employed in the RISSM. Cardiorespiratory fitness tests are as follows: relative consumption of oxygen, anaerobic threshold expressed by heart rate value, anaerobic threshold expressed through running speed and maximum heart rate. A spiroergometry lab test was used. Direct measurement of VO_{2max} was performed on the treadmill (Cosmed T150-Italy) with the use of a gas analyser (Cosmed Quark b2-Italy) by means of a progressive overload increase. The testing protocol is such that, after a warm-up (3 minutes at the speed of 3 km/h, without inclination), the speed up to 7 km/h is linearly increasing (each minute per 1 km/h with the inclination of 1.5%).

Furthermore, an increase of 0.5 km/h every 30 seconds follows, with the continued constant inclination up to 1.5%. In addition to determining VO_{2max} , the running speed data with VO_{2max} were also obtained by using this test. All the tests for muscle strength assessment were performed in the RISSM on the electronic reaction dynamometer with the fixing. The probes attached to the computer were made by the company Hottinger Baldwin Messtechnik (HBM) Inc. Marlborough from Darmstadt, Germany. The probes RSCA C1/200 were certified under the number TC2631 and classified as D1. The serial number is 381201A. Maximum force was 1000 N (Newton) with the electrical potential difference of .0286% V (volts). The device for converting the force impulse into digital impulse measured by the probe is called Digitale Aufnehmerelektronik AED 9001, and it is made by the same manufacturer. For the maximum strength jump and jump endurance tests, "Fitro jumper" manufactured by the Slovakian manufacturer of diagnostic equipment "Fitronic s.r.o. Pc system" was used for the assessment of the explosive power of lower extremities. It is comprised of a contact pad, serial port interface

and software programme. The board detects presence/absence of sportsman on the platform (the gravity centre of the subject) and, accordingly, the programme package shows other jump parameters (Ostojić et al., 2010). In order to determine the body composition, the method of bioelectrical impedance (BIA) is used with the Biospace Inbody 230 device. The basic descriptive parameters are calculated: mean value (Mean) and standard deviation (SD). In order to check the normality distribution, skewness and kurtosis were applied. For the purpose of determining the differences between the groups, MANOVA and ANOVA were applied. In order to have more complete consideration of hierarchical differences in fitness components, canonical discriminative analysis was applied. The data were processed by means of the statistical package SPSS 21.0.

RESULTS

In this part of the research, the results of individual conditions were shown in each of the five applied variables. This was done in order to determine the fitness status of dancesport and folk dancers and, at the same time, for their comparison.

Table 1: Descriptive parameters of folk and dancesport dancers

Variable	Dancesport dancers (n=35)			Folk dance dancers (n=45)		
	Mean±SD	Ske	Kur	Mean±SD	Ske	Kur
Body height	178.11±7.49	.404	.538	182.37±7.09	.385	.502
Body weight	70.86±9.63	.620	.654	80.66±9.98	.652	.692
VO2max	52.62±9.53	.246	-.569	47.09±8.58	.231	.065
Anae Thrh / HR val	182.00±4.14	.266	-.788	181.45±4.25	.449	-.533
Anae Thrh / RS val	14.83±1.20	.495	-.449	16.04±1.33	-.621	-.103
HR max	188.23±7.04	.573	-.780	197.50±6.33	-.905	-.334
Resting heart rate	73.92±6.36	-.878	.345	80.75±8.18	-.658	-.935
Should flexibility	56.92±13.05	.814	.624	79.80±15.56	-.662	.491
Deep Forward Bend	33.69±8.13	-1.115	1.701	34.38±6.54	-.736	2.640
Sup Side leg splits	100.08±7.80	.454	-.818	105.30±9.56	-.609	1.168
Sup Straig leg raise	86.92±8.78	-1.134	.319	95.65±7.82	-.964	1.183
Trunk Flexors	65.85±16.84	-1.362	.333	66.45±8.79	.538	-.165
Trunk Extre absolute	149.00±31.02	-1.144	.072	150.65±29.63	.500	-.509
Leg Extensors	228.54±61.33	-.503	-1.092	250.95±55.02	.967	1.876
Stren Jump max	36.03±4.01	-.832	.492	31.76±7.31	-.754	-.130
Stren Trunk flex max	63.00±5.82	.703	.631	62.70±7.71	-.065	-.980
Stren Trunk extre max	60.46±5.71	.310	-1.564	54.30±8.11	-1.142	1.698
Endurance Jump	23.18±3.36	.736	-.797	23.78±3.92	-.507	-.257
BMI	22.28±1.99	1.317	2.877	24.21±2.13	1.119	1.143
Muscle mass %	47.70±1.07	.652	3.087	48.30±2.18	.121	-.757
Adipose mass %	10.38±2.53	.416	-1.022	11.70±2.76	1.395	2.983
Bone mass %	17.19±1.29	.065	-1.075	16.07±1.36	-.380	-.105

Legend: SD – standard deviation

Table 1 shows that the observed behaviour in all cardiorespiratory assessment tests is in line with the normal distribution. The test results for joint mobility assessment of the dancesport dancers, namely the shoulder flexibility and the straight leg raise, indicate normal distribution, while the test results of deep forward bend have a mild negative asymmetry and the kurtosis larger than normal. The supine straight leg raise test indicates negative asymmetry in relation to normal distribution. As for the folk dancers, the shoulder flexibility test is in line with normal distribution, while the other three tests show kurtosis larger than normal. The test result for maximum strength jump of the dancesport dancers is in line with normal distribution. The test results for trunk flexor and extensor maximum indicate negative asymmetry, while the test results for leg extensors have smaller kurtosis than normal. Elongation greater than that with the normal distribution is seen in the folk dancers, in the leg extensors test, while the other tests used for the assessment of muscle strength variable show normal distribution. As for the assessment of the dancesport dancers' muscular endurance, normal distribution is observed in all tests except the trunk extensors maximum test, whereas smaller kurtosis than normal is observed. As for the folk dancers, out of all the observed tests of muscular endurance, attention should be paid to the trunk extensors maximum test since it has negative asymmetry in relation to the normal distribution and elongation that is greater than normal. When assessing body composition of the dancesport dancers, the body mass index is positively asymmetric and elongation is greater than normal, while normal distribution is observed with other tests. Positive asymmetry in comparison to normal distribution along with elongation

greater than normal is observed in the body mass index and adipose tissue percentage of the folk dancers. In Table 2, MANOVA results show that the F-test is bordering statistical significance of $p=.05$. It may be concluded that the dancesport and folk dancers are statistically significantly different in the system of applied parameters for the assessment of the basic fitness status. Individual differences in each parameter are established by the ANOVA procedure.

Statistically significant differences of the arithmetic mean between the dancesport and folk dancers may be observed in the following tests: anaerobic threshold of running speed, resting heart rate, trunk extensors maximum, body mass index and bone tissue percentage, while statistically significant differences are observed in the tests for maximum heart rate, shoulder flexibility, straight leg raise, which may be observed in Table 3.

Table 2: Multivariate Analysis of Variance (MANOVA) - all parameters between folk and dancesport dancers

Effect	Value	F	Sig.
Pillai's Trace	.858	2.752*	.050
Wilks' Lambda	.142	2.752*	.050
Hotelling's Trace	6.054	2.752*	.050
Roy's Largest Root	6.054	2.752*	.050

There is a statistically significant difference in average body weight of the observed groups, while there is no statistically significant difference of the body height parameter.

Table 3: Univariate Analysis of Variance (ANOVA) - all parameters between folk and dancesport dancers / * $r=.05$, ** $r=.01$

Variables	Type III Sum of Squares	Mean Square	F	Sig.
Body height	142.955	142.955	2.718	.109
Body weight	755.254	755.254	7.778**	.009
VO2max	240.907	240.907	3.001	.093
Anae Thrh / HR val	2.383	2.383	.135	.716
Anae Thrh / RS val	11.616	11.616	7.069*	.012
HR max	676.935	676.935	15.484**	.000
Resting heart rate	367.206	367.206	6.480*	.016
Should flexibility	4.123.392	4.123.392	19.233**	.000
Deep Forward Bend	3.672	3.672	.071	.792
Sup Side leg splits	214.938	214.938	2.699	.111
Sup Straig leg raise	600.042	600.042	8.911*	.005
Trunk Flexors	2.873	2.873	.018	.893
Trunk Exte absolute	21.450	21.450	.024	.879
Leg Extensors	3.957.334	3.957.334	1.195	.283
Stren Jump max	143.705	143.705	3.689	.064
Stren Trunk flex max	.709	.709	.014	.906
Stren Trunk exte max	299.115	299.115	5.649*	.024
Endurance Jump	2.866	2.866	.207	.652
BMI	29.441	29.441	6.801*	.014
Muscle mass %	2.836	2.836	.846	.365
Adipose mass %	13.792	13.792	1.934	.174
Bone mass %	10.013	10.013	5.654*	.024

Table 4 shows discriminative function structure. It may be observed that the following variables have the largest projections to discriminative function: shoulder flexibility, heart rate max, supine straight leg raise, body weight and anaerobic threshold of running speed, whereas statistically significant difference between the dancesport and folk dancers has already been established. These variables actually contribute to the greatest differences.

Table 4: Discriminative function structure

Variables	Discriminative Function
Shoulder Flexibility	.344*
HR max	.309*
Sup Straig leg raise	.234*
Body weight	.219*
Anae Thrh / RS val	.209*

DISCUSSION

While observing Table 1, which presents descriptive parameters of the dancesport and folk dancers, skewness and kurtosis of the dancesport dancers are of normal distribution, thus, it may be ascertained that the mean values represent the actual state in this group. Therefore, the cardiorespiratory profile of the dancesport and folk dancers may be defined, although with a distinction that this is evident only in the analysed sample and it cannot be suggested in general terms. The mean values of VO₂max and anaerobic threshold are above the value in the standard population of the same age and gender. This may speak in favour of the dancesport and folk dances having influence on the improvement of cardiorespiratory functions, i.e. that activities in these two types of dance significantly increase aerobic power and efficiency. Mild advantage goes to the dancesport dancers that have shown greater aerobic power in comparison to the folk dancers. This certainly indicates that dancesport requires a higher level of cardiorespiratory fitness, or that it has a greater influence on the aerobic power in this sample than that of the folk dances. It was confirmed that, during a competition simulation, competitive ballroom dancers had the maximum oxygen intake (VO₂max) equal to swimmers or gymnasts (Bria

et al., 2011), but higher in other dance forms (Blanksby and Reidy, 1988; Liiv et al., 2014). By analysing flexibility, the greatest standard deviation has been obtained in the shoulder flexibility test as the subjects of this test have shown very different results. Despite some poor results, there were also some better results in comparison to the mean value, thus, the distribution

is normal. These results show that the dancesport dancers from the analysed sample have generally weaker flexibility in the shoulder region. The same may be said for the deep forward bend, whereas the larger number of subjects achieved weaker results. Other flexibility test results are of average value. Based on these results, it may be concluded that the dancesport and folk dances have not had remarkable limberness and, thus, this ability had probably been significantly neglected on the trainings or had not been expressed in the movement structures of the analysed sample. It is a fact that specific ways of training for particular dance disciplines may contribute to success in dancing (Deighan, 2005). It is necessary to develop motor abilities in order to accomplish particular success in dancing. These have been shown in the dance training research (Brown et al., 2007; Cross et al., 2005; Kattenstroth et al., 2011; Weiss et al., 2008). Distribution results in the test are as follows: maximum strength trunk flexors and extensors show mild negative asymmetry which means that a larger number of subjects have achieved better results than the mean value. Very high standard deviations are detected in the following tests: leg and trunk extensors absolute.

The range of the test results was very large and there was great heterogeneity. Some of the subjects had very weak leg muscles and trunk extensors, while particular dancers had very high values, higher than average in the standard population of the same age and gender. Trunk flexors were within average, while explosive power of lower extremities was slightly above the average. As for the folk dancers, there were very high standard deviations in leg and trunk extensors absolute variables. The range of test results was very large, since there was great heterogeneity. Trunk flexors were average, while explosive power of lower extremities was slightly above the average. Based on these results, it may be concluded that, in general, the muscle power of trunk and legs of the folk dancers is evident and significantly above the average than that of standard population. Equally, this suggests that engaging in folk dance has a positive influence, especially on the legs and trunk. The analysis of the test value of muscular endurance assessment with the dancesport dancers noticeably shows that all the distributions are normal, along with the standard deviations, suggesting that the dancers' group has shown high homogeneity in these tests. As for the folk dancers, it may be seen that only in the test-trunk extensors max, the skewness is beyond the limits of normal distribution and that there is a negative characteristic, meaning that a larger number of subjects had achieved better results. Standard deviations are approximating normal values, which means that the dancers' group has shown a high homogeneity in these tests. Based on the average variables of muscular endurance assessment, it may be concluded that such ability has not been particularly emphasized, but, on the other hand, the maximum values are in favour of the positive impact tendency of the dancesport and

folk dance on muscular endurance. The analysis of the distribution normality in the same Table 1 shows evident asymmetry in the body mass index values and, where the distribution is inclined towards higher values than the arithmetic mean, more subjects have achieved lower values. This is certainly a positive tendency of the dancesport impact on the body composition. This is further proved by lower values of adipose tissue percentage, which is one of the vital indicators and conditions for good health and stamina.

The percentage of muscular mass is above the average, in comparison to the standard population of the same age and gender. The analysis of the distribution normality results for assessment of the folk dancers' body composition shows asymmetry in the following values: adipose tissue percentage and body mass index, where the distribution inclines towards higher values than arithmetic mean, i.e. more subjects have achieved lower values for both parameters. Just as with the dancesport dancers, this is certainly a positive tendency of the folk dance impact on the body composition. Adipose tissue percentage value, as one of the vital indicators and conditions for good health and stamina, is lower. The percentage of muscular mass is above the average for standard population of the same age and gender. The obtained results may suggest a general conclusion that the engagement in the dancesport and folk dance has a positive influence on the body composition, especially on the reduction of adipose tissue percentage and an increase of muscular tissue percentage in this sample. Similar results may be found in the research in this area (Yanakoulia et al., 2000). Authors agree in their assessment that increased voluminosity is a burden to the body for the dance engagement. Table 4, showing the discriminative function structure, explains that the tests where statistically significant difference between dancesport and folk dancers had already been established had larger projections to discriminative function. This suggests that exactly those variables contributed to the greatest differences. Considering the mean values of all parameters, it is clear that this discriminative function belongs to the group of dancers that were engaged both in the dancesport and folk dance. The function is multidimensional and saturated by the parameters of body composition assessment, flexibility, and aerobic efficiency with some strength parameters. Therefore, these variables contributed to the largest differences between the groups.

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CONCLUSION

Therefore, in general, there is a statistically significant difference between the dancesport dancers and folk dancers in body composition, muscular strength, aerobic efficiency, explosive power and flexibility. The structure of the dancers' discriminative function shows that variables where statistically significant difference between the dancesport and folk dancers had already been established had the largest projections to discriminative function. The function is multidimensional and saturated by the parameters of body composition assessment, flexibility, and aerobic efficiency with some strength parameters. Therefore, these variables contributed to the largest differences between the groups. Considering the results of all the analysed variables of the dancesport dancers, it may be concluded that the engagement in the dancesport dances has the largest impact on cardiorespiratory fitness, body composition and explosive power, while the lowest on flexibility. Muscular endurance and strength indicate a development tendency and there is a likelihood of more prominent abilities if the sample is more extensive. Maximum values in these abilities show a very distinctive ability, but the mean values do not prove the claim that this ability is on a remarkable level when it comes to the folk dancers.

As for the results of all the analysed variables with the folk dancers, it may be concluded that the engagement in folk dances has the largest impact on cardiorespiratory fitness, body composition and muscular strength and the lowest on the flexibility and muscular endurance. Explosive power indicates a development tendency and there is a likelihood of better abilities if the research sample was more extensive. Maximum values of these abilities show a very distinctive ability, but the mean values do not prove the claim significant for the abilities of folk dancers. Based on the obtained results, it can be concluded that the fitness components are statistically significantly different between the dancesport and folk dancers. The possible reason may probably be found in different technical requirements, which means that dancers partaking in different types of dance have elements that are essentially different in motion characteristics.

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RAZLIKE U FITNES KOMPONENTAMA IZMEĐU DVE VRSTE PLESOVA

Cilj istraživanja bio je da se utvrde razlike u fitnes komponentama plesača dve vrste plesova. U istraživanju je učestvovalo ukupno 80 plesača muškog pola i to: 35 sportskog plesa, i 45 narodnog plesa sa teritorije AP Vojvodine, starosti između 18 i 22 godine. Varijable su podeljene u 5 kategorija: kardiorespiratorni fitnes, fleksibilnost, mišićna snaga, mišićna izdržljivost i telesnu kompoziciju. Rezultati istraživanja obrađeni su deskriptivnim i komparativnim statističkim procedurama. Statistički značajne razlike aritmetičkih sredina između ove dve vrste plesova mogu se uočiti na testovima: anaerobni prag brzine trčanja, srčana frekvenca u miru, opružać trupa maksimalno, indeks telesne mase i procenat koštanog tkiva, dok se statistički vrlo značajne razlike uočavaju na testovima maksimalna srčana frekvenca, iskret palicom, prednoženje iz ležanja na leđima. Najveće projekcije na diskriminativnu funkciju imaju testovi: iskret palicom, maksimalna srčana frekvencija, prednoženje iz ležanja na leđima, telesna težina i anaerobni prag brzine trčanja. Izvodi se zaključak da se bazične fitnes komponente statistički značajno razlikuju između plesača sportskog i narodnog plesa. Razlog je verovatno u različitim tehničkim zahtevima, tj. plesači različitih vrsta plesova imaju elemente koji se u osnovi razlikuju u kretnim karakteristikama.

Ključne riječi: Tjelesna kompozicija, izdržljivost, fleksibilnost, snaga, VO_{2max} .

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LATENT STRUCTURE OF THE GJILAN REGION CADET FOOTBALL PLAYERS' BASIC MOTOR ABILITIES

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ABSTRACT

The research was conducted on the sample of 160 young footballers in the cadet age of 14 to 16 years old from two schools, who are included in the training of the football schools K.F. "Gjilani 1", K.F. "Gjilani 2", K.F. "Drita 1" and K.F. "Drita 2". The goal of the research was to determine the latent structure of the cadet age footballers in relation to basic motor abilities with 24 variables. Young footballers play in the competition of the Gjilan regional league. This shows that the players from two selections, from both clubs, are included in the research, which shows the big popularity of football in this part of Kosovo which is included in the systematic training in their football schools. The data were analysed using the SPSS package, version 19. Based on the results in relation to basic motor abilities, by applying the factor analysis according to Guttman - Kaiser rotation, eight latent dimensions have been extracted, named as follows: 1. Lower extremity explosive strength factor, 2. Flexibility factor, 3. Lower extremity repetitive strength factor, 4. Flexibility factor of repetitive strength and explosiveness factor, 5. Flexibility and frequency of hand movements factor and 6. Flexibility and frequency of leg movements factor, 7. Balance factor and, 8. Ball balancing factor.

Keywords: Basic motor abilities, footballers, latent dimension, football schools, factor analysis.

INTRODUCTION

Football has become the most popular sport in recent years and is also the most important game nowadays. Better said, it's a planetary game, as it is being played on all six continents. And as such, it holds the most important place in the wide family of sports activities in which everyone participates, starting from simple street football players all the way up to the professional football female and male players. The football game is represented by a continuous growth in all dimensions, both in terms of quality, attraction, financial impact, and accessibility to the masses of the world's population, especially Kosovo. New roles in the attack and defence have established the need for intensive skills of the football players, especially the skills such as speed, explosive force,

flexibility, coordination, balance and precision which present the main indication in the football game. The basic prerequisite of effective movement is rational technique, which enables the player's full motor potential. Otherwise, the bad technique becomes a factor of disturbance in the realization of the movement and the limiting factor in the display of the motor capacities. Young cadets need freedom of expression to become creative football players. They need to be encouraged and motivated to try their skills without fear of failure. On 13th June, Kosovo was accepted to FIFA, the greatest house of football, which motivates new generations to play football. Similar research were found in the papers (Mekić, 1985), (Mikić, 2000) (Perić, 2007), (Bajrić, 2009), (Sylejmani, 2014), (Maliqi, 2014) (Bangsbo et al. 1991), (Gabrijelić et. al. 1983). According to the KFF regulation, the footballers from 14 to 16 years old belong to the category of cadets. The football cadets present the

perspective population that, with good expert work in the club and continuous monitoring of the developing abilities, should present the grounds for future junior, i.e. senior composition of football clubs.

RESEARCH METHOD

The research was conducted on the sample of interviewees consisting of 160 football players (cadets) that are registered in the football school K.F "Gjilani" from Gjilan and K.F "Drita" from Gjilan (the age span is 14 to 16 years old). They have been training for at least 3 years and have been actively playing football for the mentioned clubs. The interviewees belong to the football school K.F "Gjilani" (F.C. Gjilan) and football school F.C "Drita (F.C Drita) from Gjilan that compete in the Gjilan regional league. Prior to the testing, the interviewees were healthy, had undergone medical check-up and were able to include themselves in the process of measuring and testing.

VARIABLE SAMPLES

The selected variables in this research have hypothetically covered the basic motor skills (24 variables).

Tests to assess the basic motor skills

Tests to assess the explosive power: Long jump (MFESDM), High jump (MFESVM), Triple jump (MFETRO), Running 20 meters with high start (MFE20V), Speed assessment tests: Foot tapping (MBFTAN), Foot tapping on the wall (MBFTAZ), Hand rotation (MBFKRR), Leg rotation (MBFKRN). Coordination assessment tests: Leg slalom with two balls (MKLSNL), Side steps (MAGKUS), Envelope test- running in a rectangle (MAGTUP), Slalom running (MAGTSL).

Repetitive strength assessment tests: Push-ups (MRCSKL), Lying torso raise for 30" (MRCDTZ), Deep squats (MRCČUČ), Lying leg raise (MRCDNL), Flexibility assessment tests: Bench forward bend (MFLPRK), Right forward bend (MFLPRD), Side splits (MFLBOŠ), Straight leg raise (MFLPLU), Balance assessment tests: Standing transversally on both legs on a balance bench with eyes open and (MBAP20), Standing longitudinally on both legs on a balance bench with eyes open (MBAU20), Standing transversally on both legs on a balance bench with eyes closed (MBAP2Z), Standing longitudinally on both legs on a balance bench with eyes closed (MBAU2Z) (Mikić, 1999).

DATA ANALYSIS METHODOLOGY

Adequate mathematical – statistical procedures and methods are selected in accordance with the basic and specific targets of this paper: The test results obtained by this research have been analysed using the statistical package SPSS, statistics version 19, and then undergone the following statistical operations and procedures: Factor analysis /Main component method in order for the research to provide satisfactory scientific results, the adequate, correct and comparable procedures, compatible with the presented subject matter were used, which enabled determining latent dimensions and establishing basic legitimacy in the scope of this research. Having all these facts in mind, for the purpose of this research, the procedures considered to be compatible with the research subject were selected.

RESULTS AND DISCUSSION

Factorial structure of the football players' basic motor abilities

The adequacy of the information for applying the factor analysis has been determined in table 1 based on Bartlett and Kaiser-Meyer-Olkin tests, which shows a satisfactory index k that is statistically significant at the level $p < .01$. The data from table 1 confirm that this matrix can undergo factorial analysis.

Table 1: KMO values and Bartlett's Test of basic motor abilities

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.707
Bartlett's Test of Sphericity	Approx. Chi-Square	1333.817
	Df	276
	Sig.	.000

According to the calculation of the interrelation matrix characteristic equation by applying Guttman- Kaiser criteria, table 2., eight characteristic roots were obtained which an explanation (Cumulative %) 67.241% belongs to common variance. The individual contribution for explaining common variance (% of Variance) for the first latent dimension is 22.923 %, for the second latent dimension it is 9.188 %, for

the third latent dimension it is 7.555 %, for the fourth latent dimension it is 6.770 %, for the fifth latent dimension it is 6.036 %, for the sixth latent

dimension it is 5.464 %, the seventh latent dimension is 4.853 %, and the eighth factor for the latent dimension is 4.452 %.

Table 2: Characteristic roots of basic motor abilities

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.501	22.923	22.923	5.501	22.923	22.923
2	2.205	9.188	32.111	2.205	9.188	32.111
3	1.813	7.555	39.666	1.813	7.555	39.666
4	1.625	6.77	46.436	1.625	6.77	46.436
5	1.449	6.036	52.472	1.449	6.036	52.472
6	1.311	5.464	57.936	1.311	5.464	57.936
7	1.165	4.853	62.789	1.165	4.853	62.789
8	1.069	4.452	67.241	1.069	4.452	67.241

Oblimin rotation method has revealed 8 characteristic roots whose value is greater than one. According to the obtained results in table 2, 67.241% of the common variance belongs to the whole variable system for the assessment of basic motor abilities (matrix assembly that explains isolated factors). Out of this, the first factor carries 22.923% of variance, it is mixed but largely saturated by the explosive power assessment variables: triple jump – MFETRO (.797), long jump MFESDM (.787) and high jump – MFESVM (.695) Standing longitudinally on both legs on a balance bench with eyes open – MBAU20 (.564), which is named lower extremities explosive power factor.

The second factor carries 9.188% of variance, and in relation to the total common variance, it is composed of two variables for lower extremity flexibility assessment, right forward bend – MFLPRD (.854) bench forward bend – MFLPRK (.866). Having in mind the high variable coefficient for flexibility assessment, the second factor is named dual flexibility factor. The third factor (7.555%) is saturated with two variables: lying leg raise – MRCDNL (.835), torso raise with flexed legs MRSDTZ (.365). This is a dual “dual” factor, and it is named lower extremities strength repetitive factor. The fourth factor with 6.770 % participating in the common variance is saturated with the variables of coordination assessment, running in a rectangle (envelope test) – MAGTUP (.713), slalom running – MAGTSL (.665), one variable of repetitive strength, namely the legs squats – MRŠČUĆ (-.475) and the shoulder area push-ups – MRSSKL (-.506), running speed for 20m form high start – MFE20V (.460), so it might be considered as a factor of repetitive strength, coordination and explosiveness.

The fifth factor (6.036% of variance) participating in common variance is saturated with only one variable –hand rotation for 15 seconds – MBFKRR (.885) and, therefore, it might be considered as a single factor of the hand movement speed. The authors have defined this measurement as speed of simple movements and it is most commonly known as segmented speed, the rate of fast movements, the speed of alternative movements, or just a factor of movement frequency, defined by the movement of the fastest frequency with the steady amplitude in a given time.

The sixth factor participates with 5.464% in the total variance of basic motor abilities and it is named frequency of leg movement flexibility factor because it is saturated with the high coefficient of two variables: for the assessment of the named ability Side splits – MFLBOŠ (.838), Straight leg raise MFLPLU (.603) and the variable leg tapping – MBFTAN (.457).

The seventh factor (4.853% of participation) is named balancing factor, because two balance assessment variables make up the largest part of forming this factor and those are: Standing transversally on both legs on a balance bench with eyes closed MBAP2Z (.822) and Standing transversally on both legs on a balance bench with eyes open MBAP20 (.629) that are considered to be balance assessment indicators. The eighth factor participates with (4.452%) in the total variance of basic motor abilities and it is named balanced ball handling factor, because it is mixed and composed of five variables for three different subspaces: frequency rate – leg rotation –MBFKRN (.632), ball coordination – leg slalom with two balls – MKLSNL (-.507) and side steps MAGKUS (-.487) and the variable for balance assessment which is standing longitudinally on both legs on a balance bench with eyes closed MBAU2Z (.703).

Table 4: Characteristic roots of basic motor abilities

	Variable	Component							
		1	2	3	4	5	6	7	8
1.	MFESDM	0.787	-0.049	-0.12	0.009	0.103	0.211	-0.059	-0.006
2.	MFESVM	0.695	0.202	0.15	-0.165	-0.104	0.05	-0.218	-0.175
3.	MFETRO	0.797	0.083	0.116	-0.045	0.01	0.055	0.004	0.048
4.	MFE20V	-0.254	0.345	0.017	0.460	-0.230	-0.187	-0.098	-0.098
5.	MBFTAN	0.155	0.286	0.138	0.089	0.075	0.457	-0.009	0.253
6.	MBFTAZ	-0.179	0.239	0.276	-0.239	-0.097	0.063	-0.084	0.677
7.	MBFKRR	0.002	0.002	-0.163	0.085	0.885	0.058	-0.04	0.010
8.	MBFKRN	0.064	0.092	-0.309	-0.110	0.418	-0.102	0.026	0.632
9.	MKLSNL	-0.083	0.007	0.169	0.427	0.198	-0.119	-0.039	-0.507
10.	MAGKUS	-0.478	-0.025	0.112	0.080	0.190	-0.022	-0.023	-0.487
11.	MAGTUP	0.029	-0.263	0.128	0.713	0.040	-0.030	-0.01	0.049
12.	MAGTSL	-0.083	0.285	-0.079	0.665	0.135	0.002	-0.172	-0.116
13.	MRSSKL	0.041	0.226	0.204	-0.506	0.405	0.041	-0.05	-0.127
14.	MRSDTZ	0.113	-0.357	0.365	-0.322	0.363	-0.005	0.135	-0.055
15.	MRSCUC	0.149	0.137	0.036	-0.475	0.140	-0.098	-0.211	0.122
16.	MRSDDL	0.099	0.012	0.835	0.028	-0.161	-0.051	-0.047	-0.101
17.	MFLPRK	0.142	0.866	-0.050	-0.045	0.080	-0.02	0.135	-0.012
18.	MFLPRD	0.069	0.854	0.071	-0.074	-0.042	0.115	0.025	0.044
19.	MFLPLU	-0.025	0.136	0.285	-0.017	0.123	0.603	-0.145	0.300
20.	MFLBOŠ	0.119	-0.060	-0.171	0.036	-0.003	0.838	0.17	-0.174
21.	MBAP20	0.026	0.053	0.375	0.164	0.042	0.026	0.629	0.259
22.	MBAU20	0.564	0.063	0.130	0.136	0.177	-0.394	0.227	0.130
23.	MBAP2Z	-0.125	0.134	-0.215	-0.189	-0.067	0.062	0.822	-0.158
24.	MBAU2Z	0.101	-0.093	-0.039	0.141	0.077	-0.004	0.062	0.703

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 28 iterations.

By analysing the matrix of the structure shown in table 42, in the first latent dimension, it can be seen that explosive force and balance tests have the largest projections. In the second isolated latent dimension, the variables for flexibility of the spinal column have the largest orthogonal projections of the manifest variables on this factor. In the third isolated latent dimension, the largest vector projections are seen in the same variables as in the previous matrix, i.e. matrices of the assembly, only with other values as seen in table 5. In the fourth isolated latent dimension, the same variables as in the matrix of the assembly have the largest projections of the vector, only with other values. In the fifth isolated latent dimension, the variable hand rotation has the

largest projection of the vector. In the sixth isolated latent dimension, three variables of foot tapping that measure the speed of the movement frequency and two variables of flexibility have the largest projections of the vector. In the seventh and eighth latent dimensions, the same variables as shown in the matrix of the assembly have the largest projections of the vector, only with other values. The obtained results within the matrix of the structure, which show a certain matching of the results obtained in the matrix of the circuit, confirm the structure of the isolated latent dimensions within the basic motor abilities, and the definition of these factors itself.

Table 5: Matrix of the sum of basic motor variables

	Variable	Component							
		1	2	3	4	5	6	7	8
1	MFESDM	0.809	0.062	0.009	-0.209	0.283	0.309	-0.021	0.221
2	MFESVM	0.707	0.316	0.276	-0.322	0.058	0.174	-0.251	0.05
3	MFETRO	0.858	0.192	0.255	-0.263	0.212	0.183	0.017	0.297
4	MFE20V	-0.432	0.259	-0.036	0.558	-0.358	-0.256	-0.173	-0.243
5	MBFTAN	0.333	0.402	0.194	-0.094	0.139	0.533	-0.028	0.383
6	MBFTAZ	0.115	0.369	0.314	-0.334	-0.04	0.18	-0.075	0.702
7	MBFKRR	0.172	-0.013	-0.119	-0.01	0.869	0.065	-0.005	0.075
8	MBFKRN	0.308	0.146	-0.23	-0.243	0.487	0.014	0.102	0.692
9	MKLSNL	-0.265	-0.107	0.117	0.514	0.09	-0.246	-0.091	-0.582
10	MAGKUS	-0.574	-0.141	0.011	0.248	0.028	-0.15	-0.078	-0.613
11	MAGTUP	-0.129	-0.308	0.085	0.715	-0.014	-0.166	0.026	-0.08
12	MAGTSL	-0.228	0.223	-0.098	0.669	0.021	-0.078	-0.221	-0.211
13	MRSSKL	0.282	0.277	0.265	-0.574	0.462	0.149	-0.085	0.042
14	MRSDTZ	0.284	-0.325	0.385	-0.366	0.445	0.008	0.182	0.047
15	MRSCUC	0.328	0.225	0.116	-0.541	0.227	0.03	-0.209	0.239
16	MRSDDL	0.154	0.065	0.838	0.003	-0.111	-0.059	-0.095	-0.053
17	MFLPRK	0.254	0.857	0.031	-0.153	0.107	0.127	0.021	0.162
18	MFLPRD	0.206	0.891	0.142	-0.185	-0.019	0.259	-0.094	0.2
19	MFLPLU	0.224	0.297	0.318	-0.186	0.168	0.656	-0.148	0.395
20	MFLBOŠ	0.144	0.009	-0.179	-0.079	0.019	0.821	0.168	-0.058
21	MBAP20	0.156	0.015	0.366	0.084	0.095	0.035	0.631	0.335
22	MBAU20	0.592	0.047	0.228	0.012	0.312	-0.316	0.250	0.273
23	MBAP2Z	-0.125	-0.006	-0.264	-0.141	-0.076	0.07	0.792	-0.081
24	MBAU2Z	0.263	-0.015	0.007	0.011	0.155	0.052	0.147	0.707
Extraction Method: Principal Component Analysis.									
Rotation Method: Oblimin with Kaiser Normalization.									

In table 6, it can be seen that the intercorrelation matrix shows that the first general factor of basic motor abilities has the highest correlation with the fourth factor of the value of (-.236), the fifth factor of the value (.234), and the eighth factor of the value of (.272).

Table 6: Matrix of isolated intercorrelation components of Basic Motor Variables.

Component	1	2	3	4	5	6	7	8
1	1							
2	0.106	1						
3	0.161	0.067	1					
4	-0.236	-0.084	-0.049	1				
5	0.234	-0.014	0.051	-0.105	1			
6	0.131	0.14	-0.005	-0.152	0.02	1		
7	0.031	-0.141	-0.041	-0.004	0.033	-0.006	1	
8	0.272	0.131	0.059	-0.154	0.095	0.109	0.093	1

CONCLUSION

The conducted research represents a transversal study whose goal was to, based on the anthropological characteristics of young footballers in the cadet age (basic motor abilities – the indicators of the variables), determine the latent structure (basic motor abilities of the sample). 160 football players were the interviewees, in the age between 14–16 years old, and the competition category of cadets included in the training program of the football schools K.F "Gjilani 1", K.F. "Gjilani 2", K.F. "Drita 1", and K.F. "Drita 2". The young footballers play in the competition of the Gjilan regional league. This shows that the players from two selections, from both clubs, are included in the research, which shows the big popularity of football in this part of Kosovo which is included in the systematic training in their football schools. The goal of factor analysis in this research was to define the latent structure of the research, based on previously determined hypothetical model.

Based on the results in relation to basic motor abilities, by applying the factor analysis according to Guttman-Kaiser rotation, eight latent dimensions have been extracted, named as

1. Lower extremity explosive strength factor
2. Flexibility factor
3. Lower extremity repetitive strength factor
4. Flexibility factor of repetitive strength and explosiveness factor
5. Flexibility and frequency of hand movements factor and
6. Flexibility and frequency of leg movements factor
7. Balance factor and
8. Ball balancing factor.

The research has multiple values in the theoretical and pragmatic sense. Also, the latent structure of basic motor abilities for the treated sample of the footballers has been determined in relation to its structure and configuration. The significance of this research is in the possibilities of progress in scientific and the field of knowledge on the training process, possibility of a better selection of future football players, and creating the basic information about the anthropological status of Kosovo footballers. The segmented and global approach to this research may deliver the indicators that might theoretically define the stereotype of the desired footballer – cadet for Gjilan region.

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LATENTNA STRUKTURA OSNOVNIH MOTORIČKIH SPOSOBNOSTI FUDBALSKIH IGRAČA - KADETA IZ REGIJE GJILANI

Istraživanje je provedeno na uzorku od 160 mladih fudbalera u dobi kadeta, od 14 do 16 godina, iz dvije škole, koji su uključeni u obuku škola fudbala K.F. "Gjilani 1", K.F. "Gjilani 2", "K" F "Drita 1" i "K" F "Drita 2". Cilj ovog istraživanja je bio utvrditi latentnu strukturu fudbalera u dobi kadeta u odnosu na osnovne motoričke sposobnosti sa 24 varijable. Mladi fudbaleri se takmiče u regionalnoj ligi Gjilani. Ovo pokazuje da su igrači obje selekcije, iz oba tima, uključeni u istraživanje, što ukazuje na veliku popularnost fudbala u ovom dijelu Kosova, uključenu u sistematsku obuku u njihovim školama fudbala. Podaci su analizirani pomoću programa SPSS, verzija 19. Na osnovu rezultata koji se tiču osnovnih motoričkih sposobnosti, primjenom faktorske analize prema rotaciji Guttman - Kaiser, izdvojeno je osam latentnih dimenzija koje su nazvane: 1. Faktor eksplozivne snage donjih ekstremiteta, 2. Faktor fleksibilnosti, 3. Faktor repetitivne snage donjih ekstremiteta, 4. Faktor fleksibilnosti, repetitivne snage i faktor eksplozivnosti, 5. Fleksibilnost i frekvencija faktora pokreta ruku, 6. Fleksibilnost i frekvencija faktora pokreta nogu, 7. Faktor ravnoteže i 8. Faktor balansiranja lopte.

Ključne riječi: Osnovne motoričke sposobnosti, fudbaleri, latentna dimenzija, škole fudbala, faktorska analiza.

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PREVALENCE AND DIFFERENCES IN THE LEVEL OF NUTRITION WITH CHILDREN OF AN EARLY AND PRESCHOOL AGE

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ABSTRACT

The aim of this research was to determine the prevalence in the level of nutrition and define whether there is a certain difference in the number of early and preschool-aged children compared to the category of nutrition level. There were 138 children participating in the research, namely 66 girls and 72 boys of the Rijeka Kindergarten. The height and body mass were measured based upon which the body mass index (BMI) was calculated. To determine the children's level of nutrition, it was compared to table values of the international classification for the children and adolescents' body mass index designed by Cole et al., (2000). The obtained results show that 59% of children were of normal weight, 26% of children were overweight, while 15% of them were obese. Out of the total number of examined children, 50% of boys were of normal weight, while 36.1% of them were overweight and 13.9% were obese. Girls were in a better position than boys when it comes to normal nutrition. Thus, 69.7% of them were of normal weight, but 15.1% were estimated as obese. There were 15.2% of overweight girls. The largest difference ($p=0.00$) in the level of nutrition between boys and girls was noticed in the group of normal and excess body mass, while in the group of obese children, the number of girls and boys is almost equal. There were no underweight children in the whole group. This research has shown that this problem exists even in the early and preschool education period. Data are extremely worrying, especially because a significant percentage of obese children already exists for both sexes. Future research should be directed towards finding the way and concrete measures or intervention programmes which should be undertaken in education to prevent further growth in the number of children categorised as overweight or obese.

Keywords: Children, health, level of nutrition, education, intervention programmes.

INTRODUCTION

Due to a lack of physical activities, changes in lifestyle and incorrect diets, the percentage of people with an increased level of nutrition is growing on a daily basis (Šertović et al., 2016). The aforementioned problem did not skip children either and the number of children considered as overweight or obese according to the level of their nutrition is growing. According to the data offered by the Croatian National Institute of Public Health, 60% of the Croatian population is overweight. There are 12% of

school-aged children who have an increased body weight and 5% of them are estimated as obese. There are 2.9% of overweight early and preschool-aged children, while 2.6% of them are infants (Hajdić et al., 2014). In the Republic of Croatia and the surrounding countries, when compared to other developed countries in the world (like the USA), a lower number of overweight and obese children has been recorded. Still, this share is high and it is constantly growing. Therefore, it is necessary to constantly monitor the level of nutrition and to introduce various ways of prevention so as to

avoid a higher growth and to diminish the share of children's excess weight and obesity (Šertović et al., 2016).

PROBLEM AND THE AIM

The aim of this paper is to determine the prevalence of the nutrition level and understand whether there is a certain difference between boys and girls of an early and preschool age regarding the category of the nutrition level.

The children's body mass index is calculated in the same way as for adults, namely by dividing the value of the body weight by the square number of the body height, but, for the nutrition level, it does not use universal values or standards meant for adults, and instead, it is compared to the percentile curve of the body mass index or the table values for a certain age and sex (Šekerija et al., 2008). According to the percentile curves designed by the World Health Organisation (2007), if a person's body mass index is below the 3rd percentile, the person is described as seriously undernourished. If the value of a person's body mass index is between the 3rd and 15th percentile, the person belongs to the underweight group, while if a person's body mass index value is between the 15th and the 85th percentile, the person belongs to the group of the normally nourished. If a person's body mass index value is above the 85th percentile, reaching the 97th percentile, the person belongs to the overweight group, while if a person's body mass index value is above the 97th percentile, the person is considered obese. The ideal body mass is the one with the body mass index value at the 50th percentile. Monitoring the state of children's nutrition tells us if the growth and development of a child are within the limits characteristic for a certain sex and age and if there are any deviations (Jureša et al., 2011). Moreover, monitoring the children's nutrition level helps perceiving the already existing situation and is an important factor for the evaluation of the health situation in an adult age (Pokos et al., 2014).

Obesity is not only a problem of the adult population, but also of more and more children and adolescents. In 2014, there were 41 million children younger than five who were overweight or obese (WHO, 2016). Children are less and less active today. They do not spend their free time in a quality way, they spend a small amount of time in nature exploring the world around them by themselves. A reason for that certainly lies in the sedentary way of life, consequently leading to time spent on the computer or in front of television screens.

METHODS

Sample of examinees

The sample of examinees consists of the Rijeka Kindergarten children aged 4 to 7. There was a total of 138 children participating in the research, 66 of them being girls (48%) and 72 boys (52%). Based on the calculation of the body mass index, through the tables recommended by the International Obesity Task Force (Cole et al., 2000), the examinees were divided into three groups according to their level of nutrition (Table 1.). All children were attending mixed kindergarten groups.

Table 1: Description of examinees

	Normal	Overweight	Obesity	Total
Girls	46	10	10	66
Boys	36	26	10	72
Total	82	36	20	138

The sample of variables

The examinees were measured as a part of their annual measurements and weighing, separately for each kindergarten group. The measurement and weighing was led by the health manager working in the kindergarten and was conducted in March of the 2016/2017 pedagogic year. Two anthropometric variables were measured for children – body height (expressed in centimetres) and body mass (expressed in kilograms). Body height was measured with an altimeter, with a scale of 0.001 m, while body mass was measured with a balance of the precision scale of 0.01 kg. The body mass index was calculated based upon the measurements, and the level of nutrition was determined in regard to it, as well as to age and sex.

Statistical data processing

The level of nutrition was determined based upon the international classification of the body mass index for children and adolescents designed by Cole, T. J. et al. (2000). The way body mass index is calculated is the same as for adults, but the obtained body mass index value is not compared with adult standards, but with table values upon which it is estimated if the child, regarding his or her chronological age, belongs to the underweight, normal weight, overweight or obese group. The results of the research are shown in tables where the basic descriptive parameters were calculated (the arithmetic mean, the standard deviation and the minimal and maximal value) for the boys and girls' body mass index, height and weight separately. Results are presented in charts with percentages. Differences in the number of children in a certain level of nutrition were calculated by the chi – square test at the level of significance $p=0.05\%$.

RESULTS

Table 2. shows the arithmetic means and standard deviations for all the evaluated variables.

Table 2: Basic descriptive parameters (mean $\pm$ standard deviation) for girls and boys

Variables	Male	Normal	Overweight	Obesity	Total
Height	Girls	117.94 ± 7.68	117.63 $\pm$ 9.49	116.70 $\pm$ 6.03	117.70 $\pm$ 7.59
	Boys	116.25 ± 8.78	116.91 $\pm$ 8.32	121.16 $\pm$ 7.46	117.17 $\pm$ 8.38
Weight	Girls	20.53 ± 2.54	22.55 $\pm$ 3.89	25.42 $\pm$ 3.46	21.61 $\pm$ 3.35
	Boys	19.96 ± 3.56	23.07 $\pm$ 3.57	27.78 $\pm$ 4.54	22.17 $\pm$ 4.49
BMI	Girls	14.73 ± 0.67	17.87 $\pm$ 0.38	19.90 $\pm$ 0.62	16.04 $\pm$ 2.11
	Boys	14.67 ± 0.82	17.86 $\pm$ 0.35	20.24 $\pm$ 0.82	16.59 $\pm$ 2.20

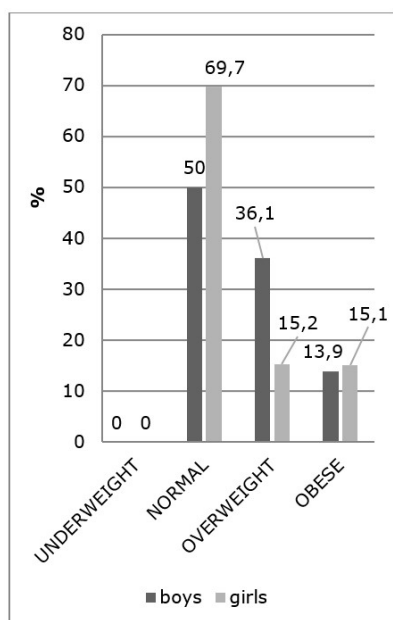


Chart 1: Chart 1. Prevalence in the level of nutrition for boys and girls (%)

Chart 1. shows that, out of the total number of boys, half of them, or 50% of boys are of normal weight, while the other 50% are overweight or obese, which are devastating results for such a young age group. Girls are in a better position than boys when it comes to normal

nutrition. According to Chart 1., 69.7% of girls are of normal weight, 15.2% of girls are overweight and 15.1% of them are obese. However, the inspection of results shows that the percentage of obese girls (15.1%) is higher than the percentage of obese boys (13.9%), while there are more overweight boys (36.1%) than overweight girls (15.2%). The greatest difference between boys and girls can be observed in the groups of normal and excess body mass, while in the obese group, the number of girls and boys is almost equal and it can be thus considered that in this group, children are not different. Table 3. shows the differences in the number of boys and girls according to nutrition groups. The analysis of differences shows that children of different sexes differ significantly in regard to the category of the nutrition level.

Table 3: Differences in the number of boys and girls in regard to the category of the nutrition level

chi - square	Degrees of freedom	p - value
11.82	2	0.00

DISCUSSION

The aim of this research was to determine the prevalence of the children's nutrition level and to check if there is a certain difference in the number of early and preschool-aged children in regard to the level of nutrition.

There were 138 children participating in the research, who were attending mixed kindergarten years in the pedagogic year 2016/2017. Out of the total number of examinees, there were 33 girls (48%) and 36 boys (52%) participating in the research. All of them were between 4 and 7 years old. The obtained results show that, out of the total number of children (69), 59% were normally nourished (41), 26% were overweight (18) and 15% of them were obese (14). In the whole sample, there were no underweight children. According to the obtained results, the normal weight group consists of 18 boys (44%) and 23 girls (56%), the overweight group consists of 13 boys (72%) and 5 girls (28%), while the obese group consists of 5 boys and 5 girls.

In general (Chart 1.), out of the total number of examined children, 50% of boys have normal weight, while 36.1% of them are overweight and 13.9% are obese. Girls are in a better situation than boys regarding normal weight, but not regarding obesity. Consequently, 69.7% of girls have normal weight, but 15.1% were estimated as obese which is 1.2% more than boys.

There are 15.2% of overweight girls which is 20.9% less than boys. The analysis of differences shows that there are 20% more normal weight girls and almost 20% less overweight girls, while in the obese group, the number of girls and boys is almost the same. There are various reasons for that. One of the reasons for a high percentage of obese and overweight children is an inactive and sedentary way of life, as well as an irregular diet. However, the reason why there are more normal weight and less overweight girls than boys can be only assumed. The level of nutrition largely depends on nutrition habits and physical activity, "but also on the genetic background, both parents' physical weight, the amount, quality and way of preparation of the food taken" (Puharić and Perasović, 2013:68).

Females are generally more concerned about their appearance and take more care of the quantity and type of food they consume. All this is the consequence of the world we live in and the existence of stereotypes about the perception of the "ideal" female body. From a young age, through various broadcasts, cartoons, picture stories, where there are female characters of an "ideal" figure, children are under the influence of opinions about such an "idyllic" understanding of the female body. It is also known that children learn by imitating a model and the first persons the children look up to are their parents. If parents tend to have a certain type of diet, healthy or unhealthy, and lead a physically active or inactive way of life, such habits and preferences are taken up by their children, too (Šekerija et al., 2008). Thus, one of the reasons of a lower number of overweight girls can lie in the fact that girls whose mothers are under a special dietary regime (diet) and control the intake of calories will want to be like them (Birch and Fisher, 1998). It is also known that male persons generally have the need for a higher intake of energy into their organism.

The male population needs a higher share of food for the normal functioning of their body, so they take in more calories than women (Sweeting, 2008). According to the World Health Organisation data (WHO, 2016a), in 2014, there were 41 million children younger than 5 who were overweight or obese, and according to the result of this research, Croatia follows the same trend.

The obtained results, like the results of numerous former research (Antonić-Degać et al., 2004; Pokos et al., 2014; Puharić and Perasović, 2013; Puharić et al., 2015; Šertović et al., 2016) indicate the fact that there is a growth in the number of overweight or obese children, while the number of normal weight children is getting lower. A similar research conducted by Farkaš et al. (2015) on a sample of 760 children aged 3 to 7, attending kindergartens

of the city of Osijek, determined whether there was a difference between body weight, body height and the level of nutrition according to age and sex. The measured anthropometric values were compared to the values prescribed by the World Health Organisation (WHO). The results showed that most children belonged to the normal weight group, while 24% of boys and 16.36% of girls belonged to the overweight or obese groups. The fact that the percentage of excess weight and obesity increases with age, which is more common among boys than girls, is a major reason for concern.

If the results of the research conducted by Farkaš et al. (2015) and this research results are compared, not considering the size of the sample, it can be said that the results are very similar.

According to the National plan of activities for children's rights and interests for the period 2006 to 2012 (2006), in the period between 1997 and 2002, there were 14.3% of children belonging to the group of "thin" and underweight children and 0.9% of them were underweight, while 69.5% of children belonged to the normal weight group. The rest of 16.2% of children were overweight or obese. Out of this percentage, 5.2% of children were obese and 11% of them were overweight. When these results are compared with some former research (Antonić-Degać et al., 2004; Pokos et al., 2014; Puharić and Perasović, 2013; Puharić et al., 2015; Šertović et al., 2016), it can be noticed that the share of obese or overweight children is very similar to the one expressed at the time of the research, or even growing.

Due to the growing share of obese or overweight children, it is necessary to conduct preventive programmes with the aim of acquiring a healthy way of life and timely recognise excess weight and then influence its diminution (Puharić and Perasović, 2013). Škrabić and Unić Šabašev (2014) have quoted a number of authors who applied preventive measures in their research to fight obesity and excess weight in differently aged children. Despite the existence of some, "systematic reviews about the topic of scientifically based preventive interventions for preschool children are rare" (Škrabić and Unić, 2014:9)

According to Škrabić and Unić Šabašev (2014), Cochrane's review about measures for the prevention of children's fatness quotes that, out of a total of 55 studies, 8 studies were carried out with children aged 0 to 5 and the results of efforts done to suppress children's fatness were the best. According to the same authors, Starki et al. carried out a controlled research on 18 children aged 2 to 5, who were overweight. According to the results, there was a decline in the z-value of the body mass index with "children who were included in the intervention." (Škrabić and Unić Šabašev, 2014:9).

Besides different preventive measures, parents play an important role in the recognition and prevention of

fatness. Parents who are inclined towards a healthy diet and a physically active way of life transfer such habits and preferences on their children, too (Šekerija et al., 2008). In such a way, the risk of the child becoming obese or overweight is prevented. However, very often, parents are not aware of their children's fatness (Šekerija et al., 2008) and deal with it uncritically (Hajdić et al., 2014).

Parents often underestimate their children's body weight which can be seen in the results of an American research where 98% of parents having overweight children and 80% of parents whose children were obese determined their children's weight as normal (Cornell et al., 2015, after Šekerija et al., 2008). Due to this reason, before intervention with the aim of suppressing children's fatness is initiated, parents should be educated to change their perception of children's fatness. The obtained results show that there is a problem of excess weight and obesity and that it should be given special attention.

The most worrying is the number of obese children at early ages. Since obesity is treated as a disease in medicine, these children are already considered ill. The most serious flaw in regard to this research is a small sample of examinees due to which the obtained results cannot be generalised, but in comparison to other larger research, the results are relatively similar. Most former research deal with the difference in schoolchildren's nutritional status, while the data about the early and preschool-aged children are scarce. Therefore, the number of research including early and preschool-aged

children should grow and this research represents a good starting point for future ones.

CONCLUSION

Obesity and excess weight are important modern-time health issues for adults, but also for children. Obesity is defined as a disease which means that there is a large percentage of ill children. This research results have shown that there is a certain sample of children belonging to the category of excess weight and to the category of obesity.

These results indicate the serious problem of excess weight and obesity found with early and preschool-aged children which is seriously dangerous for their health and further development. However, since obesity is a global trend, such results are not surprising, but cause worry. Children who are described as overweight or obese in their childhood are seriously exposed to the possibility of being such as adults, which imposes preventive measures as necessary. It is extremely important to educate the whole population about the bad effect of fatness on health, raise awareness about the importance of physical activity and correct nutrition for a good and healthy life, all with the aim of preventing the growth of obesity and other health problems linked to it. Attention should be especially directed towards the prevention and diminution of the share of overweight or obese children of an early or preschool age. Responsibility is here borne by parents, but also institutions attended by these children.

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PREVALENCIJA I RAZLIKE U STUPNJU UHRANJENOSTI KOD DJECE RANE I PREDŠKOLSKJE DOBI

Cilj ovoga rada bio je utvrditi prevalenciju stupnja uhranjenosti, te vidjeti postoji li određena razlika u broju djece rane i predškolske dobi u odnosu na kategoriju stupanja uhranjenosti. U istraživanju je sudjelovalo 138 djece, 66 djevojčice i 72 dječaka Dječjeg vrtića Rijeka. Izmjerena je visina i masa tijela na temelju kojih se izračunavao indeks tjelesne mase (ITM) koji se, kako bi odredili stupanj uhranjenosti djece, uspoređivao s tabličnim vrijednostima međunarodne klasifikacije indeksa tjelesne mase za djecu i adolescente koju su izradili Cole i sur., (2000). Dobiveni rezultati pokazuju da je 59% djece normalno uhranjeno, 26% djece prekomjerno uhranjeno, dok ih je 15% pretilo. Od ukupnog broja ispitivane djece, 50% dječaka je normalno uhranjeno, dok ih je 36,1% prekomjerno uhranjeno te 13,9% pretilo. Djevojčice su u boljem položaju od dječaka što se tiče normalne uhranjenosti. Prema tome, normalno je uhranjeno 69,7% djevojčica, ali ih je 15,1% procijenjeno kao pretilo. Prekomjerno uhranjenih djevojčica je 15,2%. Najveća razlika ($p=0,00$), u stupnju uhranjenosti dječaka i djevojčica, primijećena je u skupinama normalne i prekomjerne tjelesne mase, dok je u skupini pretilih, broj djevojčica i dječaka gotovo podjednak. Od ukupnog uzorka, pothranjene djece nije bilo. Ovo istraživanje je pokazalo da problem ove tematike postoji već u ranom i predškolskom odgoju i obrazovanju. Podaci su vrlo zabrinjavajući, a posebno zato što već postoji znatan postotak pretile djece kod oba spola. Buduća istraživanja bi se trebala usmjeriti na pronalazak načina i konkretnih mjera, odnosno intervencijskih programa koje treba poduzeti u odgoju i obrazovanju da bi se spriječio daljnji porast broja djece koja spadaju u kategorije prekomjernog stupnja uhranjenosti i pretilih.

Ključne riječi: Djeca, zdravlje, stupanj uhranjenosti, odgoj i obrazovanje, intervencijski programi.

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INFLUENCE OF PERIPHERAL VISION INDICATORS ON THE EFFICIENCY OF 15-YEAR-OLD BASKETBALL PLAYERS' GAME ACTIONS

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ABSTRACT

The purpose of the research is the development of improvement approaches for 15-year-old basketball players' game indicators under the influence of the program for the development of the visual analyser. Material: 12 basketball players at the age of 15 from Kharkiv, who entered into the experimental group, participated in the research; the control group consisted of 10 sportsmen from Lozova. A device called "Forster's Perimeter" was used for determining the size of the vision field. The field of vision was defined for white colour of two main meridians – horizontal (to the temple, to the nose) and vertical (up, down). Within 8 weeks, the sportsmen of the control group were engaged according to the standard program of basketball sports school. The training process of the experimental group basketball players was based on the standard program of preparation for basketball sports school and complemented with specially selected sets of exercises, directed to increase peripheral vision and improve the condition of eye muscles. Results: It is established that, at this age, the degree of peripheral vision, for both the right and the left eye, reaches the greatest indicators on the horizontal meridian to the temple. A comparison of the results for the basketball players' perimetry of the right and left eye showed that indicators of the right eye are better on three directions. Indicators of perimetry, for both the right and left eye, on the horizontal meridian to the nose and up on the vertical meridian authentically improved after the pedagogical experiment. An increase in indicators of the experimental group sportsmen's peripheral vision is in turn influenced, mediating the improvement of the basketball players' game indicators in the next competition games. Conclusions: The executed research demonstrate considerable influence of peripheral vision indicators on the game actions of young basketball players. The developed system of special basketball exercises on trainings and independent performance of exercises for the eyes improved the level of peripheral vision for 15-year-old basketball players and immediately affected the efficiency of game actions.

Keywords: Basketball players, visual analyser, peripheral vision, perimetry, physical exercises.

INTRODUCTION

The analysis of competitive activity in team sports is the most important task for determining the efficiency of the whole system for training sportsmen (Perevoznik, Pertsukhov, & Paevskiy, 2013; Korsun, Shaposhnikova, & Perevoznik, 2018). A game activity consists of a large number of indicators in attack and

defence, unlike individual sports in basketball. It is necessary to consider the effectiveness of technical-tactical actions and their activity during the process of controlling the efficiency of team play in general and certain players in particular (Pomeshchikova, Kucherenko, Yevtushenko, 2013; Mishyn, 2017). Formation of a technical-tactical skill of sportsmen is impossible without the high level of development related to the sensory systems of an organism (Iermakov et al., 2016; Podrigalo et al., 2017).

One of the leading analysers for basketball players is the visual one. The sportsman perceives the surrounding situation, actions of the opponent and partners in the team, analyses his situation relatively to the surrounding situation, guided in space, carries out the current and final control of the results pertaining to actions by means of visual organs (Bredikhina, 2013).

Interest in this problem is also caused by the fact that vision is the main supplier of information in the majority of sports. In his research, M. P. Bijman noted the importance of visual perception, when studying the ability to avoid barriers, (Bijman, Fisher & Vallis, 2015). The possibilities of knowledge on sizes, colours, distances and speeds of objects' movements, and their arrangement are created by means of visual perception. So, in basketball, the accuracy of a throw depends on the sensitivity of the kinetic sensory system, which is improved during numerous repetitions, and on the ability to define the distance and ball flight trajectory by the visual sensory system. Visual perception also influences the efficiency of tactical actions.

A number of authors note that various motor activities, physical exercises by different kinds of sport, considerably influence the functional state of the visual sensory system, and a systematic application of special game exercises considerably improves the functional state of the organism in general and the visual system in particular (Menkhin, 1998). So, in their research, O. K. Moiseyenko and co-authors confirmed the data about an excess of indicators norm of peripheral vision related to volleyball players at the age of 13-14 and basketball players of the student's team (Moiseyenko, Yu. A. Horchanyuk & V.A. Horchanyuk, 2017).

Teresa Zwierko also indicates the best conductivity of the visual signal and the highest visual potential in young volleyball players, in comparison with untrained people (Zwierko, Lubiński, Lubkowska, Niechwiej-szwedo & Czepita, 2011; Zwierko et al., 2014). Professional sportsmen have exclusive skills of fast perception for difficult dynamic visual scenes (Faubert, 2013).

The motor answer of reaction with the choice, which directly influences the effectiveness of sportsmen-players, is formed on the basis of afferent visual impulses (Moiseyenko, Strelnykova & Lyakhova, 2014). Yu. M. Makarov, A. I. Osypenko established the predictive importance of the central link pertaining to the visual analyser for an effective definition of the functional duties for the qualified football players (Makarov, Osypenko, 2005). O. O. Shevchenko stated the improvement of indicators of the visual analyser in children at the age of 5-6, after one year of doing tennis (Shevchenko, 2013). S. Mochiduki and co-authors developed the technique with the use of

computer technologies, which allows baseball players to improve the field of peripheral vision without turning their head and, thus, increasing the efficiency of game actions. Some authors also noted a difference in the line of vision between more and less skilled players (Mochiduki, Suganuma, G Shoji, 2016).

Our previous research were directed towards the assessment of indicators related to peripheral vision of different colours in basketball players at the age of 14-16. We established that young sportsmen perceive green colour better. It is defined that peripheral vision indicators increase with the age of sportsmen and with their experience of doing basketball. The greatest indicators of the peripheral vision field are fixed on the horizontal meridian to the temple. It was defined that indicators of peripheral vision of the right eye are insignificantly better than the left one (Pomeshchikova, & Kudimova, 2017; Pomeshchikova, Kudimova, Tseslitska, & Musketa, 2018). Various and multidirectional motor activity of basketball players during the game demands constant visual fixing of the partners and rivals' position on the basketball court, the location of the ball and assessment of its movement trajectory from the sportsmen.

We have already considered the influence of indicators of young basketball players' peripheral vision on the efficiency of actions during the game (Pomeshchikova, Ruban, & Pokrovenko, 2015). However, theoretical and practical development of this question remains exclusively relevant. The results of our previous research allowed us to establish that the positive influence of the size of the peripheral field of vision on the vertical meridian on the accuracy of three-point shots on the rim, and on the horizontal meridian – both on the accuracy of three-point shots, and on the number of turnovers in game, is observed at the age of 14. Also, it was established that the positive influence of the size of the peripheral field of vision on the vertical meridian on the efficiency of game for rebound of the ball, which is unsuccessfully thrown on the rim and for the horizontal meridian – on effectiveness of two-point shots is observed at the age of 16.

The received results are some of the foundations of our approaches for the real research. Earlier, we showed the directions of the solution for the problems of preventing short-sightedness and the correction of sight for children and teenagers by means of physical exercises (Ruban, 2016).

Based on the results of the previously conducted research, it is possible to assume that the use of specially selected exercises on basketball trainings with simultaneous independent application of the exercises, which are directed to strengthening and extension of eye muscles, can raise the indicators of the visual analyser and affect the efficiency of game actions performed by basketball players at the age of 15. The purpose of the research is the development of improvement approaches for 15-year-old basketball players' game indicators under the influence of the program for the development of the visual analyser.

RESEARCH METHODOLOGY

22 boys at the age of 15 participated in the research. All participants in the research studied in sports school, in groups of specialized preparation, and had permission of the doctor for attending classes in sports clubs. The research was conducted in compliance with WMA Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects 2013.

A device called "Forster's Perimeter" was used for determining the size of the vision field. The field of vision was defined for white colour of two main meridians – horizontal (to the temple, to the nose) and vertical (up, down) (Balyn, Haida & Horbachevskyi, 2000). The pedagogical observation of the efficiency of game actions conducted by young basketball players was made during the games of All-Ukrainian junior basketball league. 16 games, which were held by two teams – Kharkiv and Lozova, were analysed. Such indicators as quantity of throws (two-point, three-point, free throws), quantity of their hits, throw accuracy percentage, the number of ball rebounds on the backboard (on their own, offensive, and in general), the number of turnovers and tackling, blocked shots, the number of scored points were defined.

Control and experimental groups of sportsmen were allocated for the purpose of establishing the efficiency of using the specially selected exercises during trainings for young basketball players. The experimental group consisted of basketball players from Kharkiv in the number of 12 players, the control group from Lozova had 10 sportsmen. At the previous investigation phase, there was certain lack of reliability in differences between the perimetry results and indicators of the efficiency of game actions for the two groups ($p > 0.05$). Within 8 weeks, the sportsmen of the control group were engaged according to the standard program of basketball sports school. The training process of the experimental group basketball players was based on the standard program of preparation for basketball sports school and complemented with specially selected sets of exercises, directed to increase peripheral vision and improve the condition of eye muscles.

Exercises on improving the condition of eye muscles were performed independently by boys, three-four times per day. The complex consisted of five exercises in which circular sideways movements, fast blinking, resting with eyes closed, changing what they were looking at were carried out with the fingers of an outstretched arm in the distance (Kuindzhi, 2000).

The special sets of exercises, which are aimed at the development of peripheral vision, were carried out in the main part of each training session. They combined, by themselves, the task for improving the receptions of game technique. They were carried out in couples, on three persons, by large groups. The performance

of technical actions without turning their head and controlling the actions on each side due to peripheral vision was the main requirement during the exercises. For example, a player stood in the basketball player's stand, watching the coach and calling aloud the number of fingers which were shown on the hands (or gestures which indicate other tactical combinations), and, along with it, had to do a pass to the partner who appeared on one of wings. At first, the appearance of the partner was discussed, and then it was unknown. This exercise was complicated when, along both sides, two sportsmen appeared, and a pass needed to be directed on the player in the form determined by colour. As an option, this exercise could be performed when the sportsman not only stands with the ball, but carries out dribbling in place, or slowly moves while dribbling. In another exercise, basketball players (5-7 boys) with balls settled down on the arch with a diameter amounting to 180 degrees, and one player in the centre of the circle. He is trying to control all players visually. The position of the basketball player changed – standing, kneeling, and sitting. For the purpose of improving the accuracy of throws, exercises were carried out by applying "visors" which were put on under their nose and closed the field of vision. 3-5 exercises, which are aimed at the development of peripheral vision, were applied in each training.

RESULTS AND DISCUSSION

Indicators of 15-year-old basketball players' peripheral vision on white colour are presented in table 1.

Table 1: A comparison of indicators of 15-year-old basketball players' peripheral vision ($n=22$) of the right and left eye (degrees)

Eye	Up	Down	To the temple	To the nose
	Indicators $\bar{X} \pm m$			
Right eye	52.40 ± 1.43	65.20 ± 1.71	88.80 ± 1.20	63.00 ± 0.84
Left eye	51.60 ± 2.13	65.00 ± 2.61	89.00 ± 0.48	61.20 ± 0.58
t	0.31	0.06	0.15	1.76
p	>0.05	>0.05	>0.05	>0.05

It is established that, at this age, the degree of peripheral vision, for both the right and the left eye, reaches the greatest indicators on the horizontal meridian to the temple. A comparison of the results for the basketball players' perimetry of the right and left eye showed that indicators of the right eye are better on three directions.

The indicator of the horizontal meridian to the temple, which is higher for the left eye, was an exception. However, the difference in the degree of peripheral vision of the right and left eye is inconsiderable ($p > 0.05$).

Indicators of the efficiency of game actions performed by teams of basketball players at the age of 15 in official competitions (in games of All-Ukrainian junior basketball league), on average, for one game are presented in table 2.

As a result of the carried-out correlation analysis, the interrelation between separate indicators of game actions performed by young players and the results of the basketball players' perimetry is established.

The received data on the analysis of peripheral vision indicators on the vertical meridian down specify, on average, the return correlation level with the number of tackling ($r = -0.621$) and quantity of blocked shots ($r = -0.518$); but, the average level of correlation with the number of ball rebounds on the backboard ($r = 0.534$) and the number of turnovers ($r = 0.622$). The moderate level of correlation with the quantity of "blocked shots" is established on the vertical meridian ($r = 0.353$).

On the horizontal meridian to the temple – the high level of correlation with accuracy of two-point shots ($r = 0.880$) and accuracy of three-point shots ($r = 0.771$), as well as with the quantity of "blocked shots" ($r = 0.783$); the high level of correlation of the return with the number of assists ($r = -0.765$); the average level of correlation with the quantity of free throws ($r = 0.673$) and an average return correlation level with the number of ball rebounds on the backboard ($r = -0.664$). On the horizontal meridian to the nose – the high level of correlation of the accurate return of free throws ($r = -0.834$); the average level of correlation with accuracy of two-point shots ($r = 0.691$), the number of tackling ($r = 0.596$) and the number of assists ($r = 0.515$); an average return correlation level with the accuracy of free-point shots ($r = -0.523$), the number of turnovers ($r = -0.554$) and the quantity of "blocked shots" ($r = -0.538$).

The received data on interrelations of young basketball players' game indicators with the functional state of the visual analyser became the basis for using specially selected exercises. The offered system of performing special basketball exercises, which were directed to increase peripheral vision and exercises on improving the condition of eye muscles, was introduced in the experimental group basketball players' training process for the purpose of increasing the efficiency of their game actions.

Table 2: Indicators of the effectiveness of 15-year-old basketball players' game actions during the games of All-Ukrainian junior basketball league (for one game on average)

Statistical game indicators		X	m
points		64.1	3.6
Two-point shots	Scored (times)	18.9	2.1
	Thrown (times)	53.3	3.4
	% of accuracy	35.4	4.9
Three-point shots	Scored (times)	5.4	1.7
	Thrown (times)	18.5	5.1
	% of accuracy	29.9	5.9
Free throws	Scored (times)	21.6	2.5
	Thrown (times)	10.2	0.6
	% of accuracy	47.2	2.9
Assists (times)		18.3	1.8
Ball rebound	Total (times)	44.5	8.2
	Their own backboard (times)	27.5	3.1
	Offensive backboard (times)	17.0	1.4
tackling (times)		13.0	0.8
blocked shot (times)		4.2	0.5
turnover (times)		22.5	4.3

Indicators of peripheral vision before and after the pedagogical experiment in 15-year-old basketball players are given in table 3. The resulting changes indicate a positive influence of basketball exercises and the exercises on strengthening and the extension of eye muscles on the results of the experimental group basketball players' perimetry. It should be noted that

the indicator of peripheral vision on the horizontal meridian to the temple in all sportsmen, both the right, and left eye, exceeded 90°.

In this connection, there was no opportunity to measure it after the pedagogical experiment on the device called "Forster's Perimeter".

Table 3: A comparison of indicators of the experimental group basketball players' peripheral vision (n=12) before and after the pedagogical experiment (degrees)

eye	Testing period	Up	Down	To the nose
		Indicators $\bar{X} \pm m$		
Right eye	Before the experiment	51.90±1.48	65.70±1.90	63.10±0.94
	After the experiment	58.60±1.78	67.90±1.82	74.20±1.42
	t	2.89	0.84	6.52
	p	>0.05	>0.05	>0.001
Left eye	Before the experiment	51.40±2.10	64.00±2.40	62.20±0.88
	After the experiment	57.20±1.60	67.60±2.13	71.60±1.14
	t	2.20	0.84	6.53
	p	>0.05	>0.05	>0.001

Indicators of perimetry, for both the right and left eye, on the horizontal meridian to the nose ($p < 0.001$) and up on the vertical meridian authentically improved ($p < 0.05$) after the pedagogical experiment. The gain of indicators on the vertical meridian down increased slightly ($p > 0.05$). The gain of indicators of the 15-year-old experimental group basketball players' peripheral field of vision was: for the right eye up on the vertical meridian 7.3° (14.06%), down – 2.2° (3.34%), on the horizontal meridian to the nose – 11.1° (17.59%). For the left eye, these changes were: 5.8° (11.28%), 3.6° (5.62%), and 9.4° (15.11%), respectively. It should be noted that a slightly bigger increase in the peripheral vision of the right eye and to the nose – left was observed in the directions up and to the nose. The results of the control group basketball players' perimetry during the pedagogical experiment didn't change significantly. An increase in indicators of the experimental group

sportsmen's peripheral vision is in turn influenced, mediating the improvement of the basketball players' game indicators in the next competition games (table 4). So, the indicator of accuracy for 2-point shots grew by 3.1%, for 3-point shots by 1.4%, and free throws by 7.1%. Changes in the accuracy of free throws had a reliable character ($p < 0.05$). On average, for a game, the number of assists increased to 5.1 times, tackling to 2.8 times, blocked shots to 1.2 times, ball rebounds on their backboard to 2.4 times, ball rebounds on the offensive backboard to 4.5 times. The number of turnovers decreased to 1.2 times. The improvement of indicators of assists, the fight on the offensive backboard and tackling had a reliable character ($p < 0.05$). Changes of game indicators led to an increase in points for a game to 5.1 points on average.

Table 4: Indicators of the effectiveness of the experimental group basketball players' game actions in competitive games before and after the pedagogical experiment (for one game on average)

Statistical game indicators		X±m		t	p
		Before the experiment (n=8)	After the experiment (n=6)		
% of throws accuracy	points	64.1±3.6	69.6±3.4	1.11	>0.05
	two-point shots	35.4±4.9	38.5±3.4	0.52	>0.05
	three-point shots	29.9±5.9	31.3±4.8	0.18	>0.05
	free throws	47.2±2.9	54.3±1.1	2.29	>0.05
	assists (times)	18.3±1.8	23.4±1.4	2.24	>0.05
Ball rebound	Their own backboard (times)	27.5±3.1	29.9±2.5	0.60	>0.05
	Offensive backboard (times)	17.0±1.4	21.5±1.5	2.19	>0.05
	tackling (times)	13.0±0.8	15.8±0.9	2.33	>0.05
	blocked shot (times)	4.2±0.5	5.4±0.8	1.27	>0.05
	turnover (times)	22.5±4.3	20.5±3.1	0.38	>0.05

As a result of the conducted research, data on the functioning of the 15-year-old basketball players' visual analyser and its influence on the efficiency of game activity are obtained.

Higher borders of the field of vision were noted for the basketball players, already having sufficient experience in trainings that is confirmed by the research and other authors on sportsmen playing game sports (Moiseyenko et al., 2017; Zwierko et al., 2011; Zwierko et al., 2014; Faubert, 2013). The fact of an insignificant prevalence of indicators of the right eye was characteristic and it was also noted in other scientific works (Kuzmenko, 2014; Romanova, A. A. Naumova, & T. A. Naumova, 2016).

Our research were conducted in the context of the already existing data on the influence of specially selected physical exercises on an increase in the limits of peripheral vision. The authors suggest to use outdoor games (Shevchenko, 2014), game exercises (Menkhin, 1998), specially developed exercise machines (Akinfeev, 2012; Mochiduki et al., 2016) for expanding the indicators of the field of vision. A positive influence of physical exercises on the sensory systems is confirmed by research of other authors (Kuzmenko, 2014). In our research, the elicited facts of an increase in indicators of perimetry for boys at the age of 15, playing basketball after the pedagogical experiment, indicate a positive influence of the exercises, which are directed to strengthening and extension of eye muscles in combination with the technical-tactical basketball exercises which were followed by additional visual tasks. It is noted that the Forster's device does not give sufficient information on the indicators of 15-year-old basketball players' perimetry on the horizontal meridian to the temple which didn't allow us to define the changes of

the field of vision in this direction after applying the experimental program.

The received growth of peripheral vision indicators in our research is expressed more significantly, both the right, and left eye, in the direction up and to the nose. The revealed tendencies coincide with O. Shevchenko's data in the research of the visual analyser of young tennis players (Shevchenko, 2013, 2014). Experts already noted that one of the directions of the increase in technical-tactical preparedness of young sportsmen in game sports is the development of functions related to the visual analyser (Akinfeev, Tikhomirov, & Pravdov, 2015; Katukov, & Prolomova, 2000); Mochiduki et al., 2016). It is confirmed by the results of our research, in which the influence of peripheral vision indicators on the efficiency of some game indicators is revealed. It is established that the indicators of accuracy of the free throws, the number of assists, tackling, ball rebounds on the offensive backboard authentically improved with an increase in the basketball players' field of vision.

CONCLUSIONS

1. The executed research demonstrate considerable influence of peripheral vision indicators on the game actions of young basketball players.
 2. Using the developed system of special basketball exercises on trainings and independent performance of exercises for the eyes improved the level of peripheral vision for 15-year-old basketball players. It was expressed in reliable improvements of the indicators of perimetry up and to the nose. The chosen approaches promoted the improvement of the young players' game indicators which was displayed in a reliable increase in indicators: accuracy of the free throws, assists, the fight on the offensive backboard and tackling in competitions.
- Conflict of interests: the authors declare that there is no conflict of interests.

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UTICAJ INDIKATORA PERIFERNOG VIDA NA EFIKASNOST AKTIVNOSTI U IGRI PETNAESTOGODIŠNJIH KOŠARKAŠA

Svrha ovog istraživanja je razvoj pristupa za poboljšanje indikatora igre petnaestogodišnjih košarkaša pod uticajem programa za razvoj vizuelnog analizatora. Materijal: 12 košarkaša u dobi od 15 godina iz Harkiva, koji su pripadali eksperimentalnoj grupi, je učestvovalo u istraživanju; kontrolna grupa se sastojala od 10 sportista iz grada Lozova. Uređaj naziva "Forster's Perimeter" je korišten za određivanje veličine vidnog polja. Vidno polje je definisano za bijelu boju dva glavna meridijana - horizontalni (do sljepoočnice, do nosa) i vertikalni (gore, dole). Unutar 8 sedmica, sportisti kontrolne grupe su učestvovali u standardnom programu škole košarke. Proces obuke košarkaša koji su pripadali eksperimentalnoj grupi je bio zasnovan na standardnom programu pripreme za školu košarke uz dopunu u vidu posebno odabranih setova vježbi usmjerenih na povećanje perifernog vida i poboljšanje stanja mišića oka. Rezultati: Ustanovljeno je da, u ovom dobu, stepen perifernog vida, za desno i lijevo oko, dostiže najveće indikatore na horizontalnom meridijanu do sljepoočnice. Poređenje rezultata za perimetriju desnog i lijevog oka košarkaša je pokazalo da su indikatori desnog oka bolji u tri smjera. Indikatori perimetrije za desno i lijevo oko, na horizontalnom meridijanu do nosa i na vertikalnom meridijanu gore, su se autentično poboljšali nakon provođenja pedagoškog eksperimenta. Povećanje indikatora perifernog vida eksperimentalne grupe sportista je pak vidljivo, posredujući u poboljšanju indikatora igre košarkaša na narednim utakmicama takmičenja. Zaključci: Provedena istraživanja prikazuju znatan uticaj indikatora perifernog vida na aktivnosti u igri mladih košarkaša. Razvijeni sistem posebnih košarkaških vježbi na obukama i samostalno provođenje vježbi za oči su poboljšali nivo perifernog vida petnaestogodišnjih košarkaša, te neposredno uticali na efikasnost aktivnosti u igri.

Ključne riječi: Košarkaši, vizuelni analizator, periferni vid, perimetrija, fizičke vježbe.

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THE MOST APPROPRIATE MENTORING PRACTICE CONDUCTED BY A COOPERATING TEACHER DURING A PHYSICAL EDUCATION PRACTICAL TEACHING INTERNSHIP

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ABSTRACT

This study examines the degree to which the quality and frequency of mentoring conducted by cooperating teachers during a practical teaching internship influence the professional competence of future teachers. The analyses are based on a sample of more than 164 Tunisian physical education trainees and 96 cooperating teachers, who participated in a pre-test and post-test study during an academic year. The results indicate that the quality and frequency of mentoring explain the success of starting a professional life. In terms of learning, mentoring that follows helpful rather than transmissive principles stimulates the performance, motivation and job satisfaction of future teachers and reduces emotional fatigue.

Keywords: Professional development, Transmission, Mentoring, Cooperating teacher, Trainees.

INTRODUCTION

The research results of Hoyle and John (1995) indicated that much of the current teaching research agenda encompasses practical knowledge, personal practical knowledge, and knowledge about educational content. In this sense, Eraut (2002) confirmed that all these types of knowledge refer to the knowledge of teachers expressed in practice. However, there is still very little information on the processes of interpretation and personalization of theory and its integration into the conceptual contexts that guide their actions in practice (Darling-Hammond, 1996). According to Fantilli & Mc Dougall (2009), the practical teaching internship is often described as a stressful period in the life of future

teachers. Haser, C., & Star, J. R. (2009) research on the process of supervising students in initial education states that supervision is one of the key factors that determine the success of novice teachers in the early stages of their teaching experience. In Kram's (1983) definition, mentoring is usually considered a form of developmental assistance offered to a novice by an older person with experience in his field. Mentoring is also considered as a developing practice (Mullen and Kealy 1999), a contemporary concept, in which values, rules, expertise are transferred from one person to another.

In the education and training context, training mentoring is represented as an integral part of all teacher education programs in the field (Sullivan & Glanz, 2000).

In addition, internship mentoring is also an important collaboration between teacher education institutions and schools that facilitates and enhances teacher professional development (Levin & Rock, 2003). Melki et al. (2016), indicate that initial training in physical education in Tunisia is identified by a dual characteristic: a set of theoretical courses offered by a university professor and practical field experience conducted by a cooperating teacher. Given that many authors consider the internship as the most important element of their training and that the cooperating teacher is essential to the success of their degree (Kirk, Macdonald, & O'Sullivan, 2006), the participation of cooperating teachers in the training of teachers is particularly important (Keogh, Dole, & Hudson, 2006). Cooperating teachers are those who spend the most time with future teachers (Clarke, 2007) and who have an impact on the identity formation of pre-service trainees (Gratch, 2000). According to Beck & Kosnik (2000), the cooperating teacher is a key element, acting as a facilitator of ecologically sensitive transitions that occur during teaching practice, as a support and guide to the teaching-learning process, and as an important source of emotional support. In Ingersoll & Strong's (2011) educational research, the role of cooperating teachers and their effects in the process of integration into professional life has received much attention. In the context of the teachers' physical education training, Roberts (2000) demonstrated that cooperating teachers perceive their role in the training of future teachers as the most important part of learning to teach. With the same idea, Smith (2005) argued that cooperating teachers have the most significant influence on the quality of the trainees' training experience. Graham (2006) points out that there are two essential elements to the success of the internship: the cooperating teacher who guides and supports the trainees and the internship site.

The cooperating teacher role is crucial for the growth and development of future teachers. It has consistently emerged from the literature that future teachers perceive their cooperating teachers as one of their most important sources of significant support during their practical internship (Raimondi, 2007). Lindgren (2005) indicated that cooperating teachers provide crucial practical advice on teaching and reflect on working methods; they also look at the positive and negative aspects of lessons. Some of the research on trainee mentoring has shown that the support of a cooperating teacher is positively associated with teacher efficacy (LoCasale-Crouch, Davis, Wiens, & Pianta, 2012), educational engagement (Rots, Aelterman, Vlerick, & Vermeulen, 2007) and best pedagogical practice (Gagné, 2015). There is consistent evidence that trainees perceive their cooperating teachers as one of the main sources of support during pre-service education

training (Marable and Raimondi, 2007). Cooperating teachers provide essential practical advice on teaching and the role of teachers (Lindgren, 2005). In addition, in the presence of a cooperating teacher, future teachers discuss the positive and negative aspects of the lessons. Studies on teacher mentoring have shown that the support of a cooperating teacher is positively correlated with teacher effectiveness (LoCasale-Crouch, Davis, Wiens, & Pianta, 2012), educational engagement (Rots, Aelterman, Vlerick, & Vermeulen, 2007), and improved teaching practices (Stanulis & Floden, 2009).

Ganser (2002) studied the mentoring - psychology process and stated that the psychological support of the cooperating teacher includes the development of self-confidence, the promotion of self-esteem, as well as the ability to listen and the desire to become more autonomous (Brooks & Sikes, 1997). This assistance is particularly useful in the first year of teaching, since future teachers must adapt to their new work environment. Seibert (1999) believes that psychological support reduces stress and improves job satisfaction. Rhodes' (2005) research results presented that mentoring affects future teachers through two closely related models: First, a model that proposes the transmission of knowledge. The second model introduces the concept of educational mentoring. According to Olds, Kitzman, Cole, & Robinson (1997), mentors perceive their role as expert teachers and pass on their knowledge in a structured relationship of hierarchy. They add that, in educational mentoring, cooperating teachers act with their novices in reflecting which helps them to learn in their practice. In summary, Sfard (1998), concluded that the two models presented show resemblances with two paradigms of the learning theory, a knowledge transmission model based on behaviourist learning theories, in which trainees are becoming passive to information. This mentoring model aligns with the mentoring reflections focused on the transmission of learning (Wang & Odell, 2002).

In fact, for Collins & Miller (1994), these two models - knowledge transformation and educational mentoring - reflect a theory of professional development according to which future teachers develop their own knowledge by linking new information to their previous knowledge. This research suggests that mentoring can have a positive influence on the teacher's transition to the teaching profession.

However, there is very little research on the effects of mentoring on the development of the professional skills of future teachers. Few studies examine the differences in the quality of mentoring offered (Kessels et al., 2008; Rots et al., 2007). Consequently, there is limited knowledge about the mentoring practices that best support teacher development during practice internship. This study intended to determine the extent to which the quality and frequency of mentoring predict the development of the professional competence of future teachers during the practical teaching internship.

In particular, we study the effects of mentoring on teacher effectiveness, teacher motivation, perceptions of learning, emotional fatigue, and job satisfaction.

METHODS

Research method and design

The first physical education teacher training in Tunisia took place over a period of three years and is entitled to a bachelor's degree. Indeed, in the third year of training, a single preparatory training for professional life took place for a period of one continuous school year. During this period, future teachers take theoretical courses at their teacher universities and acquire practical experience by teaching physical education in a school, while their task also includes observing other trainees. In addition, according to Jones & Turner (2006), all these future teachers are assigned to cooperating teachers who provide supervision, feedback and advice during the internship period. The cooperating teachers generally follow the same course programme as their trainees and are involved in evaluating their summative assessments. The school director, based on their experience and their professional competence, usually selects these cooperating teachers.

This study used a pre-test and post-test protocol with two groups and two measurement levels. The future teachers of the first group were evaluated at the end of the first semester of the school year (from the beginning of the internship to the end of the first semester). Their second group partners were evaluated at the start and end of the second semester of the practical training year, so both groups were skilled at the same time interval. This conception allows us to explore the evolution of the characteristics of future teachers and the relevance of mentoring for cooperating teachers in this integration period.

Participants

The sample was recruited from various randomly selected schools in four governorates in Greater Tunis (Manouba, Tunis, Ben Arous, Ariana). All future teachers in the sample will teach physical education in college. The first group of trainees included an average of 98 persons aged 22.4 (SD = 2.0 years) and predominantly male (65.4%). The second group consisted of 66 persons with an average age of 23.3 (SD = 3.1 years) and 63.3% female. A total of 162 future teachers from both groups participated in the first level of measurement and 103 (74.2%) continued in the second level of measurement. Participants in the longitudinal sample were, on average, 22.8 years old (SD = 2.6 years) at the start of the study and the majority were male (73.9%). The comparison between the participants revealed no significant differences in gender, but the participants in either evaluation were about two years younger.

Furthermore, we found no statistically significant differences between the two groups in the effectiveness of outcome variables, teacher motivation, transmissive and professional development perceptions, and emotional fatigue. Participation in the study was voluntary.

Instrument and Analysis

Firstly, as part of a mentoring assessment focusing on professional development and transmission mentoring, we asked future teachers to assess their level of satisfaction with their cooperating teachers. This does not include the content of their interactions. Three items measured professional development mentoring (Table 1); two items measured mentoring focused on transmission. The assessment model was a 6-point scale from (1) strongly disagree to (6) strongly agree. A subset of the items (15 items) were used in this study to assess professional development mentoring and transmission. The development mentoring scale demonstrated an internal consistency of $\alpha = 0.84$. Transmission mentoring has a reliability of $\alpha = 0.80$. The validity of the professional development was examined by cross-validation, half of the data used in an exploratory scaling analysis (ESA) and the other half in a confirmatory data analysis (CSA). We have conducted latent profile analyses (Vermunt and Magidson, 2002) using Mplus Version 7.4 software (Muthén and Muthén, 2015) utilizing oblique rotation to allow correlations between factors. The correlation between the two factors was not significant at $r = 0.05$ ($p = 0.52$). According to Pastor, Barron, Miller and Davis (2007), the analysis of latent profiles is one of the methods used to identify groups or subtypes of profiles in multivariate data. Indeed, this method is recognized as leading to more reliable and robust results than grouping analysis (Pastor, Barron, Miller and Davis, 2007; Vermunt and Magidson, 2002). In summary, these results suggest that our instrument evaluates two independent factors that reflect professional development and transmission-oriented mentoring. To ensure that future teacher evaluations accurately represented the quality of mentoring and agreed with cooperating teachers' perceptions of student learning, we obtained additional validity data from a questionnaire on the mentoring relationship. A total of 164 cooperating teachers completed this questionnaire. The cooperating teachers who participated in this study were on average 46.1 years old (SD = 9.1 years) and 73.6% of them were male. The questionnaire included a 10-item scale using the professional development perceptions of cooperating teachers about teaching-learning. The format of the evaluation was 6 points, ranging from (1) strongly disagree to (6) strongly agree. The scale was aggregated for analysis. Overall, the scale had an internal consistency of $\alpha = .70$. The results showed that the professional development views of

cooperating teachers were negatively correlated with transmission-oriented mentoring, as evaluated by trainees ($r = .40$, $p < .05$) and positively correlated with professional development oriented mentoring.

In addition, the latter association was not statistically

significant due to the small sample size ($r = .32$, $p > .05$). This finding indicates that the assessments of future teachers coincide with the perceptions of their cooperating teachers about learning to teach, suggesting that trainee assessments are useful indicators of the quality of mentoring.

Table 1: Factor saturation for exploratory and confirmatory scaling analysis

Factors	Items	Results of the ESA		Results of the CSA	
	My cooperating teacher:	Factor 1	Factor 2	Factor 1	Factor 2
Mentoring centred on Transmission	Says what I should do to get better.	0.14* (.05)	0.82* (.04)	-	0.79* (.03)
	Had some suggestions as to how I should teach the theme of the course.	0.10 (.05)	0.70* (.03)	-	0.68* (.03)
	Telling me what I'm supposed to do in another way in lessons.	0.00 (<.01)	0.76* (.03)	-	0.71* (.03)
Mentoring centred on professional development	Allows me to make progress more on my own.	0.82* (.04)	0.02 (.01)	0.86* (.04)	-
	Allows me to familiarize myself with various teaching approaches.	0.80* (.04)	0.08 (.04)	0.73* (.04)	-
	Allows me to formulate my personal statements.	0.62* (.03)	0.29* (.04)	0.78* (.04)	-
	Is a source of reflection that invites self-examination.	0.67* (.03)	0.03 (.04)	0.69* (.03)	-

Note : CSA = Confirmatory Scaling Analysis; ESA = Exploratory Scaling Analysis. * $p < 0.05$.

Secondly, we evaluated the quantity of mentoring based on the frequency of interactions between the cooperating teacher and the trainee. The frequency was assessed by a single question: "On average, how often did you talk to your cooperating teacher during your practical training?" Responses were made on a 6-point scale ranging from (1) less than once a month to (6) all sessions. Responses that indicated trainee-cooperative teacher interactions "several times a week" or "every day" were recorded as '1' and all other responses that indicated less frequent interactions were recorded as '0'.

Thirdly, to support the research, we used a scale to measure the cooperating teacher's efficacy (Schwarzer, Schmitz, & Daytner, 1999) and to

determine the professional abilities that exist among mentors. It focused on two main areas: (a) professional development, (b) knowledge transfer. For each of these two topics, cooperating teachers may have specific efficacy needs. It seems that these important items are fundamental to successful mentoring.

Each item was developed following Bandura's social cognitive theory (Bandura, 1997; Schwarzer, 1992). We note that future teachers were asked to assess their agreement with 10 statements on a 4-point Likert scale ranging from (1) strongly disagree to (4) strongly agree. Reliability was satisfactory at both measurement points ($\alpha = .75$; $\alpha = .77$). To support our statistical analyses, we followed the methodological procedures of Vandenberg and Lance (2000), involving: (1) factor saturation, (b) correlation rates, and (c) residual variances.

RESULTS

Descriptive statistics of mentoring practices

We indicated that, in table 2, the results of mentoring focused on transmission were significantly lower than the theoretical average of 3.5 in the 1st group ($t = 2.69$, $p < 0.05$), while the values of mentoring focused on sustainable professional development significantly exceeded the theoretical average in both groups (group 1: $t = 15.23$, $p < .05$ group 2: $t = 12.62$, $p < .05$). Table 2 presents the means and standard deviations of the variables evident for each group at both levels of measurement. The results show statistically significant changes in different variables and groups. The effectiveness of future teachers decreased significantly ($t = 2.63$, $p = 0.03$) in the first group and increased, but not significantly, in the second group. There has

been a significant change in the transmissive and professional development perceptions of future first group teachers. Transmissive perceptions about teaching increased during the first half of the internship ($t = 3.32$, $p < 0.05$), while professional development perceptions decreased ($t = 2.90$, $p < 0.05$). We note that both groups have seen significant changes in job satisfaction and emotional fatigue. The first group showed increased emotional fatigue ($t = 4.55$, $p < .05$) and decreased job satisfaction ($t = 4.47$, $p < .05$).

In the second group, however, emotional fatigue decreased ($t = 4.77$, $p < 0.05$) and job satisfaction increased ($t = 2.28$, $p < 0.05$). Briefly, the results indicate that future teachers progressed differently during their first and second semesters of training internship, which may reflect differences in the teacher training provided each semester.

Table 2: Descriptive statistics of mentoring practices

Result	Groups	N	period 1		period 2		t	p
			M1	SD1	M2	SD2		
Mentoring Frequency	1	98	*	*	0.56	0.50	*	*
	2	66	*	*	0.72	0.47	*	*
Mentoring centred on the development	1	98	*	*	4.53	1.18	*	*
	2	66	*	*	4.75	1.20	*	*
Mentoring centred on Transmission	1	98	*	*	3.33	1.44	*	*
	2	66	*	*	3.43	1.27	*	*
Job satisfaction	1	98	3.44	0.52	3.30	0.64	4.47	0.00
	2	66	3.39	0.56	3.44	0.48	2.28	0.01
Emotional fatigue	1	98	2.19	0.58	0.76	4.73	4.55	0.00
	2	66	2.43	0.62	0.62	4.82	4.77	0.00
Transmissive perceptions	1	98	3.41	0.54	3.42	0.59	3.32	0.00
	2	66	3.36	0.49	3.37	0.61	0.86	0.27
job satisfaction	1	98	3.58	0.55	3.63	0.54	4.47	0.00
	2	66	3.50	0.52	3.77	0.38	2.28	0.00
development perceptions	1	98	2.89	0.39	2.94	0.39	2.90	0.01
	2	66	2.88	0.40	2.90	0.40	0.83	0.38
Efficiency teaching	1	98	3.00	0.39	3.02	0.36	2.63	0.30
	2	66	3.02	0.34	3.12	0.38	1.97	0.50

Determining the qualification level of future teachers

Data revealed separate developmental models for groups 1 and 2 of future teachers. The study findings showed that the unlimited model provided a better adjustment to the model data. Invariance tests showed that the restricted model produced only small changes in the overall model. The limited model, therefore,

provides an appropriate representation of the complete model data. Table 3 shows the regression coefficients of the six structural equation formulas and their adjustment statistics. The predictive indicators were the measurement reference of the outcome variable as assessed at the first level of measurement and the three variables indicating the quality and frequency of mentoring.

Table 3: Results of structural equation formulas to predict future teachers' performance (*p < .05.).

	Measurement reference β_1	Mentoring centred on Transmission β_2	Mentoring centred on development β_3	Interaction periodicity β_4
Job Satisfaction	0.59*	0.05	0.21*	0.4*
Teacher's efficiency	0.53*	0.05	0.11*	0.04
Teacher's pleasure	0.56*	0.05	0.09*	0.00
Transmission perception	0.68*	0.08*	0.02	0.04
Emotional fatigue	0.61*	0.09	0.33*	0.1
Development perception	0.59*	0.03	0.02	0.2*

It is shown that the regression coefficients of the model that predicts the development of teacher effectiveness indicate that the measurement reference strongly predicted teacher efficacy at the second measurement level ($\beta_1 = 0.53$, $p < .05$), which suggests that the design is highly stable between the two measurement periods. In addition, future teachers whose cooperating teachers have demonstrated a sustainable development mentoring style have shown a significant increase in teacher efficacy over the semester ($\beta_3 = 0.11$, $p < .05$). There were no significant changes in teacher efficacy among future teachers who experienced a style of mentoring focused on transmission or who had frequent interactions with their cooperating teacher. Teachers' pleasure was strongly predicted ($\beta_1 = 0.56$, $p < .05$) and a professional development mentoring style ($\beta_3 = 0.09$, $p < .05$). The professional development models of future teachers' perceptions showed a strong homogeneity between the first and second levels of measurement (transmissive perceptions: $\beta_1 = 0.68$, $p < .05$; professional development perceptions $\beta_1 = 0.59$, $p < .05$). While the practice of transmissive mentoring positively predicted the development of transmissive perceptions ($\beta_2 = 0.08$, $p < .05$), professional development mentoring was not significantly associated with constructivist perceptions of future teachers. Only periodic interactions with the cooperating teacher negatively predicted the perceptions ($\beta_4 = 0.20$, $p < 0.05$) when all other variables of the model were controlled. This conclusion suggests that future teachers who expand professional development perceptions are less frequently in interaction with their cooperating teacher. The predictive models of future teachers are characterized by high coefficients of stability (emotional fatigue: $\beta_1 = 0.61$, $p < .05$; job satisfaction: $\beta_1 = 0.59$, $p < .05$). When the reference levels were tested, future teachers who received professional development mentoring showed a statistically significant decrease in emotional fatigue ($\beta_3 = 0.33$, $p < .05$) and a statistically significant increase in job satisfaction ($\beta_3 = 0.21$, $p < .05$). This clearly proves that professional development-oriented mentoring promotes the success of future teachers.

DISCUSSION AND CONCLUSION

In this study, we distinguished two mentoring practices: professional development and transmission mentoring style. We have worked out a methodology to measure the two mentoring practices and evaluate their quality. After establishing the reliability and validity of our measure, we predicted the development of future teachers based on the qualitative and quantitative characteristics of the mentoring experience. We used a pre-test and post-test study design to determine whether mentoring predicts trainees' effectiveness, motivation to teach, the perception of learning, emotional fatigue, and job satisfaction once the various reference thresholds were adjusted.

Most of the future teachers in our study were the participants who received professional development mentoring which provided the mentoring that included opportunities for self-reflection, trying out various teaching methods, and making independent decisions. This means that many cooperating teachers provide a learning atmosphere that supports individual learning and development. This orientation to professional development mentoring can be seen as an unexpected phenomenon, as the teachers who assume the role of cooperating teacher are not qualified teacher trainers, but regular teachers chosen by the head of the school. In this way, cooperating teachers have tended to choose useful monitoring practices despite their limited training. Subsequently, the results of the descriptive analyses showed that the two mentoring practices are unrelated. This means that mentoring for transmission and mentoring for professional development are two distinct practices and cannot be seen as two pillars of a single model. Our results are aligned with Sfard (1998) who argued that the two forms of mentoring make different theoretical suppositions about how to learn and it would not be correct to exclude either of them from research focused on the training-learning process.

There is evidence that a future teacher who is experimenting with professional development mentoring shows higher levels of job effectiveness, motivation and satisfaction and lower levels of emotional fatigue after a semester of training, compared to teachers who

have not received the same mentoring. This confirms Ingersoll & Strong's (2011) findings that mentoring is an important source of support for trainees. In this study, the different mentoring practices predict the development of future teachers differently. Theoretical predictions that mentoring is based on collaborative research and critical thinking have been supported. According to Hudson (2004), this theoretical prediction is helpful in developing the motivation of future teachers. In contrast, while mentoring focused on transmission has increased, trainees' transmissive perceptions do not have significant effects. In this way, it is perceived that the cooperating teachers who provide close supervision of their trainees and pass on their knowledge, their teaching ideas, do not encourage the start of learning effectively. The results also showed that future teachers who interact frequently with their cooperating teachers showed fewer perceptions of professional development when the quality of mentoring instruction was taken into account. It may be hypothesized that future teachers who receive professional development mentoring may not need close guidance and frequent interactions. In this study, we found that the impacts of mentoring are limited in importance and this finding is similar to Cohen's (1988) research findings. It is important to take into account that, when interpreting these impacts, future teachers are also open to training offered at the university. Furthermore, Jones (2000) stated in his study that the time allocated to cooperating teachers for close cooperation with the trainee is limited by the fact that their teaching mission is not generally suited to their monitoring functions. For this reason, special attention

should be paid to the fact that cooperating teachers facilitate the development of trainees despite their limited means.

With the results of our research, we had the opportunity to study the rate of change in future teachers over an entire university year. The methodology applied for our study is the pre-test and post-test to determine the extent to which mentoring provides for the development of the trainees' motivation and perceptions. The main conclusion we drew was that mentoring centred on professional development supports the development of future teachers during pre-service training. Based on our results, we find that mentoring focused on professional development and transmission can be supported by mentoring concepts that are developed and adapted to different concepts of the training theory. Findings from this study indicate that cooperating teachers should be provided with training on supervision during pre-service training.

We conclude that cooperating teachers training should include supervision practice themes to provide their trainees with real practice opportunities and to support them as needed. For future studies, however, we should consider research projects with multiple measures during a university year and compare the results with other studies in countries that have examined this topic and proposed practical solutions.

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NAJPRIKLADNIJA PRAKSA MENTORSTVA NASTAVNIKA-SARADNIKA TOKOM OBAVLJANJA PRAKSE STUDENATA FIZIČKOG OBRAZOVANJA

Ova studija istražuje u kojem stepenu kvalitet i frekvencija mentorstva nastavnika-saradnika tokom obavljanja prakse studenata fizičkog obrazovanja utiče na profesionalne kompetencije budućih nastavnika. Analize su zasnovane na uzorku od više od 164 pripravnika iz oblasti fizičkog obrazovanja iz Tunisa i 96 mentora koji su učestvovali u pred-testiranju i post-testiranju tokom jedne akademske godine. Rezultati ukazuju da kvalitet i frekvencija mentorstva objašnjavaju uspjeh započinjanja profesionalnog života. U pogledu učenja, mentorstvo koje slijedi principe za pružanje pomoći, a ne one koji su usmjereni na prenos znanja, stimuliše izvedbu, motivaciju i zadovoljstvo poslom budućih nastavnika, te smanjuje emocionalnu iscrpljenost.

Ključne riječi: Profesionalni razvoj, prenošenje znanja, mentorstvo, mentor, pripravnici.

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PERCEIVED HEALTH BENEFITS AND BARRIERS TO PHYSICAL ACTIVITY AMONG SECONDARY SCHOOL STUDENTS

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ABSTRACT

Background: This study investigated the perceived health benefits and barriers to physical activity among secondary school students in the United Arab Emirates (UAE). **Methods:** A sample of 585 secondary school students (288 males, 297 females), currently taking physical education, from the city of Al-Ain, Abu-Dhabi, UAE, voluntarily participated in this study. Perceived health benefits and exercise barriers were evaluated by answering a self-filled questionnaire. The health benefit scale consisted of 40 items which were divided into 5 subscales, while the perceived exercise barrier scale consisted of 24 items divided into 4 subscales. **Results:** Students' education levels played a role in the perception of health benefits and PA barriers. Gender differences existed between health benefits and barriers of PA. There was a list of selected benefits and barriers to PA among all students' consensus in the study, with all of the health benefit statements, most on developing fitness and psychological aspects. In terms of perceived barriers, it was the environmental one such as temperature and humidity. **Conclusions:** Since all students' perception to PA benefits was high, it was suggested to reschedule the time of PA and find ways to overcome most barriers.

Keywords: Health benefits, exercise barriers, physical activity, UAE.

INTRODUCTION

Engagement of school students in regular physical activity (PA) is vital to a healthy lifestyle. The health benefits of regular PA are well-documented and include prevention of osteoporosis, type 2 diabetes, heart diseases, high blood pressure, hypercholesterolemia, depression, anxiety, weight problems, along with improving one's heart-lung functions (Kilani, 2015; Reiner et al., 2013; Carson et al., 2013; Palakshappa et al., 2015; U.S. Dept. of Health and Human Services, 2008, 1, Biddle, S.J.H.; Gorely, T.; Stensel, D.J., 2004, Depres et. al., 2006; Rowland, T 2001). Both children and adolescents who practice at least 60 min of PA per day, show an improved cardiorespiratory endurance, muscular endurance, bone health, cardiovascular and metabolic

health biomarkers, body composition, and improved symptoms of depression (as cited by <https://health.gov/paguidelines/guidelines/chapter2.aspx>; Insel & Roth, 2006). Furthermore, PA was found to enhance the functional status and the cardio-respiratory capacity to deliver oxygen and improve body metabolism (Insel & Roth, 2006). Lopez, Gallegos and Extremera (2010) added that regular PA participation would allow the body to gain better physical, psychological and physiological benefits. Regular PA participation was also found to improve one's sense of well-being, self-esteem, and mental health (Zayed & Kilani, 2014; Weinberg & Gould, 2007; Warburton et al., 2006; Bull et al., 2004).

Regular PA was also found to aid secondary school students in coping with stress, stronger feeling of social integration and coherence, improve relaxation, and reduce aggressive behaviour, frustration and anger

(Kubayi & Surujlal, 2014; Dhurup, 2012; Hassmen, Koivula & Uutela, 2000). Several previous studies have also reported that regular PA would strengthen the immune system of the body (Insel & Roth, 2006). Engagement in regular PA was also found to help develop respect for one's body (Talbot, 2001). O'Dea (2003) stated that some social benefits associated with PA participation include having fun and enjoyment, interacting with others, and enhanced life skills (Zayed & Kilani, 2014). Other health benefits were also reported in terms of muscle strength and enhanced academic performance (O'Dea, 2003).

Previous studies suggested that PA benefits might be influenced by gender (Robbins, Sikorskii, Hamel, Wu, & Wilbur, 2009). Young schoolgirls showed greater response to PA and the expected health benefits than boys of the same age and level (Robbins, 2009). Other researchers indicated that female students perceived health benefits of PA in terms of staying in shape, losing body-weight, and increasing the energy level, while male students perceived health benefits of PA in terms of becoming strong, staying in shape and being competitive (Tergerson and King, 2002). Other researchers found that most health benefits of PA participation were perceived in terms of maintaining good health, releasing tension, getting fit, as well as socializing with friends, controlling body weight and having fun (Zunfil et al., 1999). Dubbert (2002) stated that regular PA participation may reduce the risks of obesity, maintains healthy joints, controls pain, builds bone mass, enhances cardiovascular and muscular endurance, builds muscular strength and improves balance.

Despite the well documented health benefits of regular physical activity participation, many people still choose not to exercise. Researchers summarized PA barriers to include time constraints, lack of motivation, lack of energy, lack of self-discipline, lack of family and friends' support, inadequate sport facilities and equipment, discomfort, cost, diseases and physical injuries (Allison, Dwyer & Makin, 1999; Canadian Fitness and Lifestyle Research Institute, 1996; Weinberg & Gould, 2007). Published studies related to investigating students' perceived health benefits and barriers to PA in the UAE are scarce. In a comprehensive review of the literature, only one study investigated students' perceived health benefits and exercise barriers in the UAE. (Dalibalta and Davison, 2016). However, the study did not report statistical comparisons in terms of gender differences, and school grade level. Therefore, due to lack of results related to students' perceived health benefits and barriers to PA in terms of genders and high school grade levels in the UAE, this study was carried out to investigate secondary students' perceived health

benefits and barriers of PA in maintaining their health. The research objectives of this study were: (1) To explore perceived health benefits and barriers to PA among secondary school students; (2) To compare the perceived health benefits and barriers to PA between male and female students; (3) To compare the perceived health benefits and barriers to PA among students based on grade levels; and (4) To compare the perceived health benefits and barriers to PA between PE participants and non-PE participants.

METHODS

Study Design and Participants

The current study employed a cross sectional design. An approval of conducting this study in Abu-Dhabi secondary schools was obtained on 7th February 2017 from the Institutional Ethics Committee. A signed IRB approved informed consent was obtained from the parents or legal guardians prior to commencing data collection. A total of 585 students (288 males, 297 females), with the mean age of 15.90 ± 0.96 years voluntarily participated in this study. Two secondary schools within Al-Ain Education Zone were randomly selected, one for males and one for females. Students were selected randomly for this study. All data were collected in the same school room during the academic year 2017-2018. Body weight and height were measured according to the previously described procedure (Sechrist, Walker, & Pender, 1987) with the use of a stadiometer (SECA model 700, Germany).

Questionnaire:

The Health Belief Model (HBM) is the theoretical model adopted by the current study (Green & Kreuter, 2005). The HBM's original four constructs representing the perceived threats and benefits are: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers. This study utilized both descriptive and inferential research methods to determine the students' perceived health benefits of and barriers to physical activity. Minor modifications of the questionnaire have been made following reviews by an experts' panel from the UAEU faculty members and physical educators.

The perceived health benefits and exercise barriers were evaluated using the perceived health benefits and exercise barriers of physical activity questionnaire (PHBEBPAQ). In addition to the demographic information, the PHBEBPAQ is comprised of two scales: perceived health benefits to PA and perceived exercise barriers to PA.

The health benefits scale consisted of 40 items and was divided into 5 subscales: 1) developing physical fitness subscale (9 items), 2) preventing hypokinetic disease subscale (7 items), 3) maintaining healthy lifestyle behaviours subscale (9 items), 4) promoting psychological health subscale (8 items), and 5) promoting social health subscale (7 items).

The exercise barrier scale was comprised of 21 items and divided into 4 subscales: 1) physical health subscale (7 items), 2) personal subscale (6 items), 3) social subscale (4 items), and 4) environmental subscale (7 items). The items were rated on a 5-point Likert-scale (1 being "strongly disagree" to 5 being "strongly agree"). It was estimated that the questionnaire should not take more than 10 minutes to complete.

The reliability of the questionnaire was measured using Cronbach's alpha. The internal consistency (alpha) for the health benefits and exercise barriers scales of PA were .95 and .97, respectively. The reliability coefficients for the 5 health benefit subscales which were mentioned above were: .93, .93, .90, .92, and .92 respectively. Likewise, the reliability coefficients for the 4 exercise barrier subscales which were mentioned above were: .91, .91, .89, and .93 respectively. The reliability analyses indicated that these subscales were internally reliable as measured by Cronbach's Alpha.

Statistical Analysis

All data are presented as means $\pm$ standard deviation (SD) and were analysed using SPSS (version 23). Preliminary analyses were performed to ensure that there was no violation of the assumptions of normality, linearity, and collinearity.

For demographic measures and physical activity, an independent samples t-test was used to detect significant differences between male and female participants. One-way ANOVA was used to detect significant differences between grade levels for various demographic variables. For PHBEBPAQ scores, independent samples t-test and one-way ANOVA were used to detect significant differences by gender and grade level. Statistical significance was set at $p < 0.05$.

RESULTS

In regard to the first objective which explored the students' perceived health benefits and barriers of physical activity, Table 1 shows the samples' mean and standard deviation for each statement of the benefit subscales (see column 3). The data analysis indicated that almost all secondary school students either agreed or strongly agreed with all of

the health benefit statements. The findings of this study showed that the most perceived health benefits for the study participants regardless of gender were: moving quickly and lightly ($M=4.60$, $SD=.66$), lowering the risks of developing obesity ($M=4.53$, $SD=.76$), maintaining body posture ($M=4.53$, $SD=.72$), maintaining a healthy percent of body fat ($M=4.51$, $SD=.74$), and having fun ($M=4.50$, $SD=.78$). The data analysis also indicated that the least agreed with statements were: "participating in physical activity on a regular basis will help stay away from bad peers" ($M=3.49$, $SD=1.42$), a statement classified under maintaining a healthy lifestyle habit subscale and "participating in physical activity on a regular basis will help become more popular in schools or the neighbourhood" ($M=3.49$, $SD=1.41$), a statement classified under promoting social health subscale.

Generally speaking, statements with the highest scores (i.e., perceived as most beneficial) were related to developing physical fitness subscale ($M=4.48$, $SD=.57$), followed by promoting psychological health subscale ($M=4.39$, $SD=.65$), then preventing hypokinetic diseases subscale ($M=4.37$, $SD=.70$), promoting social health subscale ($M=4.01$, $SD=.95$), and lastly, maintaining healthy lifestyle behaviours subscale ($M=3.93$, $SD=.90$). Table 2 shows the study sample's mean and standard deviation for each statement of the perceived barrier subscales. Data analysis indicated that the most agreed with statements were: 'I do not participate in physical activity because of high temperature' ($M=2.65$, $SD=1.50$), 'I do not like to change my clothes' ($M=2.60$, $SD=1.53$), 'I do not participate in physical activity because of high humidity' ($M=2.57$, $SD=1.50$), 'physical education grades are not counted' ($M=2.49$, $SD=1.47$), and 'I do not prefer wearing sport uniforms' ($M=2.46$, $SD=1.49$).

The least agreed with statements were: 'I do not participate in physical activity because I am afraid that my clothes will be stolen' ($M=2.09$, $SD=1.35$) and 'I do not participate in physical activity because my parents do not encourage me to participate in sports' ($M=2.09$, $SD=1.35$). The findings revealed that almost all students disagreed with all of the barrier statements. Statements with the highest scores (i.e., perceived as most barriers) were related to perceived barriers in the environmental subscale ($M=2.43$, $SD=1.22$) while the barrier statements with the lowest mean scores were in the social subscale ($M=2.19$, $SD=1.20$).

To compare the perceived benefits and barriers to PA between male and female students, an independent t-test was conducted on each subscale to compare the responses of males and females, as summarized in Tables 1 and 2.

Gender differences were found to exist between male and female students in regard to perceived health benefits. The greatest health benefits perceived by male students were: moving quickly and lightly ($M=4.59$, $SD=.71$), having fun ($M=4.58$, $SD=.67$), improving self-

image ($M=4.56$, $SD=.65$), lowering daily psychological stress ($M=4.52$, $SD=.69$), and improving self-confidence ($M=4.52$, $SD=.73$). However, the greatest health benefits perceived by female students were: moving quickly and lightly ($M=4.61$, $SD=.61$), lowering the risks of developing obesity ($M=4.56$, $SD=.69$), maintaining body posture ($M=4.55$, $SD=.66$), maintaining a healthy percent of body fat ($M=4.53$, $SD=.70$), and improving joint flexibility ($M=4.52$, $SD=.59$).

Gender differences were found to exist between male and female students in regard to the perceived exercise barriers. The greatest exercise barriers perceived by male students were: proper settings to change clothes are unavailable ($M=2.73$, $SD=1.56$), high temperature ($M=2.70$, $SD=1.47$), my body is unfit ($M=2.66$, $SD=1.45$), while the greatest exercise barriers perceived by female students were: high temperature ($M=2.60$, $SD=1.54$), I do not like to change my clothes ($M=2.56$, $SD=1.51$), and high humidity ($M=2.49$, $SD=1.52$). Results of the data analysis were summarized in Table 2. Male students attributed greater significance to 14 (items 41, 42, 43, 48, 50, 51, 52, 54, 56, 57, 58, 59, 60, and 61, see Table 3) out of 24 PA barriers which were investigated in this study. From the benefits list, males and females were significantly different in their perceptions of maintaining healthy lifestyle behaviours ($t(566) = 3.09$, $p < .002$), promoting psychological health ($t(571) = 4.33$, $p < .000$), and promoting social health ($t(577) = 8.55$, $p < .000$).

In these three subscales, male students attributed more significance to health benefits of these subscales than female students (see Table 2). No other significant differences were found between male and female students in developing the physical fitness subscale and preventing the hypokinetic diseases subscale. Overall, male students had significantly higher perceived health benefits of PA than female students (see Table 1).

As for the barriers, statistically significant differences were observed between males and females on the four subscales. Table 2, shows the secondary school male and female students' means and standard deviations for each subscale of the barrier scale. Data analysis showed that secondary school male students reported significantly greater physical health barriers than secondary school female students, ($t(575) = 2.31$, $p < .021$). Also, secondary school male students reported significantly greater personal health barriers than secondary school female students, ($t(577) = 2.41$, $p < .016$). Similarly, secondary school male students reported significantly higher social barriers than secondary school female students, ($t(580) = 4.32$, $p < .000$). Lastly, secondary school male students reported significantly higher environmental barriers than secondary school female students, ($t(579) = 3.29$, $p < .001$).

Next, to compare the perceived benefits and barriers to PA among secondary school students based on grade levels, students were divided into three groups:

10th, 11th, and 12th graders. In regard to the perceived health benefits, the data analyses showed significant differences among two of the three groups on 1) "developing physical fitness subscale" $F(2, 575)=7.29$, $p < .001$; 2) "preventing hypokinetic disease subscale", $F(2, 577)=12.24$, $p < .000$; 3) "maintaining healthy lifestyle subscale", $F(2, 577)=7.88$, $p < .000$; and 4) promoting psychological health subscale, $F(2, 570)=3.88$, $p < .021$. No other significant differences were found to exist on "promoting social health subscale", $F(2, 576)=.04$, $p < .960$. Post hoc analyses were conducted using Tukey's post hoc test. The post hoc analyses indicated that 12th graders rated most health benefit subscales greater than 10th graders. However, no difference was found among the three groups in regard to "promoting social health subscale". Likewise, post hoc analyses indicated no significant differences between 10th and 11th graders, and 11th and 12th graders in all health benefit subscales (see Table 3).

In regard to the perceived barriers, data analyses showed significant differences among two of the three groups on 1) personal health barrier subscale $F(2, 576)=4.14$, $p < .016$; 2) and environmental barrier subscale, $F(2, 578)=5.56$, $p < .004$. No significant differences were found to exist on both personal barrier subscale $F(2, 574)=1.77$, $p < .171$ and social barrier subscale $F(2, 581)=1.65$, $p < .192$ among the three groups. Post hoc analyses were conducted using Tukey's post hoc test. While the post hoc analyses indicated that 12th graders rated personal barrier subscale $F(2, 576)=4.14$, $p < .016$; and environmental barrier subscale $F(2, 578)=5.56$, $p < .004$ greater than 10th graders, other post hoc analyses indicated no significant differences between 10th and 11th graders, and 11th and 12th graders in all barrier subscales, see Table 3.

To compare the perceived health benefits and barriers to PA between PE participants and non-PE participants, the students were divided into two groups. Table 5 shows the data analyses of students who did participate in PE periods vs. students who did not participate in PE periods in all subscales. Data analyses indicated that PE participants ($M=4.45$, $SD=.60$) had a significantly higher mean in their perception of "promoting psychological health subscale" than non-PE participants ($M=4.25$, $SD=.72$), $t(364)=2.59$, $p < .02$. No other significant differences between PE participants and non-PE participants were reported in any other subscales of the health benefit scale, see Table 4.

In terms of perceived barriers, the data analyses indicated that non-PE participants ($M=2.22$, $SD=.94$) had a significantly higher "physical health barrier subscale" mean than PE participants ($M=1.85$, $SD=.95$), $t(365)=-3.14$, $p < .002$.

Also, the data analyses indicated that non-PE participants ($M=2.78$, $SD=1.11$) had a significantly higher "personal barrier subscale" mean OR a higher mean of personal barrier subscale than PE participants ($M=1.99$, $SD=1.11$), $t(368)=-5.83$, $p < 0.000$. Furthermore, the data analysis indicated that non-PE participants had a significantly higher mean (2.53 , $SD=1.27$) in the "social barrier subscale" than the PE participants ($m=2.00$, $SD=1.19$), $t(369)=-3.56$, $p < 0.000$. Lastly, the data analyses indicated that non-PE participants ($M=2.88$, $SD=1.21$) had a significantly higher "environmental barrier subscale" mean than PE participants ($M=2.15$, $SD=1.19$), $t(368)=-4.97$, $p < 0.000$, see Table 4.

DISCUSSION

Consistent with previous research (O'Dea, 2003; Kubik, Lytle, & Fulkerson, 2005; Tergerson & King, 2002), this study indicated that the most perceived health benefits to the UAE high school students had to do with moving quickly and lightly, lowering the risks of developing obesity, maintaining body posture, maintaining a healthy percent of body fat. However, other studies showed different results. Deflandere et al. (2004), for example, reported becoming physically fit and having energy were perceived to be the most cited health benefits of PA. Lennox et al. (2017) and Shirinde et al. (2012) reported staying in good health, feeling well and having energy as the most perceived health benefits of PA. Generally, lowering the risks of developing obesity and maintaining body posture can be understood to mean staying in good health, while moving quickly and lightly and maintaining a healthy percent of body fat can be understood to mean becoming physically fit.

Although students in another study reported long sitting time and more watching TV than PA, (Kilani, et al., 2013) our students have not reported such interest. In terms of barriers, the results of this study revealed that high temperature, not liking to change my clothes, high humidity, PE grades not being counted, and not preferring to wear sport uniforms to be the most perceived barriers to PA. Weather seems to play a major role in PA participation for the UAE secondary school students. Consistent with Tappe et al. (1989), unsuitable weather was found among the major barriers to exercise. In a more recently published study, adverse weather conditions were among the most cited perceived barriers to PA, reported by Pandolfo et al., 2016. Other studies also reported similar results (Copetti et al., 2012; Müller et al., 2013; and Dambros et al., 2013). The climate in the UAE is extremely hot, humid in the coast and extremely hot, dry, and sandy in the interior during the summer season. In our study, the data

was collected prior to the very hot season and this might have had an effect in their perception of such PA barriers. This, itself, discourages students to participate in PA, suggesting indoor and air-conditioned climate should always be available.

In our study, gender differences were found to exist between male and female students in regard to perceived health benefits. The greatest health benefits perceived by male students were: moving quickly and lightly, having fun, improving self-image, lowering daily psychological stress, and improving self-confidence. On the other hand, the greatest health benefits perceived by female students were: moving quickly and lightly, lowering the risks of developing obesity, maintaining body posture, maintaining a healthy percent of body fat, and improving joint flexibility. Lovell, El Ansari, and Parker (2010) have found that the greatest perceived benefit from exercise was physical performance, followed by the benefits of psychological outlook, preventive health, life enhancement, and then social interaction. In contrast, the most commonly reported benefit of exercising among females was "to stay in shape," whereas the most commonly reported benefit to exercising among males was "to become strong." Among females, the most common barrier to exercising was "having no time to exercise," whereas males were most likely to report "wanting to do other things with my time." (Tergerson and King, 2002), in another study conducted by Robins, et al. (2009), have different responses as they stated. Only "take care of myself, stay in shape, and be healthier" emerged as a greater benefit for girls than boys. Among students not on a sports team, boys reported fewer barriers than girls. Among those selecting an active pursuit, boys perceived more barriers than girls. When controlling for sports team participation and perceived benefits and barriers, boys reported more minutes of vigorous PA than girls.

Modification of current PE curriculum and strategy in UAE schools in regard to physical education class offering and other school PA opportunities (e.g., more invasive and sport teams) is justified to ensure optimal engagement of students.

Gender differences were also found to exist between male and female students in regard to the perceived exercise barriers. The greatest exercise barriers perceived by male students were: proper settings to change clothes are unavailable, high temperature, my body is unfit, while the greatest exercise barriers perceived by female students were: high temperature, I do not like to change my clothes, and high humidity. In this study, secondary school male students were found to attribute greater significance to barriers than secondary school female students. Previous studies revealed that girls perceived more barriers to PA than boys (Deflandre et al., 2004; Allison et al., 1999; Sallis, Zakarian, Hovell & Hofstetter, 1996). However, the findings of this study were found to be consistent with

the results reported by a more recent study which found that male adolescents perceived more barriers to physical activity than did female adolescents (Robbins et al., 2009).

As a result, most of the perceived barriers are derived from their thought that is related to sport rather the physical activity per se. This observation is not surprising considering school physical education is sport driven and that physical educators and parents are likely to portray this perspective as well. It is therefore not surprising that the barriers identified were very sport oriented and environmental ones. More focus toward providing students with a greater knowledge and awareness about more general forms of physical activity and diverse modes of being physically active is, therefore, required. In order to enhance physical activity levels among the students, a wide plan of infrastructure in the environmental setting in the school, lockers, and indoor gym were suggested by the participants.

In regard to the perceived health benefits between grade levels, the data analyses showed significant differences among two of the three groups on 1) "developing physical fitness subscale", 2) "preventing hypokinetic disease subscale", 3) "maintaining healthy lifestyle subscale" and 4) "promoting psychological health subscale". No other significant differences were found to exist on "promoting social health subscale". Post hoc analyses were conducted using Tukey's post hoc test. The post hoc analyses indicated that 12th graders rated most health benefit subscales greater than 10th graders. However, no difference was found among the three groups in regard to "promoting social health subscale". Likewise, post hoc analyses indicated no significant differences between 10th and 11th graders, and 11th and 12th graders in all health benefit subscales (see Table 4). In regard to the perceived barriers between students' grades level, data analyses showed significant differences among two of the three groups on 1) personal health barrier subscale and 2) environmental barrier subscale. No significant differences were found to exist on both personal barrier subscale and social barrier subscale among the three groups. Post hoc analyses conducted using Tukey's post hoc test analyses indicated no significant differences between 10th and 11th graders, and 11th and 12th graders in all the barrier subscales, see Table 4. This means that all grade levels have similar output in their perception to health benefits and barriers toward PA. However, data analyses indicated that PE participants had a significantly higher mean in their perception of "promoting psychological health subscale" than non-PE participants. It might be due to the cohort physical development at this stage such as self-involvement, alternating between unrealistically high expectations and poor self-concept. The post hoc analyses indicated that 12th graders rated most health benefit subscales greater than 10th graders. This is also related to age differences, the older students have greater emotional stability and ability to make

independent decisions. (Busch and Hofer, 2012)

In terms of perceived barriers, the data analyses indicated that non-PE participants had a significantly higher "physical health barrier subscale" mean than PE participants. Also, the data analyses indicated that non-PE participants had a significantly higher "personal barrier subscale" mean or a higher mean of the personal barrier subscale than PE participants. Furthermore, the data analysis indicated that non-PE participants had a significantly higher mean in the "social barrier subscale" than the PE participants. Lastly, the data analyses indicated that non-PE participants had a significantly higher "environmental barrier subscale" mean than PE participants. Birnbaum, et al. (2006) had investigated the girls' perceptions of the perceived certain barriers of the environment, facilities, and transportation with their importance correlation to PA. The findings from the current study are also similar to Case-Smith et al. (2010) study. These findings are similar despite the differences in the age of the student population, demographics, and specifics of the yoga program. In addition, the results of the current study also found an additional benefit of psychological health, especially with those who participated in PE classes. It is believed that the key to overcome these health problems lies with what learning experiences students are exposed to in physical education. Students can be exposed to various learning experiences through the implementation of a quality physical education curriculum. A quality physical education curriculum should provide students with good foundations that will enable students to lead a healthy and active lifestyle (Hanif, 2017). More recently, Abu-Dhabi Education Council initiated, in 2011, some educational reforms in the health and physical education curriculum through introducing many health aspects into the curriculum. (Abu Dhabi Education Council (ADEC), 2012)

CONCLUSION

Our study investigated public secondary school students' perceived health benefits and barriers to physical activity in the UAE. Most of the evidence from this survey stemmed from the students themselves. Both genders were in agreement of the perceived benefits and barriers to PA, despite the fact that their perceptions vary on some items of the subscales. Gender differences also existed between health benefits and barriers of PA. It was indicated that almost all secondary school students either agreed or strongly agreed with all of the health benefit statements. Developing physical fitness subscale got the highest level of agreement among participating students, followed by promoting psychological health, and then preventing hypokinetic diseases subscales. Barriers such

as climate, changing clothes, physical education grades are not counted, and not preferring to wear sport uniforms were the most ranked scores. From the benefits list, males and females were significantly different in their perceptions of maintaining healthy lifestyle behaviours, promoting psychological health, and promoting social health. As for the barriers, secondary school male students reported significantly greater physical health barriers than secondary school female students. It was suggested to modify the PE curriculum and strategy in UAE schools in regard to physical education classes, offering more PA opportunities

like invasive and sport teams to ensure the optimal engagement of students. Finally, it was suggested to reschedule the time of PA and find ways to overcome most barriers, since all students' perception to PA benefits was high.

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Table 1: Exercise Benefits Scale and Gender Differences: mean and standard deviation of each questionnaire item

Perceived Health Benefit Items		All M (SD)	Male M (SD)	Female M (SD)	T-test	Sig.
Participating in physical activity on a regular basis will help						
A. Developing Physical Fitness Subscale						
9	move quickly and lightly.	4.60 (.66)	4.59 (.71)	4.61 (.61)	-.20	.841
7	maintain a healthy percent of body fat.	4.51 (.74)	4.49 (.77)	4.53 (.70)	-.693	.489
3	improve joint flexibility.	4.49 (.68)	4.45 (.75)	4.52 (.59)	-1.09	.275
4	improve cardiovascular endurance.	4.47 (.71)	4.45 (.77)	4.47 (.66)	-.39	.694
8	improve bone strength.	4.45 (.73)	4.50 (.71)	4.40 (.67)	1.74	.082
5	improve the ability of blood vessels in the body.	4.45 (.73)	4.44 (.79)	4.45 (.67)	-.07	.940
6	improve the capability of the lungs.	4.44 (.74)	4.47 (.76)	4.39 (.64)	1.27	.203
2	increase muscular endurance.	4.43 (.70)	4.46 (.72)	4.41 (.66)	1.01	.313
1	increase muscular strength.	4.43 (.73)	4.47 (.77)	4.39 (.68)	1.28	.200
Subscale Mean		4.48 (.57)	4.48 (.62)	4.47 (.51)	0.14	.881
B. Preventing Hypokinetic Disease Subscale						
15	maintain body posture.	4.53 (.72)	4.51 (.77)	4.55 (.66)	-.70	.481
14	lower the risks of developing obesity.	4.53 (.76)	4.50 (.83)	4.56 (.69)	-.85	.394
13	lower the risks of developing a high cholesterol level.	4.31 (.84)	4.35 (.87)	4.27 (.79)	1.16	.246
12	lower the risks of developing heart diseases.	4.31 (.86)	4.34 (.88)	4.29 (.82)	.78	.434
11	lower the risks of developing diabetes.	4.30 (.87)	4.34 (.88)	4.27 (.85)	1.11	.263
10	lower the risks of developing high blood pressure.	4.28 (.85)	4.30 (.89)	4.25 (.80)	.74	.459
16	lower the risk of developing low back pain.	4.28 (.91)	4.30 (.93)	4.25 (.87)	.546	.585
Subscale Mean		4.37 (.70)	4.38 (.75)	4.35 (.51)	0.47	.633
C. Maintaining Healthy Lifestyle Behaviours Subscale						
23	monitor body-weight.	4.31 (.96)	4.29 (1.04)	4.32 (.87)	-.45	.651
25	use my free time on something useful.	4.22 (1.02)	4.26 (1.02)	4.18 (1.01)	1.06	.287
19	stay away from drugs.	4.04 (1.25)	4.22 (1.17)	3.86 (1.28)	3.46*	.001
20	stay away from alcohol.	3.99 (1.26)	4.17 (1.20)	3.81 (1.29)	3.46*	.001
17	stay away from smoking.	3.95 (1.20)	4.06 (1.19)	3.82 (1.20)	2.37*	.018
24	go to bed early.	3.79 (1.26)	3.95 (1.16)	3.65 (1.32)	2.90*	.004
18	stay away from eating unhealthy food such as fast food.	3.75 (1.18)	3.90 (1.13)	3.60 (1.21)	2.88*	.004
21	stay away from unhealthy drinks such as energy drinks.	3.75 (1.26)	3.86 (1.26)	3.64 (1.25)	1.99*	.047
22	stay away from bad peers.	3.49 (1.42)	3.70 (1.37)	3.27 (1.42)	3.58*	.000

Subscale Mean		3.93 (.90)	4.04 (.91)	3.81 (.89)	3.09*	.002
D. Promoting Psychological Health Subscale						
3	have fun.	4.50 (.78)	4.58 (.67)	4.42 (.86)	2.57*	.010
0						
2	improve self-image.	4.46 (.77)	4.56 (.65)	4.35 (.85)	3.48*	.001
8						
2	lower psychological daily stress.	4.42 (.79)	4.52 (.69)	4.33 (.85)	3.04*	.002
9						
26	maintain mental health.	4.39 (.81)	4.51 (.76)	4.28 (.84)	3.39*	.001
27	Improve self-confidence.	4.39 (.82)	4.52 (.73)	4.27 (.88)	3.78*	.000
32	stimulate the mind and improve thinking, imagination and innovative skills.	4.35 (.86)	4.49 (.77)	4.21 (.91)	3.99*	.000
31	lower the anxiety level.	4.31 (.88)	4.45 (.75)	4.17 (.96)	3.97*	.000
33	alleviate long-term pressure such as sadness and disparity.	4.28 (.90)	4.44 (.77)	4.13 (.99)	4.28*	.000
Subscale Mean		4.39 (.66)	4.51 (.58)	4.27 (.70)	4.33*	.000
E. Promoting Social Health Subscale						
39	acquire leadership skills.	4.20 (1.01)	4.46 (.81)	3.94 (1.10)	6.39*	.001
35	acquire new social skills.	4.19 (1.05)	4.47 (.82)	3.91 (1.16)	6.65*	.000
38	communicate with others.	4.10 (1.09)	4.41 (.82)	3.79 (1.23)	7.07*	.000
36	make new friends.	4.06 (1.09)	4.42 (.81)	3.71 (1.21)	8.34*	.000
34	help me be more accepted by my friends.	4.04 (1.17)	4.38 (.90)	3.70 (1.29)	7.40*	.000
37	keep my friends.	3.99 (1.18)	4.37 (.86)	3.61 (1.31)	8.27*	.000
40	become more popular in schools or the neighbourhood.	3.49 (1.41)	3.81 (1.28)	3.18 (1.45)	5.63*	.000
Subscale Mean		4.01 (.95)	4.33 (.71)	3.70 (1.04)	8.55*	.000

Table 2: Exercise Barrier Scale and Gender Differences: mean and standard deviation of each questionnaire item

Perceived Health Benefit Items		All M (SD)	Male M (SD)	Female M (SD)	T-test	Sig.
I do not participate in physical activity because						
Physical Health Barrier Subscale						
53	I do not like to change my clothes.	2.60 (1.53)	2.64 (1.55)	2.56 (1.51)	.63	.35
52	I do not prefer wearing sport uniforms.	2.46 (1.49)	2.59 (1.53)	2.32 (1.45)	2.18*	.03
48	I am not allowed to play while wearing daily school clothes.	2.44 (1.44)	2.57 (1.49)	2.31 (1.37)	2.15*	.03
49	I do not feel any enjoyment.	2.36 (1.37)	2.42 (1.41)	2.30 (1.32)	1.09	.27
51	I do not want my clothes to get dirty.	2.20 (1.41)	2.32 (1.17)	2.08 (1.35)	2.00*	.04
50	I am afraid that my clothes will be stolen.	2.09 (1.35)	2.27 (.89)	1.91 (.80)	3.26*	.001
Subscale Mean		2.35 (1.20)	2.47 (1.26)	2.23 (1.11)	2.41	.016
Social Barrier Subscale						
56	I am satisfied to play with my friends in the evening in our neighborhood or other more entertaining settings.	2.35 (1.44)	2.60 (1.49)	2.11 (1.34)	4.16*	.00
57	I try to avoid fights with other students.	2.21 (1.40)	2.49 (1.50)	1.94 (1.23)	4.80*	.00
54	some students do not want me to play with them.	2.13 (1.36)	2.34 (1.46)	1.92 (1.24)	3.79*	.00
55	my parents do not encourage me to participate in sports.	2.09 (1.35)	2.17 (1.41)	2.01 (1.28)	1.46	.14
Subscale Mean		2.19 (1.20)	2.40 (1.26)	1.97 (1.10)	4.32*	.000

Environmental Barrier Subscale						
62	of high temperature.	2.65 (1.50)	2.70 (1.47)	2.60 (1.54)	.81	.42
63	of high humidity.	2.57 (1.50)	2.63 (1.48)	2.49 (1.52)	1.44	.25
59	physical education grades are not counted.	2.49 (1.47)	2.62 (1.54)	2.37 (1.40)	2.04*	.04
58	proper settings to change clothes are unavailable.	2.39 (1.47)	2.73 (1.56)	2.06 (1.29)	5.67*	.00
64	of sand and dust.	2.40 (1.48)	2.51 (1.48)	2.29 (1.48)	1.79	.07
60	my classmate friends do not participate.	2.36 (1.43)	2.48 (1.45)	2.23 (1.40)	2.10*	.03
61	sport courts are unfit to play in.	2.23 (1.39)	2.52 (1.49)	1.93 (1.20)	5.29*	.00
Subscale Mean		2.43 (1.22)	2.60 (1.25)	2.27 (1.17)	3.29*	.001

Table 3: Differences in the Benefits and Barriers of Physical Activities Based on Students' Grade Levels

Subscales		Grades	Means	Sum of Squares	df	Mean Square	F	Sig.
Perceived Health Benefit Subscales								
Developing Physical Fitness Subscale	Between Groups	10th	4.41*	4.715	2	2.358	7.29*	.001
	Within Groups	11th	4.47	185.941	575	.323		
	Total	12th	4.67*	190.656	277			
Preventing Hypokinetic Disease Subscale	Between Groups	10th	4.23*	11.468	2	5.734	12.24*	.000
	Within Groups	11th	4.32	270.257	577	.468		
	Total	12th	4.67*	281.725	579			
Maintaining Healthy Lifestyle Subscale	Between Groups	10th	3.80*	12.495	2	.247	7.88*	.000
	Within Groups	11th	3.97	447.469	565	.792		
	Total	12th	4.20*	459.964	567			
Promoting Psychological Health Subscale	Between Groups	10th	4.34*	3.315	2	1.657	3.88*	.021
	Within Groups	11th	4.38	243.006	570	.426		
	Total	12th	4.56*	246.321	572			
Promoting Social Health Subscale	Between Groups	10th	3.99	.073	2	.037	.04	.960
	Within Groups	11th	4.02	519.661	576	.902		
	Total	12th	4.02	519.734	578			
Perceived Barrier Subscales								
Physical Health Barrier Subscale	Between Groups	10th	1.98	3.279	2	1.639	1.77	.171
	Within Groups	11th	2.02	530.632	574	.924		
	Total	12th	2.19	533.911	576			
Personal Health Barrier Subscale	Between Groups	10th	1.98	2.25*	11.734	2	4.14*	.016
	Within Groups	11th	2.02	2.34	815.438	576		
	Total	12th	2.19	2.65*	827.17	578		
Social Barrier Subscale	Between Groups	10th	2.11	4.779	2	2.390	1.65	.192
	Within Groups	11th	2.20	837.276	579	1.446		
	Total	12th	2.36	842.055	581			
Environmental Barrier Subscale	Between Groups	10th	2.30*	16.421	2	8.211	5.56*	.004
	Within Groups	11th	2.44	852.463	578	1.475		
	Total	12th	2.75*	868.884	580			

*indicates significant differences between groups.

Table 4: Differences in the Perceived Benefits and Barriers to PA Based on PE Participants and non-PE Participants

Subscales	PE Period Participation	M	SD	T-value	Sig
Perceived Health Benefits Subscales					
Developing Physical Fitness Subscale	yes	4.53	.51	.71	.48
	no	4.49	.54		
Preventing Hypokinetic Disease Subscale	yes	4.38	.68	.14	.89
	no	4.37	.71		
Maintaining Healthy Lifestyle Subscale	yes	4.01	.83	1.70	.09
	no	3.83	.95		
Promoting Psychological Health Subscale	yes	4.45	.60	2.59	.02*
	no	4.25	.72		
Promoting Social Health Subscale	yes	4.06	.92	1.37	.17
	no	3.91	1.02		
Perceived Exercise Barriers Subscales					
Physical Health Barrier Subscale	yes	1.85	.95	-3.14	.002*
	no	2.22	.94		
Personal Barrier Subscale	yes	1.99	1.12	-5.83	.000*
	no	2.78	1.11		
Social Barrier Subscale	yes	2.00	1.19	-3.56	.000*
	no	2.53	1.27		
Environmental Barrier Subscale	yes	2.15	1.19	-4.97	.000*
	no	2.88	1.21		
Perceived Health Benefits Subscales					
Developing Physical Fitness Subscale	yes	4.53	.51	.71	.48
	no	4.49	.54		
Preventing Hypokinetic Disease Subscale	yes	4.38	.68	.14	.89
	no	4.37	.71		
Maintaining Healthy Lifestyle Subscale	yes	4.01	.83	1.70	.09
	no	3.83	.95		
Promoting Psychological Health Subscale	yes	4.45	.60	2.59	.02*
	no	4.25	.72		
Promoting Social Health Subscale	yes	4.06	.92	1.37	.17
	no	3.91	1.02		
Perceived Exercise Barriers Subscales					
Physical Health Barrier Subscale	yes	1.85	.95	-3.14	.002*
	no	2.22	.94		
Personal Barrier Subscale	yes	1.99	1.11	-5.83	.000*
	no	2.78	1.11		
Social Barrier Subscale	yes	2.00	1.19	-3.56	.000*
	no	2.53	1.27		
Environmental Barrier Subscale	yes	2.15		-4.97	.000*
	no	2.88			

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ZAPAŽENE ZDRAVSTVENE DOBROBITI I BARIJERE ZA FIZIČKU AKTIVNOST OD STRANE UČENIKA SREDNJIH ŠKOLA

Relevantni podaci: Ova studija je istraživala zapažene zdravstvene dobrobiti i barijere za fizičku aktivnost od strane učenika srednjih škola u Ujedinjenim Arapskim Emiratima (UAE). Metode: Uzorak se sastojao od 585 učenika srednjih škola (288 muškog i 297 ženskog pola) koji trenutno pohađaju fizičko obrazovanje, iz grada Al-Ain, Abu-Dhabi, UAE, a koji su dobrovoljno učestvovali u ovoj studiji. Zapažene zdravstvene dobrobiti i barijere za tjelovježbu su procijenjene putem samostalnog odgovaranja na pitanja navedena u upitniku. Skala zdravstvene dobrobiti se sastojala iz 40 stavki koje su bile podijeljene na 5 subskala, dok se skala zapaženih barijera za tjelovježbu sastojala od 24 stavke podijeljene na 4 subskale. Rezultati: Nivo obrazovanja učenika je igrao ulogu u percepciji zdravstvenih dobrobiti i barijera za fizičku aktivnost. Razlike u spolovima su postojale između zdravstvenih dobrobiti i barijera za fizičku aktivnost. Sačinjena je lista odabranih dobrobiti i barijera za fizičku aktivnost za koje su se svi učenici složili tokom studije, a koja je navodila sve izjave koje se tiču zdravstvenih dobrobiti od kojih se većina odnosila na razvoj tjelesne kondicije i psiholoških aspekata. Kada su u pitanju zapažene barijere, navedena je ona koja se odnosi na klimu poput temperature i vlažnosti. Zaključci: Budući da je percepcija dobrobiti fizičke aktivnosti od strane učenika bila visoka, predloženo je da se promijeni vrijeme održavanja fizičkih aktivnosti, te da se pronađu načini za prevazilaženje većine barijera.

Ključne riječi: Zdravstvene dobrobiti, barijere za tjelovježbu, fizička aktivnost, UAE.

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THE EFFECT OF COMBINED TRAINING (HIP ABDUCTOR AND EXTERNAL ROTATORS STRENGTHENING+BALANCE) ON MUSCLE STRENGTH AND POSTURAL CONTROL IN PATIENTS WITH PATELLOFEMORAL PAIN SYNDROME

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ABSTRACT

Patellofemoral pain syndrome (PFPS) is a musculoskeletal disorder of the knee joint. The purpose of this study was to investigate the effect of combined exercise (hip abductor and external rotators strengthening + balance) on muscle strength and postural control in patients with PFPS. In this semi-experimental research, 20 men with PFPS who were accessible were selected purposively and were then randomly assigned to two groups, i.e. the experimental (10) and control (10) groups. The experimental group performed a training program for eight weeks. Muscle strength and postural control in the patients were measured through the handheld dynamometer, static balance (stork test) and dynamic balance (Y test), before and after the exercise. Repeated measures ANOVA were used to analyse the data with $P \leq 0.05$. The results indicated that the changes and interactions of all the variables were significant in the experimental group ($P < 0.05$). The results also showed that the experimental group, compared with the control group, had a significant improvement in all the variables ($P < 0.05$). With respect to the effectiveness of training on the improvement of muscle strength and postural control, the rehabilitation experts and therapists can use this research training protocol in the physical rehabilitation of PFPS.

Keywords: PFPS, combined training (hip abductor and external rotators strengthening + balance), disability function

INTRODUCTION

Patellofemoral pain syndrome is a musculoskeletal disorder, and is diagnosed for people who need medical care (Wood, Muller, & Peat, 2011). The clinical symptoms of patellofemoral

pain syndrome; the pain behind the patella that is associated with movements such as squats, crouching, climbing stairs, running and sitting down (Cook, Hegedus, Hawkins, Scovell, & Wyland, 2010). The disorder in these individuals limits their participation in daily activities and exercise.

The mechanism of Patellofemoral pain syndrome is unknown (Bolgla, Malone, Umberger, & Uhl, 2008; Näslund, Odenbring, Näslund, & Lundeberg, 2005; Tang et al., 2001). The most appropriate method for this disease lies in intervention strategy. Given that the cause of patellofemoral pain syndrome is growing, empirical evidence show that a disruption in controlling pelvic muscles can alter the kinematics and kinematics of the patellofemoral joint syndrome in people. (Powers, 2010) Hip external rotator muscles are not directly related with patella. However, in a closed kinetic chain, through Tensor Fasciae Latae and internal rotation, control and adduction of the hip muscle can affect patella displacement (Boling, Bolgla, Mattacola, Uhl, & Hosey, 2006; Neumann, 2013; Powers, 2010).

In the past, in most treatment centres for people with patellofemoral pain syndrome, focus had been placed on strengthening the quadriceps muscles, particularly the vastus muscle, but today, according to the conducted studies, it is more appropriate to strengthen the muscles of the hip joint which help reduce clinical symptoms of patients (Mohamad-khani, Kh, & Ghaznavi, 2010) (Khayambashi, Mohammadkhani, Ghaznavi, Lyle, & Powers, 2012). Several studies addressed the impact of weakness around the hip muscle groups which creates improper hip and consequently leads to patellofemoral pain syndrome (Robinson & Nee, 2007). Ireland and colleagues (2003), who studied the comparison between the strength of hip abductors and external rotator in women with/without patellofemoral pain syndrome, concluded that women have hip muscle weakness syndrome (Ireland, Willson, Ballantyne, & Davis, 2003). Despite the various causes of this malady, one of the expressed disorders is the problem of balance in these patients (Aminaka & Gribble, 2008; Ebrahimi, Salavati, Marufi, & Esmaili, 2007). Balancing is one of the key elements for successful daily performances and sports activities (Salavati, Moghadam, Ebrahimi, & Arab, 2007). Controlling static and dynamic balance is highly dependent upon visual, vestibular and proprioceptive information (Hassan, Mockett, & Doherty, 2001). Proprioception and balance in adults are closely connected and proprioception is one of the balance factors (Prentice & Kaminski, 2004).

A study reported that people with patellofemoral pain syndrome have less proprioception than healthy subjects (Salavati et al., 2007). Thus far, a few studies have been carried out in connection with balance in patients who suffer from anterior knee pain. In a study done by Goto and colleague in 2009, the impact of anterior knee pain syndrome on dynamic postural control was examined by a Star Excursion Balance Test. The results indicate that these patients, anteriorly, are able to travel shorter

distance compared to healthy subjects (Goto, 2009). As shown in previous studies, these subjects have weakness in hip muscles and disruption in their balance. Moreover, no investigation has been carried out to study the effect of strength and balance exercises combined; each study has been separate and different. Therefore, the objective of this study is to study the impact of combined training (strengthening the hip abductors and external rotators + balance) on postural control and strength in patients who suffer from patellofemoral pain syndrome.

METHODS

The pre-test and post-test study was quasi-experimental. The statistical sample consisted of patients referred to the orthopaedic centres in Isfahan. They were diagnosed with patellofemoral pain syndrome and referred to Baharestan physiotherapy centre for rehabilitation treatment.

A total of 24 male patients with patellofemoral pain syndrome were checked for availability and chosen randomly and evenly into two groups, the experimental (n=12) and control (n=12) groups. 4 patients were excluded for irregular participation in training and their absence during post-test. Thus, all analysis was done with data from 20 patients.

Inclusion criteria of this study included: 1) participants aged 18 to 35, 2) clinical components of patellofemoral pain on one side for more than three months, 3) reported pain in the anterior or posterior in at least two activities: prolonged sitting, going up and down the stairs, squats, running and jumping, 4) pain in at least two to three of the following tests: pain during resisted isometric contraction of the quadriceps muscle, pain and tenderness to touch at the back of the knee, pain during squatting.

Exclusion criteria of the study included: 1) knee surgery operation, 2) ligament instability or internal disorders of the knee, 3) dislocation of the patella or its partial dislocation, 4) locking or unloading the knee, 5) acute and chronic diseases, 6) Osgood-Schlatter disease, muscle rupture, Johansson syndrome, bursitis, patellar diseases, 7) participation in training programs of lower limbs (Davis & Powers, 2010). Before and after the training period, in order to assess the strength and postural control, a handheld dynamometer, static balance (stork test) and dynamic balance (Y test) were used respectively.

To measure muscle strength, the subject should be in a lying position on one side, while the whole body remains in the same side. Then, in order to stabilize the body, the leg below was slightly bent in the knee, and the leg under test was fixed. The patient's hip joint is fixed by an examiner and a dynamometer pad is placed higher than the femoral epicondyle. The patient, by pressing towards the device, tries to have hip abduction, and the maximum force is recorded by the device.

To measure muscle strength and lateral rotator of the hip, the subject should be in a sitting position. The first patient sits on the edge of the bed and his knee is in a 90° flexion. His leg hangs out of the bed, to prevent the patient from using a muscle round, the distal part of the femur is fixed by the tester and the dynamometer pad is slightly above the ankle of the leg. The patient pushes towards the device to try to turn the thigh outward, and the maximum force is recorded by the device.

For measuring balance, a static balance test (stork test) and a dynamic balance test (Y test) were used. (B) To measure the static balance test, the subject lays his hands on the iliac crest and it is done on the dominant leg. The examiner hits the stopwatch as the test begins, and in case of an error during the test, pauses the watch to save his time. This time is calculated. The test is performed three times and its average is calculated for the individual. To measure the dynamic balance (Y test), this test has three anterior, inner posterior, outer posterior directions which are in the form of Y with 135, 135 and 90 degrees from each other.

To run the test, the subjects stand in the centre of the device with their dominant leg, while the other leg moves the moving part forward until no error occurs (the leg does not move from the centre of the device, the subject does not lean on the leg which is tested or the examinee does not fall) and then, the subjects return to normal - standing on two feet. The distance between the moving part to the centre of the device is the achieving distance. The examinee takes the test three times, and the examiner measures the achieved average from each direction and records it for the subject.

Measurements of static and dynamic tests on the patient's leg are performed with open and closed eyes. Patients in the experimental group did the training protocol in 8 weeks, 3 sessions per week, with 40 minutes per each session (5 minute warm-ups, 30 minutes for strengthening the abductor

muscle, external rotator, and balance training, and 5 minutes of cool-down). Strengthening exercises were done by using resistance tubes made in America with five different colours (yellow, red, green, blue, black) in order to create the resistance and muscle strength.

Before the start of the training, all the examinees of the experimental group were assessed to determine the training intensity and appropriateness of the training tube. For this reason, the patient is asked to start with low resistance (yellow) 10 times for exercises with rubber. In case of success, the type of rubber changes based on its resistance to determine the basic level of the individual's stamina to begin the training.

Then, each patient begins the training based on the early assessment by colour tube suitable to his strength. In order to respect the principle of overload training, if the patients are able to do exercises in three sets of 10 repetitions in each session, a new rubber (with higher resistance) is then prescribed. In the experimental group, in order to strengthen the muscles, the subject leans on one side and is fixed on the bed with a proper strap for the hip. One end of the tube is attached to the top of the ankle, while the other end is fixed under the bed, and the examinee is asked to do an abduction move in the range of 30 degrees (Figure 1). Hip external rotator muscle strengthening exercises were done while seated on the bed with the knee flexion of 90 degrees. One end of the tube is attached to the ankle, while the other end is linked to a fixed bar, and the patient does the exercises in the range of 30 degrees of movement (Figure 2).

Balance training, both on the ground and balance on both feet was conducted by using a board. Balance trainings are done both on the ground level and balance board on both feet. In balance training, the patient stands on the ground and balance board with one hand around his waist (Figure 3). Wobble board were (Figure 3). The variance analysis for repeated data was used for data analysis. The significance level for all analyses is considered and it is $0.05 > P$.

RESULTS

Table (1) shows demographic data samples and, in Table 2, the findings of descriptive variables and analysis of variance are evident.

The most important part of the analysis of variance for repeated data is interaction. This part of the test represents a change in groups towards each other. In other words, the process of change is shown (slope of the lines) in both groups and it can explain the probable

influence and superiority of groups over each other. As shown in table 2, there is a significant interaction observed in both groups in abductor muscle strength, external rotator muscle strength, static balance with eyes open, static balance while blindfolded, dynamic balance anterior and dynamic balance posterior with eyes open, dynamic balance posterior-external with eyes open, anterior dynamic balance blindfolded, posterior-internal dynamic balance blindfolded and dynamic balance posterior-external blindfolded.

Table 1: Demographic information of the subjects (Mean $\pm$ SD) belonging to the studied groups

	Experimental group	Control group	t	p
Age (year)	28.9 $\pm$ 5.7	28.9 $\pm$ 0.7	0.344	0.79
Height (cm)	177.25 $\pm$ 4.7	177.2 $\pm$ 2.7	0.743	0.48
Weight (kg)	77.38 $\pm$ 7.3	77.6 $\pm$ 8.4	0.870	0.43

Table 2: Analysis of variance with repeated measures for study variables

Variable	Test	Experimental group Mean $\pm$ SD	Control group Mean $\pm$ SD	Comparison Within Groups	Comparison Between Groups	Interaction
Abductor muscle strength	Pre-test	20 $\pm$ 2.02	22 $\pm$ 3	F=15.0	F=4.0	F=1382
	Post-test	24 $\pm$ 2	21 $\pm$ 3	P=0.001	P=0.053	P=0.001
External rotator muscle strength	Pre-test	17 $\pm$ 2.07	18 $\pm$ 3	F=11.0	F=4.0	F=1550
	Post-test	20 $\pm$ 2	17 $\pm$ 2	P=0.003	P=0.037	P=0.001
Static balance with eyes open	Pre-test	53 $\pm$ 6.03	53 $\pm$ 6	F=5	F=0.000	F=1873
	Post-test	57 $\pm$ 6	51 $\pm$ 6	P=0.033	P=0.000	P=0.001
Static balance with eyes closed	Pre-test	11 $\pm$ 2	9 $\pm$ 2	F=14.0	F=9.0	F=716
	Post-test	14 $\pm$ 2.06	9 $\pm$ 2.0	P=0.001	P=0.005	P=0.001
Anterior dynamic balance with eyes open	Pre-test	69 $\pm$ 6	72 $\pm$ 3	F=2	F=1	F=477
	Post-test	71 $\pm$ 6	72 $\pm$ 3	P=0.001	P=0.001	P=0.001
Posterior-internal dynamic balance with eyes open	Pre-test	67 $\pm$ 6	66 $\pm$ 3	F=2.007	F=2.007	F=4883
	Post-test	70 $\pm$ 5	66 $\pm$ 4	P=0.001	P=0.001	P=0.001
Posterior-external dynamic balance with eyes open	Pre-test	70 $\pm$ 6	71 $\pm$ 3	F=2	F=0.069	F=43.07
	Post-test	71 $\pm$ 6.3	70 $\pm$ 4	P=0.001	P=0.001	P=0.001
Anterior dynamic balance with eyes closed	Pre-test	58.7 $\pm$ 2.02	62 $\pm$ 5	F=2	F=1	F=2519
	Post-test	61 $\pm$ 5	62 $\pm$ 4	P=0.001	P=0.001	P=0.001
Posterior-internal dynamic balance with eyes closed	Pre-test	54 $\pm$ 8	59 $\pm$ 5	F=11.5	F=5	F=1768
	Post-test	58 $\pm$ 6	58 $\pm$ 4	P=0.003	P=0.033	P=0.000
Posterior-external dynamic balance	Pre-test	58 $\pm$ 7	61 $\pm$ 4	F=6	F=3	F=2226
	Post-test	60 $\pm$ 6	61 $\pm$ 5	P=0.022	P=0.078	P=0.001

*Indicates statistically significant difference between the periods before and after training ($p \leq 0.05$)

DISCUSSION

The results of this research significantly indicate an increase in muscle strength and balance improvement, postural control, following the combination of strength and balance exercises. Most disabilities in carrying out everyday activities may occur due to muscle weakness and impaired balance. And, consequently, higher pressure is placed on the joints. The knee joint is the most important joint in the body whose purpose is

holding the weight and performing daily activities. If there is any disorder in this joint, people may have difficulties doing their daily activities.

In this study, a significant increase in muscle strength and postural control can be observed in the experimental group. It seems that this increase in muscle strength and postural control occurs after compound exercises (to strengthen the hip abductors and external rotator + balance).

This increase in muscle strength and balance improvement can cause less pressure towards the knee joint which leads to improving the condition of the knee. Due to the impairment of balance and weakness of the muscles around the hip in these patients, no research has ever estimated the effect of strengthening exercises and balance on a combination of strength and postural control in patients. However, other studies measured the effects of these exercises on the patients individually, and not in combination. Therefore, the aim of this research is to study the effect of compound exercises (to strengthen the hip abductors and external rotator + balance) on the strength and postural control in patients with patellofemoral pain syndrome.

The results of Fukuda and colleagues' (2010) study are in close connection with our study; they compared the effects of exercise on muscles, the abductor and lateral rotator with quadriceps in patients with patellofemoral pain syndrome and concluded that exercise increases muscle strength in these patients (Fukuda et al., 2010). The results of Leavey and his colleagues' (2010) study are consistent with this study; they analysed and compared balance training exercises, gluteus muscle strength and balance and strength combined training on dynamic postural control.

To evaluate the dynamic balance, a Star Excursion Balance Test is used, which eventually indicates a positive effect of exercises on all the achieving distance in all directions, from 85.2 to 22.6 percent. But, this balance has a smaller effect in

balance exercise programs. In fact, the impact of these exercises is reported to be lesser and medium. It also shows that strength training can have more impact on dynamic balance and have achieving distance through the star test (Leavey, Sandrey, & Dahmer, 2010). At the same time, McLeod and colleagues, in their study (2009), analysed the impact of balance training through neuromuscular techniques and found significant improvement in all directions of dynamic balance. However, they had no viewpoints regarding the level of balance exercises and no estimation of their results was reported (McLeod, Armstrong, Miller, & Sauer, 2009). Many studies expressed weakness in muscular groups near the hip joint (Robinson & Nee, 2007), as well as a few studies which expressed the presence of a disorder in the balance of these patients (Aminaka & Gribble, 2008; Ebrahimi et al., 2007). Given that every research indicated the impact of such exercises on these patients individually and not in combination, the objective of this study is to analyse the impact of compound exercises (to strengthen the hip abductors and external rotator + balance) on the strength and postural control in patients with patellofemoral pain syndrome.

CONCLUSION

A significant improvement in strength and postural control occurred in the experimental group compared to the control group after doing compound exercises (to strengthen the hip abductors and external rotator + balance). Hence, physical therapists and rehabilitation specialists can use this exercise in the process of physical rehabilitation of patients with patellofemoral pain syndrome.

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EFEKAT KOMBINOVANOG TRENINGA (JAČANJE ABDUKTORA KUKA I VANJSKIH ROTATORA + RAVNOTEŽA) NA MIŠIČNU SNAGU I POSTURALNU KONTROLU KOD PACIJENATA SA SINDROMOM PATELOFEMORALE BOLI

Sindrom patelofemoralne boli (PFPS) je mišićno-koštani poremećaj zglobova koljena. Svrha ove studije je bila istražiti efekat kombinovanih tjelovježbi (jačanje abduktora kuka i vanjskih rotatora + ravnoteža) na mišićnu snagu i posturalnu kontrolu kod pacijenata sa PFPS-om. In ovom polu-eksperimentalnom istraživanju, 20 muškaraca sa PFPS-om koji su bili dostupni su odabrani za potrebe istraživanja, te nasumično podijeljeni u dvije grupe, tj. eksperimentalnu (10) i kontrolnu (10) grupu. Eksperimentalna grupa je prošla kroz program treninga u trajanju od osam sedmica. Mišićna snaga i posturalna kontrola kod pacijenata su mjerene putem ručnog dinamometra, statičke ravnoteže (stork test) i dinamičke ravnoteže (Y test) prije i poslije tjelovježbe. Testovi ANOVA za ponovljena mjerenja su korišteni za analizu podataka sa $P \leq 0.05$. Rezultati su pokazali da su promjene i interakcije svih varijabli bile značajne u eksperimentalnoj grupi ($P < 0.05$). Rezultati su također pokazali da je eksperimentalna grupa zabilježila značajno poboljšanje u svim varijablama ($P < 0.05$) u odnosu na kontrolnu grupu. U pogledu efektivnosti treninga za poboljšanje mišićne snage i posturalne kontrole, stručnjaci i terapeuti za rehabilitaciju mogu koristiti protokol treninga iz ovog istraživanja u fizičkoj rehabilitaciji PFPS-a.

Ključne riječi: ZPFPS, kombinovani trening (jačanje abduktora kuka i vanjskih rotatora + ravnoteža), funkcija poteškoće.

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THE SIGNIFICANCE OF VERTICAL AND HORIZONTAL COMMUNICATION FOR BUSINESS EFFECTIVENESS IN SPORTS ORGANISATIONS

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ABSTRACT

Communication is one of the basic human needs through which they create and maintain interpersonal relationships. As such, it encompasses the expression and exchange of ideas, thoughts and attitudes, which marks it as an interactive process. Consequently, we can define it as an activity of transferring and exchanging information and messages which occurs between individuals and groups with the goal of accomplishing a personal or collective success. In a sports context, communication represents the foundation of education, care, effectiveness of organisational processes, and finally, the business success of sports organisations. Communication, as an activity of creating, transferring and using information, also has its aetiology in the dimension of sports. In the aetiological sense, communication is a dimension of sporting behaviour, and sports communication is the dimension of sports. A quality internal, two-way communication is not only the most significant factor in creating a positive environment within an organisation, but also for accomplishing business success of the sports institution itself. Therefore, this paper is founded on the hypothesis that the quality of vertical and horizontal communication within sports institutions can be of vital importance for its business effectiveness. In this context, the aim of this paper is to show that the quality of exchanging information and knowledge between the management and the employees significantly contributes to a quality reputation and image in the general public.

Keywords: Sports communication, vertical communication, horizontal communication, sports organisation, internal communication.

INTRODUCTORY REMARKS

Quality communication between the management and the employees is one of the most important factors for business effectiveness in a sports organisation or institution. In this context, business communication implies communicating on different organisational levels with the goal of creating a positive environment within the organisation, parallel to evoking a desired reaction from the general public. "Without communication there can be no organisation. Effective communication is the foundation for the

development of an internal organisation, and a key factor for existing in an uncertain environment. That is why communication is an important component both in the manager's behaviour and in the functioning of the organisational system as a whole" (Jurković, 2012). Good communication in a sports organisation has to fulfil several highly significant functions, among which the most important are to: 1. Transfer information to all the members of a sports organisation; 2. Motivate the members of an organisation; 3. Control and coordinate the efforts made by various groups and individuals in an organisation and 4. Eliminate doubts and possible conflicts.

One of the greatest mistakes that managers in a sports organisation (directors, managers, coaches, etc.) can make is to fail to understand that communication has to be two-way, i.e. that, apart from transferring our ideas to others, we have to be open and listen to the ideas given by other people, regardless of their level in the organisation's hierarchy.

If a sports organisation does not stand out from the competition through its positive image and reputation based on quality internal communication, it definitely cannot boast about its successful results. Tench and Yeomans state that "the strategic purpose of internal communication can perhaps be best summarised as one that is concerned with building two-way, trusting relationships with internal publics, with the goal of improving organisational effectiveness. Better informed employees will be better motivated, thus contributing to increased productivity" (Tench and Yeomans, 2009). Accordingly, the goal of each institution, including a sports one, is to establish quality interpersonal relationships between institutional staff if they want to position themselves as a successful organisation in the minds of the general public and target groups.

In order to create such effects, it is necessary not only to establish, but also to maintain a quality internal communication. Holtz points out that "the role and purpose of internal communication can be summarized as a concern for the construction of two-way relationships of their employees, including relationships with internal audiences - with the task of improving organizational effectiveness. Employee relations and communication with them always aims to communicate the right thing in the right way. Taking this statement into consideration, the management is due to create an environment where communication is effective because the communication that exists by itself rarely achieves measurable and significant results" (Holtz, 2007). The stated opinions imply the fact that all segments of quality business in a sports organisation are founded on one factor, namely, internal communication. Even though it often appears that business success and recognition of a sports organisation are measured through its presence in the public, in order to fulfil business goals, it is necessary to have a quality two-way communication between employees in sports organisations and the management, i.e. it is necessary to behave and act in a proactive way. "Proactive organizational behaviour is defined as long-term work-related behaviours that are discretionary, not related to the formal organisational reward system, and, in aggregate, promote the effective functioning of the organisation" (Organ 1988, according to Mohammad et al. 2011; Rank, 2006). Moreover, Mohammad et al. point out that it also

includes "two dimensions of employee behaviour: general compliance reflected in a proper and thorough performance of work-related tasks in an organisation, i.e. job performance, and altruism - a desirable human trait that implies caring for others, as well as selflessness" (Mohammad et al., 2011:152). The very establishment of a two-way internal communication, regardless of whether we are talking about horizontal or vertical forms, in a sports organisation is not sufficient for business effectiveness and construction of a positive image, that is, for the functioning of an organisation and its successful business, it is necessary to constantly maintain communication in the management-employee direction and vice versa. In these situations, it is the managers who stand out the most, where one of their "fundamental tasks it to encourage and facilitate communication. But that is not often the case, so a question arises whether managers are a channel or an abyss in internal communication" (French, Holden, 2012). The specificity of vertical and horizontal communication is reflected in the fact that its quality implementation makes the institutional staff more productive, confident, timely and finally, efficient for working in business fields, because a serious education institution builds its operations on a positive influence on the teaching staff, its motivation, as well as quality interpersonal relationships. Given the above, the aim of this paper was to point out the significance of vertical and horizontal communication for business effectiveness in sports organisations.

In the structure of sports communication, a special place is reserved for sports communication representing a system of communicational activities, rationally coordinated by the sports subjects so as to, at the same time, react in presenting sports results at a certain locality. Sports communication is a process, a way of exchanging information among sports partners. Just like any other activity, it has to be learned. The significance of communication in sports consists of the fact that sports is not only made of goals, point, seconds, centimetres, but it is also an open system connected to different spheres of human activity, and, among others, connected to the socio-economic, socio-political, financial, social-philosophical, historical, pedagogical, psychological, medicinal and biological issues. Sports is a special type of communication that arose as a consequence of a complex series of needs. In sports, there are three types of communication: verbal, non-verbal and performance communication.

In regard to verbal communication in sports, it is, more or less, present in all segments, depending on the situation. Non-verbal communication is the most represented one in sports. With the help of non-verbal communication, proximal, kinetic and visual, interpersonal relationships are mostly regulated during a sports event. Performance communication in sports is connected to the fact that the viewer does not only feel as a recipient of a message, but also as an observer who experiences a sports event as a spectacle, a performance played out for him (Čović, 2007).

The significance of education in the area of sports communication is transferred to a social environment, and therefore, the interested attenders in the process of sports education will be the subjects, not objects of communication (Bjelica, 2012). Considering that it encompasses the exchange, dissemination and understanding of messages, communication can be defined as a combination of social and psychological aspects. There is a series of definitions regarding communication, so Vreg states that "the act of communication implies at least two partners in communication trying to reach an understanding in their communicative interaction" (Vreg, 1991:25). Therefore, communication is a two-way process between the sender and receiver of a message, where the receiver of the message has to, not only receive, but also understand the message" (Bovee, Thill, 2012:46). The very process of communication is characterised by an exchange of signs and symbols, and, in order to establish contact among the participants and thereby understand messages, it is necessary to be familiar with them. Consequently, we can say that understanding signs and symbols leads to an interaction among people. "Beat F. Schmid and Boris Lyezeck explain symbolic interaction as an exchange of symbols. Interaction is a synonym for social action. Symbols are signs representing meaning and purpose, especially of the elements with the goal to create understanding" (according to Milas, 2011:17).

Based upon communication, a human, as a social being, builds and maintains interpersonal relationships. Brkić defines communication as "a conscious activity of acting through signs by which humans understand each other and, at the same time, encourage each other to perform a certain action; communication, therefore, denotes communication between two people" (Brkić, 2003:193), where, "kinship is emphasised as the basic element of communication" (Dunn et

al., 1974:59). Communication, as an activity of creating, transferring and using information, also has its aetiology in the dimension of sports. In the aetiological sense, communication is a dimension of sporting behaviour, and sports communication is the dimension of sports (Bjelica, 2012). When defining the concept of communication, it is important to emphasise that the communication process does not solely include the exchange of information, talks, negotiations or agreements. To communicate means to, through stating opinions and attitudes, affect the interlocutor's points of view and perception. In this context, communication, besides the informative, encompasses a persuasive component.

Wiener states that information implies "the content of what is exchanged with the outer world as we adjust to it, and make our adjustment felt upon it" (Wiener, 1973). Regardless of the business sphere they act in, and which goals they have, they accomplish it through the communication process.

That is why we can describe communication as either effective or ineffective. If by communicating we accomplish the previously planned goals, and understand the sent and received messages, we will consider it a success, while, on the other hand, through ineffective communication, we create conflicts and confrontations. Kalinić claims that, in order to have effective communication, we need "a certain communicative situation as a combination of subjective and objective circumstances and conditions for functionality through the act of communication representing the totality of social and psychological developments accompanying the movement of messages from the communicator to the receiver of the message. From an operational point of view, communication cannot be solely limited to the media landscape of the representation policy (Kalinić, 2012:10). The very notion of communication implies a connection, understanding and kinship. Regardless of whether we talk about business or political communication, its quality is reflected in a timely exchange of information and messages. Filipović et al. state that "communication is a process of a purposeful and understandable transfer of ideas, thoughts and feelings among people. It is much more than sending a message because the active public (auditorium) observes the environment, processes information and tries to understand that which they received" (Filipović, V., Kostić, M., Prohaska S., *Odnosi s javnošću*, Beograd:2001).

The stated definition implies the fact that any exchange of information and messages, in a business or some other sphere, has its purpose and goal.

HORIZONTAL AND VERTICAL COMMUNICATION

When it comes to recognising the public's perception of business effectiveness in a sports organisation, the management, human resources, and therefore their interpersonal relationships and communication, stand out as the most important factors when building a positive image and reputation. Formal communication has become the fundamental factor for a successful business performance. Business communication is not only defined as a process of transferring information, but also as a system of motivation and influence on the attitudes and opinions of the interlocutors and associates with the purpose of accomplishing business goals. Čokorilo states that "business communication, as a special area of social interaction, is not only mere consideration and discussion on a group of weakly connected communication concepts. It originated in a business organisation as a social mechanism, producing goods and providing services. In order to organise and create values, humans within the organisation have to establish an interaction, and, in order to establish it, they have to communicate (Čokorilo, 2010:136). Broom states that "communication with employees has three main objectives: 1. acculturate the employees, 2. inform the employees on organisational developments, happenings and news, 3. listen to your employees (According to Bolfek et al., 2017:19).

Internal communication within sports organisations is divided into formal and informal. Buble states that "formal communication is a pre-planned, systemic, official process of transferring information in the spoken and written form, aligned with the organisation's needs. Formal communication is created, stimulated and encouraged by the organisation itself, more precisely the management, because it is necessary for business performance. The structure of formal communication is aligned with the structure of the organisation. Effective formal communication throughout the entire organisation is the fundamental task of management, implying a continuous communication flow through formal channels" (Buble, 2010:187). Formal communication within a sports organisation is subject to certain rules and standards created by the management of a specific organisation. When we talk about communication in sports, it is highly complex, multifunctional and multi-aspect. Some of its most important aspects are: 1. pedagogical (it is manifested through communication between the athlete and coach), 2. legal - appears in relation with the organisation's rules and holding competitions, as well as breaking the rules, 3. political - closely follows important international competitions, 4. medical - present during the athletes' preparations, providing medical assistance during competitions and rehabilitation, 5. mass media and advertising - functioning as sports propaganda, and for accomplishing goals, i.e. advertising products and

services (Čović, 2007). Lehman and DuFrene state that "a formal network flow is often accompanied by the formal organisation chart, which is created by the management to control the behaviour of individuals and groups and with the goal to accomplish the organisation's objectives. A formal system is dictated by the cultural, technical, political and economic environment of the organisation" (Lehman and DuFrene, 2015:7). There are three types of formal business communication:

- Vertical - downward (top-down)
- Vertical - upward (bottom-up)
- Horizontal (Certo, Certo, 2008).

Horizontal communication is related to communication between employees at the same level of business activity, with the purpose of increasing the total employee activity, which contributes to more effective functioning and business in the sports organisation. Buble points out that "through horizontal channels, we ensure information distribution, coordination and solution of interdepartmental problems" (Buble, 2010:190).

Therefore, in order for horizontal communication to have maximum effectiveness, people in any system or organisation should be available to one another. Companies use work teams which integrate the work flow processes instead of having specialists who exclusively deal with one function or product. That is why, in an organisation divided into cross-functional teams, horizontal communication among the team members is extremely important to achieve individual and team goals (Lehman and DuFrene, 2015:9).

Vertical top-down communication implies communication which flows from the management to the employee, and bottom-up communication flows from the employee to the management. When it comes to vertical top-down communication, it should be pointed out that a disadvantage of this type of communication is the inability to inform the management on how and in what way the employees understand their assigned demands or tasks, and the inability to listen to the employee's beat as the fundamental factor in a sports institution, together with pupils or students. "Katz and Kahn identified five categories of downward communications: 1. Communication of organisational goals and mission 2. task instructions and training (how) 3. task rationale (why) 4. communication about rules, policies, procedures 5. performance and other feedback to subordinates (Rouse and Rouse, 2005:27). Just as Jurković states "when it comes to transferring messages in a downward flow, one of the main problems is reflected in filtering information.

Filtering is a consequence of the fact that information flows from one to the other level, from one to the other employee, so, each of them can deem that they have to transfer them in their own way. This is how loss of information happens. Filtering messages is a very serious problem in enterprises, considering the fact that they have to be transferred from one to the other management level" (Jurković, 2012:387-399). Regardless of the type and level of communication, it is important to emphasise that neither will provide actual results in sports organisations, unless they are two-way. Just as Cutlip states, "the goals of communication are to identify, establish and maintain mutually beneficial relationships between the organisation and the employees on whom its success or failure depends (Cutlip et al., 1985, according to Theaker, 2003). Therefore, the stated divisions of communication are founded on an interactive process with the purpose of accomplishing business effectiveness in sports organisations.

METHODOLOGY

The goal of this research is to determine how important internal communication is to the management and employees in sports organisations. Establish to what degree, and in what way do they use horizontal and vertical communication, and do they recognise its significance for business effectiveness in a sports organisation. This research proceeds from the hypothesis that the quality of vertical and horizontal communication within a sports organisation can be of vital importance for its business effectiveness. In this context, the aim of this paper is to show that the quality of exchanging information and knowledge between the management and the employees in an organisation significantly contributes to a quality reputation and image in the general public, and finally, to achieving better business results. A survey questionnaire, delivered to the respondents

in an online form, was used as an instrument for data collection. The questionnaire consisted of the respondents' demographic characteristics (age, gender and the level of education) and six questions. The questionnaire, distributed in an online form, was filled in by 52 employees in sports clubs and organisations from the area of the Federation of BiH. The data acquired through the questionnaire were analysed by descriptive and statistical methods. The data were analysed by applying the "Statistical Package for the Social Sciences" SPSS.

Research analysis and discussion

52 questionnaires were analysed through the implemented research. When it comes to the gender structure, men were overrepresented, with 63.5% of them, while there was 36.5% of females. Besides the gender structure, the demographic data from the survey were related to age and education.

The survey was filled in by 50% of respondents aged 31-50, 28.8% aged 18-30 and 22% aged 50 and above. When it comes to the educational structure, most respondents, 94%, had higher education, 3% had two-year post-secondary school qualifications and 3% had secondary education. The fact that quality internal communication in sports organisations is a significant business component is shown in our research results (Table 1.). 50% of respondents consider that quality internal communication between the employees and the management has the most significant impact on the outcome of business performance. 36.5% of them consider that it is the quality interpersonal relationships with associates, and 13.5% of respondents point out that it is the possibility of making decisions. Tench and Yeomans point out that "the purpose of internal communication is building two-way, trusting relationships with internal publics, with the goal of improving organisational effectiveness" (Tench, Yeomans: 2006:362). Consequently, the results point out that employees in sports organisations recognise the significance of internal communication.

Table 1: Business performance efficiency

In your opinion, which of the stated items has the most significant effect on the outcome or your business performance?				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quality interpersonal relationship with associates	19	36.5	36.5
	The possibility of making decisions	7	13.5	50.0
	Quality internal communication between the employees and the management	26	50.0	100.0
	Total	52	100.0	100.0

In the survey research, we set a statement within which the respondents could express the quality of communication between the employees and the superiors (Table 2.) The majority of respondents, 63.5% of them, mostly agree with the statement that communication between the employees

and the superiors is at a satisfactory level, 7.7% of them absolutely agree, and 17.3% neither agree, nor disagree. The percentage of those who mostly disagree, 7.7% of them, and those who absolutely disagree, 3.8% of them, is not negligible.

Table 2: Communication between the superiors and the employees

Communication between the employees and the superiors is at a satisfactory level.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I absolutely disagree	2	3.8	3.8	3.8
	I mostly disagree	4	7.7	7.7	11.5
	I neither agree, nor disagree	9	17.3	17.3	28.8
	I mostly agree	33	63.5	63.5	92.3
	I absolutely agree	4	7.7	7.7	100.0
	Total	52	100.0	100.0	

An arithmetic mean was calculated for the statement "Communication between the employees and the superiors is at a satisfactory level". Based on the results, we can conclude that the largest number of respondents defined this type of communication with a score of 4, while the average score is 3.63. The stated results imply the fact that most employees

who were surveyed are satisfied with this type of communication in the education institution where they work, which finally does not mean that it cannot and should not be of better quality, because 11.5% stated that they are not satisfied with vertical communication between the supervisors and the employees.

Table 3: The arithmetic mean of vertical communication

Statistics		
Communication between the employees and the superiors is at a satisfactory level.		
N	Valid	52
	Missing	0
	Mean	3.63
	Mode	4

Moreover, besides vertical top-down communication, the respondents had an opportunity to rate the communication at a horizontal level. Just like the previously elaborated results, for the statement that communication between employees is at a satisfactory

level, 65.4% mostly agree with the statement, while 3.8% of respondents absolutely agree, 25% of respondents neither agree, nor disagree, just 3.8% mostly disagree, and 1.9% of respondents absolutely disagree.

Table 4: Communication between employees

Communication between employees is at a satisfactory level.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I absolutely disagree	1	1.9	1.9	1.9
	I mostly disagree	2	3.8	3.8	5.8
	I neither agree, nor disagree	13	25.0	25.0	30.8
	I mostly agree	34	65.4	65.4	96.2
	I absolutely agree	2	3.8	3.8	100.0
	Total	52	100.0	100.0	

What is characteristic for both statements is that, regardless of which form of internal communication is in question, the respondents pointed out that they are mostly at a satisfactory level. However, the number of those who are not

satisfied with internal communication in the sports organisation where they work is not negligible. This is further supported by the fact that the highest score for this type of communication is 4 and the average one is 3.65.

Table 5: The arithmetic mean of horizontal communication

Statistics			
Communication between employees is at a satisfactory level.			
N	Valid	52	
	Missing	0	
	Mean	3.65	
	Mode	4	

One of the questions the respondents had to answer was: "In your opinion, do you receive information and tasks in a timely manner?" 67.3% of respondents answered affirmatively, while 32.7% of respondents believe that they do not receive the information in a timely manner. It is important to emphasise that one of the fundamental prerequisites of establishing and

maintaining a quality internal communication is a timely transmission of information, regardless of whether we are talking about horizontal or vertical communication.

Withholding information stimulates employees to reach them themselves, and its absolute absence definitely leads to low-quality task fulfilment.

Table 6: The timeliness of receiving information

In your opinion, do you receive information and tasks in a timely manner?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	35	67.3	67.3	67.3
	No	17	32.7	32.7	100.0
	Total	52	100.0	100.0	

For a quality and productive performance of business tasks, besides the information sent in a timely manner, freedom to express their own attitudes, ideas and opinions is also significant. In this context, the respondents were given a question: "Are you free to express your attitudes and opinions to your superiors?" 55.8% of employees answered affirmatively, 28.8% of

them are free to do so only at times, and 15.4% do not state their opinions to their superiors. Based upon the obtained results, it is evident that a significant number of respondents sometimes or never dare to state their own opinions to their superiors.

This gives rise to a conclusion that limiting employees can affect their motivation and productivity during work.

Table 7: Freedom to express attitudes

Are you free to express your attitudes and opinions to your superiors?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	29	55.8	55.8	55.8
	No	8	15.4	15.4	71.2
	Sometimes	15	28.8	28.8	100.0
	Total	52	100.0	100.0	

Internal communication, regardless of its division and types, represents a system of activities through which the employees in institutions and organisations are considered to be primary target groups. The results obtained for the final question set in the survey have completely proved the established hypothesis

that presented the framework of this paper. All respondents answered the question affirmatively which absolutely proved the hypothesis that the quality of vertical and horizontal communication within a sports organisation can be of vital importance for its business effectiveness.

Table 8: A prerequisite for business effectiveness in a sports organisation

In your opinion, are horizontal and vertical communication a prerequisite for business effectiveness in a sports organisation?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	52	100.0	100.0	100.0

CONCLUDING REMARKS

Regardless of which aspect of communication we talk about, the obtained results give rise to the fact that recognising business effectiveness in a sports organisation is reflected in communication.

The focus of this paper was to prove that the quality of horizontal and vertical communication in sports organisations affects business performance efficiency in a sports organisation, as well as to research whether employees in sports organisations recognise the significance of internal communication. This research was founded on the hypothesis that the quality of vertical and horizontal communication within a sports organisation can be of vital importance for its business effectiveness. The research results completely proved the established hypothesis. Such results imply the fact

that, regardless of the quality of an organisational structure, propaganda and advertising contents, education and expertise of the management and the employees, it is hard to accomplish business effectiveness in a sports organisation without quality internal communication.

Inadequate and low-quality vertical or horizontal communication significantly affects motivation and productivity of all the members in an organisation, and therefore the organisation's success as a whole. That is why it is necessary for the management and the employees to give a significant contribution so as to make the communication within a sports organisation two-way and purposeful.

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ZNAČAJ VERTIKALNE I HORIZONTALNE KOMUNIKACIJE ZA EFIKASNOST POSLOVANJA SPORTSKIH ORGANIZACIJA

Komunikacija je jedna od osnovnih čovjekovih potreba kojima stvara i održava međuljudske odnose. Kao takva obuhvata izražavanje i razmjenu ideja, misli i stavova što je označava interaktivnim procesom. Shodno tome, možemo je definisati kao aktivnost prenosa i razmjene informacija i poruka, koje se odvijaju između pojedinca i grupa s ciljem ostvarivanja ličnog ili kolektivnog uspjeha. U kontekstu sporta komunikacija predstavlja osnovu vaspitanja, odgoja, efikasnosti organizacijskih procesa, a u konačnici i uspješnosti poslovanja sportskih organizacija. Komuniciranje kao aktivnost na stvaranju, prenošenju i korištenju informacija, svoju etiologiju ima i u dimenziji sporta. U etiološkom smislu komuniciranje je dimenzija sportskog ponašanja, a sportsko komuniciranje dimenzija sporta. Kvalitetna interna dvosmjerna komunikacija najznačajniji je faktor kreiranja pozitivnog ambijenta unutar organizacije, ali i ostvarivanja poslovnog uspjeha same sportske institucije. Shodno navedenom, ovaj rad se temelji na hipotezi da kvalitet vertikalne i horizontalne komunikacije unutar sportskih institucija može biti od presudnog značaja za efikasnost njenog poslovanja. U tom kontekstu, cilj rada je pokazati da kvalitet razmjene informacija i znanja između menadžmenta i uposlenih značajno doprinosi kvalitetnoj reputaciji i imidžu u eksternoj javnosti.

Ključne riječi: Sportska komunikacija, vertikalna komunikacija, horizontalna komunikacija, sportska organizacija, interna komunikacija.

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DIFFERENCES IN THE MORPHOLOGICAL AND MOTOR STATUS OF FEMALE STUDENTS FROM INNER-CITY AND SUBURBAN CITY AREAS

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ABSTRACT

This research is conducted in order to determine the differences in the morphological and motor status of female students attending primary schools from the inner-city and suburban city areas. The research sample was composed of 125 female students from primary schools, both in the inner-city and suburban areas. The students are 14 and 15 years old. The research analysed 5 variables of the morphological area and 8 variables of the motor area. The above-mentioned areas were subjected to a univariate analysis, that is, a T-test for independent samples. The significance of the T-test is checked by calculating the Cohen's d index. After the research data analysis, important differences were seen in some of the students' anthropological status variables. The main goal of the research was achieved; the differences between the morphological and motor status were determined for female students attending primary schools from the inner-city and suburban areas. Recommendation: Research with the same or similar variables should be conducted on different age groups and/or the same age group, but for different (male) gender.

Keywords: Anthropological status, T- test, students, primary school.

INTRODUCTION

Sports and physical education lessons contribute to the morphological and motor characteristics of students (Stanković, Hadžikunić, 2005). A teacher cannot influence the student's inherited genetic predispositions or the anthropological status. The environment where a student lives has its own specific features which directly influence the development of the entire organism. Whether certain genetic potentials can be developed, and to which extent, depends directly on where the student lives (Delija, Mraković, 1993). General development of technology has enhanced the "quality of life" and leads to much higher standards. Today, a small number of students walk to school; they either use public transport or the school is near their neighbourhoods. This indirectly lowers the child's physical activity and their motor ability is less developed. This also has a bad effect on posture,

which is practically one of the first levels of certain body deformities later on. When they come to a phase where they are visible and their removal cannot be done with preventive exercises, body deformities mark the child for life, both in the physical and mental sense (Nikšić, Mahmutović, Rašidagić, 2015). Research has shown that certain deformities such as feet deformities appear more often in children who live in urban areas than in those who live in suburban areas (Nikšić, Rašidagić, 2014). An appropriate approach in physical education classes can help and even completely remove this deformity (Rašidagić, Nikšić, 2014). This approach can change the way of life for certain people, that is, to change the "sedentary" way of life, where there is practically no walking involved. Physical activity is preventive to illness. Besides hypokinesia, too much calories can lead to heart diseases and blood vessel damage, as well as fatness.

To make physical education lessons more effective, it demands appropriate planning and good programmes (Momirović, 1989, Starc and Strell, 2012) and students need to have as many different activities as possible to stay interested in lessons. These facts lead to a conclusion that continuous activity with moderate intensity has a long-term positive effect on our health (Mišogoj, Duraković and co. 1999). These lessons are more useful if students have more activity outside the class which is considered as a positive extrinsic factor. Whether this enhanced activity can be seen with female students from suburban areas was investigated in this research. According to the above mentioned, the goal of the research has been set as: "DETERMINE THE DIFFERENCES IN THE MORPHOLOGICAL AND MOTOR STATUS OF FEMALE STUDENTS FROM INNER-CITY AND SUBURBAN CITY AREAS".

METHODS

The sample of examinees

Female students aged 14 and 15 were the examinee sample. The first group consisted of 57 students from the inner-city area and the second group consisted of 68 students from the suburban city area.

The sample of variables

The collected data fits the part of the data collected by the teachers during the sports and physical education classes.

The collected research variables can be listed as follows:

1. Morphological status variables are collected in an ordinary way in 3 measurements. Medium value variables are included in the analysis according to height, weight, PMT (subcutaneous adipose tissue), triceps, Subscapularis, PMT Suprailiac.
2. Motor capability variables are in fact EUROFIT tests and the way of testing has been regulated according to the description of each finalized

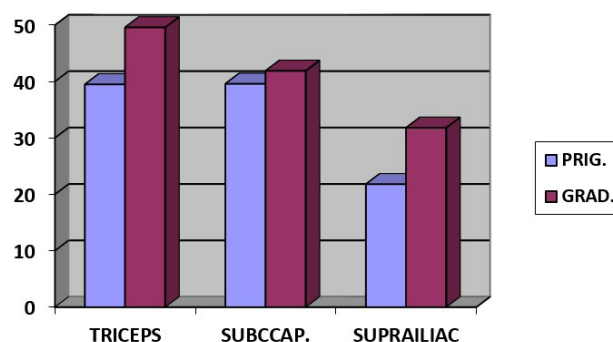
test (Drljačić, Arsić, K., Arsić, D., 2012): Flamingo Test, Hand Tapping, Sit-and-Reach, Standing Broad Jump, Handgrip Test, Sit-Ups, Bent Arm Hang, 10x5 Metre Shuttle Run.

Statistical analysis

STATISTICA 12 programme has been used for data analysis. The importance of testing differences was determined by a T-test for independent samples. The significance of the T-test was set up to ($P < .01$). Result impartiality was checked by using the method of calculating the d index according to Cohen (1988); d index value is as follows:

- small performance size 0.2 – distribution around 85%
- medium performance size 0.5 – distribution around 67%
- large performance size 0.8 – distribution around 53%.

RESULTS



Graphic 1: Morphological area – subcutaneous adipose tissue

Table 1: Descriptive Statistics, Morphological Area, Group 1/Group 2

Variable	Group	N	Mean	SD	Std. Err
PMT Triceps	1	57	169.56	92.21	13.12
	2	68	98.33	55.31	7.03
PMT Subscapularis	1	57	253.3	125.66	16.66
	2	68	93.22	63.54	7.93
PMT Suprailiac	1	57	204.13	129.99	8396
	2	68	98.33	73.55	4.01

Table 2: T-test, Morphological Area, Group 1/Group 2

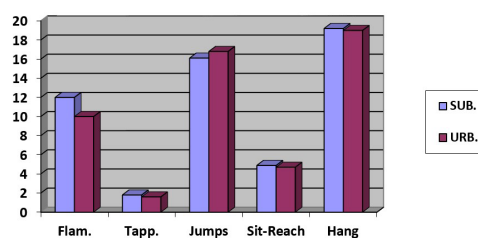
Variable	F	Sig	t	df	Sig 2	d	Mean	Std. Error	95%	
									Low	Upp
PMT Triceps	3.80	.60	3.41	123	.00	.59	39.5	11.66	16.55	62.10
			3.33	106.8	.00		49.6	11.88	16.07	63.20
PMT Subscapularis	13.40	.00	6.95	123	.00	.84	39.6	11.88	16.07	63.22
			6.81	101.1	.00		41.9	15.99	17.01	72.60
PMT Suprailiac	4.70	.33	1.48	123	.00	.63	21.8	14.83	37.99	51.68
			1.46	110.3	.00		31.8	15.05	78.05	89.88

In the descriptively analysed (graphics and Table 1.) and univariate morphological area (anthropometrics), by comparing the 5 variables, it is determined that the height and weight of the investigated population of primary-school girls have no statistically significant differences.

Unlike these 2 variables, the T-test reacted positively on all 3 variables of subcutaneous adipose tissue.

It is safe to say that it was expected to get statistically significant differences in the variables weight/body mass according to the subcutaneous adipose tissue variable (.00).

After the results were obtained, a d index by Cohen was calculated to determine the liability of the T-test where it was stated that all three variables have results from 53% to 67%, which is a medium difference between the groups.



Graphic 2: Motor Area – EUROFIT tests

Table 3: Descriptive Statistics, Motor Area, Group 1/Group 2

Variable	Group	N	Mean	SD	Std. Err
Flamingo	1	57	17.94	13.75	1.82
	2	68	12.96	11.05	1.36
Hand Tapping	1	57	11.08	1.48	0.19
	2	68	12.46	1.67	0.26
Standing Broad Jump	1	57	17.88	7.53	0.99
	2	68	19.83	7.06	0.86
Sit-and-Reach	1	57	25.28	4.40	0.59
	2	68	21.81	3.22	0.41
Bent Arm Hang	1	57	29.69	24.43	3.30
	2	68	30.92	20.43	2.59

Table 4: T-test, Motor Area, Group 1/Group 2

Variable	F	Sig	t	df	Sig 2	d	Mean	Std. Error	95%	
									Low	Upp
Flamingo	18.40	.00	5.89	123	.00	.03	11.92	2.23	7.79	16.01
			5.65	85.1	.00		11.95	2.34	7.89	16.31
Hand Tapping	1.80	.19	7.61	123	.00	.43	1.71	.22	-2.22	-1.29
			7.65	121.1	.00		1.70	.23	-2.24	-1.31
Standing Broad Jump	.420	.52	3.91	123	.00	.01	16.11	4.21	7.71	23.88
			3.90	119.99	.00		16.09	4.19	7.72	23.98
Sit-and-Reach	7.30	.00	7.01	123	.00	.57	4.89	.72	3.39	6.33
			7.91	91.9	.00		4.88	.75	3.31	6.41
Bent Arm Hang	44.01	.00	6.53	123	.00	.03	19.21	2.77	12.81	23.74
			6.33	77.1	.00		19.20	2.99	12.72	25.01

The variables used to determine the students' motor status (motor capability) have shown that five of the eight variables: keeping the balance, movement frequency speed, explosive strength of lower extremities, stomach wall muscles strength and functional/static strength of the upper extremities are on a higher level with girls who live in the suburbs. The variables with no differences were: flexibility (.87 and .86), hand grip strength (.13 and .14) and 10x5 metre shuttle run (.81 and .79). Taking into account that the stated variables have no determined statistical differences, they were not written in the tables and graphics. After the results were obtained, a d index by Cohen was calculated to determine the significance of the T-test. The D index determined that the movement frequency speed test and upper extremities strength test results had 53% to 67%, which gave us a medium difference between the groups. The differences occurred in balance, explosive strength of lower extremities, functional strength of upper extremities, but they were minimal.

DISCUSSION

Urbanization is highly present in suburban and peripheral city areas. Children have organized school transport and schools are built in accordance with the student's residence.

However, regardless of the process of urbanization, this research has shown that female students who live in suburban areas are in advantage to those who live in city areas, when it comes to the development of the morphological and motor status (Bavčević, Vlahović, Božinović-Mador, 2017). The difference can be seen in eight variables of the morphological and motor areas, which is more than enough to conclude that children from urban areas have a sedentary way of life. The extrinsic factor in this research is defined as suburban area, and it is very important.

An increase in students who walk to and from school, as well as more opportunities to play outside have led to a continuous growth in motor activities. That is why there are differences in one part of the morphological status (Burgeson at all 2001, Bowles, 2012). Differences in morphological characteristics are not stated in height and weight variables which is in accordance with the results of other research on the same subject (Cetinić, Petrić and Vidaković-Samaržija, 2011). However, three variables which define the subcutaneous adipose tissue are higher for girls who live in urban city areas.

This difference states a lack of movement in students so they have more weight problems (Özdirenc and co. 2005). By checking the distribution of results between the groups and the T-test significance, while calculating the d index by Cohen, it has been confirmed that the T-test showed statistically significant differences of the analysed areas.

Due to a higher percent of subcutaneous adipose tissue, it is expected that the general body mass of girls from urban city areas would be higher, but this was not the case. This lack of difference in weight can be seen as a variation in body structure or by assuming that girls in suburban areas have higher body mass (Momirović, 1989).

When it comes to the motor capability of students analysed by EUROFIT tests, it can be stated that out of 8 tests, 5 have statistically significant differences. Students from suburban areas have better balance, higher speed of movement frequency, bigger explosive strength of lower extremities, more strength in stomach muscles and more functional strength in upper extremities. All of the given data have shown that the results gathered by the author Pejčić et al. (1997) are correct. The differences were not noticed in the results of the following tests:

flexibility, had grip strength, and running speed (10x5). By calculating the Cohen's d-index, we have more clearly defined which characteristics have more differences. Movement frequency speed and stomach muscles strength do not crisscross between the two groups. So, regarding the motor area, these two motor contrasts can be differentiated.

Overall, a review of the morphological and motor areas gives us the conclusion that the extrinsic factor of movement activity with girls in suburban areas is bigger and it made an impact because they have continuous body activity of medium intensity without any additional motivation (Frederick et al. 1993). This research has reached the aimed target and it has determined the differences between the morphological and motor status of primary school students in urban and suburban city areas.

The results of this research could be applied and the impact of its goal increased, but there also has to be a survey made about their nutrition habits and sport activities outside schools, especially for children in suburban areas. (Kondrić, Mišigoj-Duraković and Metokoš, 2002).

CONCLUSION

To have a better insight about the relations of the morphological and motor status and their impact, there should be more complex statistical methods of data analysis.

Comparison of this research results can be made with the results of population belonging to different age categories or gender.

For a better understanding of the morphological and motor variable relations of the investigated groups, students should do certain surveys to give the examiners more information about nutrition, free time activities and social status of female students.

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RAZLIKE IZMEĐU MORFOLOŠKO-MOTORIČKOG STATUSA UČENICA TU CENTRALNOJ I UČENICA U PERIFERNOJ GRADSKOJ ZONI

Istraživanje je provedeno sa ciljem utvrđivanja razlika morfološko-motoričkog statusa učenica iz osnovnih škola u centralnoj i perifernoj gradskoj sredini. Uzorkom istraživanja obuhvaćeno je 125 učenica osnovne škole gradske i prigradske orijentacije. Učenice su u hronološkoj dobi 14 i 15 godina. U istraživanju je analizirano pet varijabli morfološkog prostora i osam varijabli motoričkog prostora. Navedeni manifestni prostori podvrgnuti su univarijantnoj analizi, odnosno T- testu za nezavisne uzorke. Značaj T-testa je provjeren izračunavanjem Cohenovog d indeksa. Nakon obrade podataka u istraživanju su uočene značajne razlike u dijelu varijabli antropološkog statusa učenica. Ostvaren je i postavljeni cilj istraživanja, odnosno utvrđene su razlike morfološko-motoričkog statusa učenica osnovnih škola u centralnoj i učenica u perifernoj gradskoj zoni. Preporuka: Istraživanje sa istim ili sličnim varijablama trebalo bi se provesti na različitim uzrasnim kategorijama i/ili na istoj uzrasnoj kategoriji ali različitim (muškom) spolu.

Ključne riječi: Antropološki status, T- test, Učenice, Osnovna škola.

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GROUP DIFFERENCES IN MORPHOLOGICAL CHARACTERISTICS OF PRESCHOOL CHILDREN FROM BELGRADE

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ABSTRACT

The aim of the research was to determine whether there are group differences in morphological characteristics among preschool children in three different kindergartens in Belgrade, and to define and check the structure of their latent dimensions. The research uses a draft of non-experimental research, namely correlation *ex post facto*. The total sample was composed of 211 children, girls ($n=103$) and boys ($n=108$) who were participants in groups of the Preschool Institution "Čukarica" in Belgrade, divided into three homogeneous groups of average age of 6.21 ± 0.56 years. A sample of morphological measuring instruments was made according to the reduced model of Kurelić, Momirović, Stojanović, Šturm, Radojević and Viskić-Štalec (1975). The results of the study indicate significant differences between the groups of subjects. Namely, children of the first group are more voluminous compared to the children of other groups, and children of the second group are slightly heavier compared to the children of the third group. By looking at BMI values for all three groups of subjects, it is noted that these values range within the normal state of nutrition, and that the differences observed in this period of life do not represent a significant relationship and can be ignored. The authors consider that greater differences and variables regarding the state of nutrition should be expected in two years in the pre-puberty period.

Keywords: BMI, difference, preschool age.

INTRODUCTION

Preschool children, unlike others, are still in the process of forming habits, which will further reflect on the quality of their lives. Therefore, children who are overweight and obese tend to have a lower exercise of physical activity (Planinšec, & Matejek, 2004), working on monitoring the parameters of obesity should be the main task of kinesiology from the earliest period of life. Monitoring these parameters is of exceptional public importance, since it is associated with many cardiovascular diseases, hypertension and

diabetes, which are the leading causes of mortality in the adult period, as indicated by much earlier findings (Sjostrom, 1992). The prevalence of obesity in preschool children in the world is on the rise and affects 25% of Canadian children and even 22 million children under the age of 5 (Canning, Courage, & Frizzell, 2004).

Morphological characteristics are understood as the biological and physiological basis that generates the manifestation of anthropometric measures by which we define growth and development, as well as constitution and determine the structure of the morphological area (Pelemiš, Macura, & Branković, 2017).

Recent research shows that standard anthropometric methods for defining morphological types and determining the structure are still used with some 33%, while, for example, the BIA method is used with 25% of the total methods used (Silva, Ribeiro, Pavão, Ronque, Avelar, Silva, & Cyrino, 2013). In addition, the fact that they are one of the good indicators, health risk indicators, as well as the growth and development of the child with the height/weight relationships used to calculate the BMI represent a significant indicator of the state of nutrition which this state brings (Janssen, Katzmarzyk, & Ross, 2004).

The results of anthropometric measurements of children can provide valuable information on the effects of these factors by comparing them with some existing norms for boys and girls. As each movement of the child is closely related to its bodily (morphological) characteristics, it is logical to link the anthropometric properties of the phenotype and the causal factors of the movement. Similar findings are available (Veselinović, Milenković, & Jorgić, 2009) and indicate that boys of preschool age, in addition to being higher, also have larger volume of upper arms and forearms. There are no statistically significant differences in terms of a semi-annual increase in height between boys and girls. It was found that boys aged 6-14 differ significantly from their peers in terms of lower BMI and body fat (Ostojić, Stojanović, Stojanović, Marić, & Njaradi, 2011; Pelemiš, Pelemiš, & Branković, 2015).

A Japanese study by Satake, Nakagawa, Kubota, Saegusa, Sano, & Ohzeki (2010), in which a computer tomography (CT) examined non-obese children aged 6-20 in subcutaneous adipose tissue and visceral fat suggests that children in age of 6-10 do not differ, while adolescents differ in subcutaneous fat in favour of girls and visceral fat in favour of boys. Contrary findings were also in Japan when preschool children aged 6-7 are concerned in the research conducted by Sakai, Demura, & Fuji, (2011).

The aim of this study was to determine group differences in morphological characteristics among children in three different kindergartens in Belgrade.

METHODS

The research uses a draft of non-experimental research, namely correlation ex post facto. According to the nature of scientific research (Bala, 2007), the empirical method of research was used according to the goal of undertaking applied, i.e., the applied method, while according to the knowledge of the problem, a

confirmatory method was used. In relation to the time duration, a transversal method was used, whereas in relation to the degree of control a semi-laboratory or semi-military method was used. The sample of respondents for research purposes was derived from the population of preschool children by the inconclusive sampling method, i.e., quota sample.

The children were 6 and 7 years old, and the average age of the sample was 6.21 ± 0.56 decimal years. The survey covered a total of 211 children, girls ($n=103$) and boys ($n=108$) who were participants in groups of the preschool "Čukarica" in Belgrade. The respondents were further divided into three homogeneous groups. The first group (I) was made up of children in the "Kids Guy" kindergarten. This group consisted of 64 respondents, out of which there were 36 boys and 28 girls. The second group (II) from kindergarten "Carić" with a total 68 children out of which 31 boys and 37 girls participated in the research, and the third group (III) from kindergarten "Sun", with 79 children - 41 boys and 38 girls.

Since the morphological status of an individual can be represented by a three-dimensional and four-dimensional morphological model (Kurelić et al., 1975), in preschool age children, due to intense growth and development phases, the hypothetical-morphological model is defined as two-dimensional (dimensionality of the skeleton and volume of the body and subcutaneous fat) (Bala, 1980).

For these reasons, the following anthropometric measures were selected as a sample of measuring instruments for the research: I For estimating the longitudinal dimension of the skeleton: 1) body height (0.1 cm); II For estimating the volume and body weight: 2) body weight (0.1 kg), 3) median circumference of the chest (0.1 cm), 4) median circumference of the stretched upper arm (0.1 cm) and 5) median circumference of the stretched forearm (0.1 cm); III For estimation of subcutaneous fat: 6) abdominal skin folds (0.1 mm), 7) back skin folds (0.1 mm) and 8) upper arm skin (0.1 mm). Based on the values of the variables: Body height and Body weight, the Body Mass Index (BMI) was calculated by dividing the body weight of the subjects in kilograms with the square height in meters, using the following formula: $BMI = (BW \text{ (kg)} / BH^2)$; IV To assess the nutrition status: 9) Body Mass Index (kg / m^2). BMI reference values are examined according to the classification prescribed by the World Health Organization, (2008).

Table 1: Classification of nutrition

BMI Assessment	Category
<16 (kg/m ²)	Severe undernourishment
16-16.9 (kg/m ²)	Medium undernourishment
17-18.4 (kg/m ²)	Slight undernourishment
18.5-24.9 (kg/m ²)	Normal nutrition state
25-29.9 (kg/m ²)	Overweight
30-39.9 (kg/m ²)	Obesity
>40 (kg/m ²)	Pathological obesity

The measurement of morphological characteristics was carried out at the halls for physical education of the Preschool Institution "Čukarica" for the following kindergartens: "Children's Grove", "Sun", and kindergarten "Carić", at the beginning of September 2015. Out of the measuring instruments for taking anthropometric measurements, medical decimal scales, a metal centimetre strip and an anthropometer type Martin and a calliper type Jon Bull were used. The measurement was carried out by standard procedure, adhering to the IBP (International Biological Standards for Each Anthropometric Measure) and the World Medical Association Declaration of Helsinki, (2013). For statistical data processing, the statistical program SPSS Statistics for Windows, version 20 was used. For all the data obtained, a calculation of the basic parameters of descriptive statistics was made: from the measures of the central tendency (M) - the arithmetic mean; from the measure of variability (S) - standard deviation.

A multivariate analysis of variance (MANOVA) was used to determine the gender differences in the entire morphological area, and to determine the individual differences of One-Way ANOVA. After identifying significant differences between the groups of subjects, a series of Post-hoc tests by Bonferonia have been identified with significant differences among the groups.

RESULTS AND DISCUSSION

Based on the obtained multivariate analysis of variance shown in Table 2, among the groups of subjects, a statistically significant difference in the entirely tested anthropometric area was established. F ratio is generally high at the level of the strictest conclusion.

Individually observed statistically significant differences, also at the level of the strictest conclusion $p < 0.01$, are shown in the variables: Body weight, Medium circumference of the stretched upper arm, Medium circumference of the stretched forearm, upper limb skin and Body Mass Index. It can be noted that the groups of subjects, when their sex is ignored, are statistically significantly different, and that this difference is mostly expressed in volume and mass of the body and subcutaneous fat on the upper arm. +The greatest contribution to the differences was expressed through the variables: the middle circumference of the stretched upper arm with 33.3% and the middle circumference of the stretched forearm with slightly more than 26%, and the smallest with the variability of the upper arm of the upper arm skin with some 7%. In the following table we will determine which pairs of groups in the mentioned variables are statistically significantly different.

Table 2: Group differences of the whole sample in morphological characteristics

Variable	Group	M	S	f	Eta Squared	p
Body height	I	1226.39	48.272	1.086	0.010	0.339
	II	1240.56	65.897			
	III	1237.00	56.352			
Body weight	I	242.66	26.271	9.697	0.085	0.000
	II	228.91	27.928			
	III	248.25	26.852			
Median chest circumference	I	633.64	78.065	0.270	0.003	0.764
	II	643.94	97.051			
	III	635.22	87.497			
Median circumference of the stretched upper arm	I	194.98	21.545	52.001	0.333	0.000
	II	174.59	7.170			
	III	176.15	4.518			
Median circumference of the stretched forearm	I	184.03	13.740	37.724	0.266	0.000
	II	174.07	6.596			
	III	170.81	6.329			
Abdominal skin folds	I	83.69	33.554	0.109	0.001	0.897
	II	85.44	38.464			
	III	86.16	23.725			

Back skin folds	I	61.86	17.926			
	II	67.35	19.860	1.910	0.018	0.151
	III	66.43	14.171			
Skin folds of the upper arm	I	83.91	21.555			
	II	77.04	24.316	8.108	0.072	0.000
	III	70.09	15.212			
Body Mass Index	I	19.775	1.8527			
	II	18.453	2.0181	13.766	0.117	0.000
	III	19.999	1.7983			

$F=12.054$; $P=0.000$

Legend: Group - I - First group; II - Second group; III - Third group; M - arithmetic mean; S - standard deviation; f - value of univariate f-test; Eta Squared - the size of the impact; p - level of statistical significance of univariate f-test; F - the value of the multivariate F test; P - level of statistical significance of multivariate F test.

Table 3: Difference between groups I, II and III in morphological characteristics

Variable	Group		Differences of M	Error of differences	p
Body height	I	II	-14.168	9.998	0.474
		III	-10.609	9.654	0.819
	II	I	14.168	9.998	0.474
		III	3.559	9.496	1.000
	III	I	10.609	9.654	0.819
		II	-3.559	9.496	1.000
Body weight	I	II	13.744*	4.708	0.012
		III	-5.597	4.546	0.659
	II	I	-13.744*	4.708	0.012
		III	-19.341*	4.471	0.000
	III	I	5.597	4.546	0.659
		II	19.341*	4.471	0.000
Median chest circumference	I	II	-10.301	15.333	1.000
		III	-1.575	14.806	1.000
	II	I	10.301	15.333	1.000
		III	8.726	14.563	1.000
	III	I	1.575	14.806	1.000
		II	-8.726	14.563	1.000
Median circumference of the stretched upper arm	I	II	20.396*	2.236	0.000
		III	18.832*	2.159	0.000
	II	I	-20.396*	2.236	0.000
		III	-1.564	2.124	1.000
	III	I	-18.832*	2.159	0.000
		II	1.564	2.124	1.000
Median circumference of the stretched forearm	I	II	9.958*	1.617	0.000
		III	13.221*	1.562	0.000
	II	I	-9.958*	1.617	0.000
		III	3.263	1.536	0.104
	III	I	-13.221*	1.562	0.000
		II	-3.263	1.536	0.104

Abdominal skin folds	I	II	-1.754	5.586	1.000
		III	-2.477	5.394	1.000
	II	I	1.754	5.586	1.000
		III	-0.723	5.305	1.000
	III	I	2.477	5.394	1.000
		II	0.723	5.305	1.000
Back skin folds	I	II	-5.494	3.015	0.210
		III	-4.571	2.911	0.354
	II	I	5.494	3.015	0.210
		III	0.923	2.864	1.000
	III	I	4.571	2.911	0.354
		II	-0.923	2.864	1.000
Skin folds of the upper arm	I	II	6.862	3.561	0.166
		III	13.818*	3.438	0.000
	II	I	-6.862	3.561	0.166
		III	6.956	3.382	0.123
	III	I	-13.818*	3.438	0.000
		II	-6.956	3.382	0.123
Body Mass Index	I	II	1.322*	0.329	0.000
		III	-0.224	0.318	1.000
	II	I	-1.322*	0.329	0.000
		III	-1.546*	0.312	0.000
	III	I	0.224	0.318	1.000
		II	1.546*	0.312	0.000

Legend: Group I - First group; II - Second group; III - Third group; Differences of M values are the differences between arithmetic means; Difference error - standard error difference among arithmetic means; p - statistical significance of Bonferroni test at $p < 0.0167$.

In Table 3, which provides information on differences in morphological characteristics between the pairs of groups of respondents based on the differences in arithmetic means and their statistical significance, Bonferroni group pair tests show that the couples of groups of subjects differ in five anthropometric variables tested. Differences have been made between the first and second groups in variables: Body weight, Medium circumference of the upper arm, Medium circumference of the forearm, Body Mass index. On the basis of the positive sign, the differences in arithmetic means indicate that the difference is directed to the first group, which in this case achieved higher average values in the mentioned variables compared to the respondents from Group II. Further on, a difference was observed between group I and group III in variables: Medium circumference of stretched upper arm, Medium circumference of the stretched forearm and Skin folds of the upper arm, also in favour of higher average values for group I, and between group II and group III in variables: Body weight and Body Mass Index in favour of higher average values of group II. In other variables, the pairs of groups of

respondents do not statistically significantly differ. The children of the tested groups, when neglecting their sex, are generally found at a similar level of development as indicated by the variables for estimating the longitudinal dimensionality of skeletons and subcutaneous fat on the stomach and back in which no differences were observed. The fact is that the children of the first group are more voluminous compared to the children of the other groups and that the children of the second group are heavier than the children of the third group, but if you look at BMI values for all three groups of respondents, it is also noted that these values are within the limits of the normal state of nutrition to the values prescribed by the National Institutes of Health (1998) and the World Health Organization (2000), indicating that normal children at this age are those whose BMI values are in the range between (BMI=18.5-24.9 kg/m²). Recent research suggest that the overweight of children in Europe has been steadily rising for the last three decades, and this is particularly manifested in Southern European countries (Lobstein, & Frelut, 2003). Previously, the thesis was that proper diet should contain a large amount of protein. Therefore, the quality of the diet regime does not depend on the amount of protein and its origin, but on the diverse use of healthy intent.

Food rich in proteins and calories given to children in developed countries affecting faster growth, can lead to serious consequences in puberty and later periods of life: obesity, diabetes and atherosclerosis (Nader, O'Brien, Houts, Bradley, Belsky, Crosnoe, Friedman, Mei & Susman, 2006).

CONCLUSION

The findings of this research are encouraging because it can be concluded that the quantitative differences between the groups of respondents have no significant projections of the morphological area related to preschool children from Belgrade. This is also confirmed by the fact of their normal state of nutrition obtained on the basis of BMI values, where significant differences

were observed that cannot be considered crucial at this age. Therefore, the growth and development of children does not run linearly, the dominance of anthropometric measures for assessing soft tissue is still prevalent, and the longer bone growth in length is the next stage that will occur. The authors further recommend constant monitoring of morphological dimensions, from the aspect of differences.

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STRUKTURA I SKUPNE RAZLIKE MORFOLOŠKIH KARAKTERISTIKA PREDŠKOLSKJE DJECE IZ BEOGRADA

Cilj istraživanja bio je utvrditi postoje li skupne razlike u morfološkim karakteristikama između djece predškolskog uzrasta u tri različita vrtića na teritoriju Beograda, te definirati i provjeriti strukturu njihovih latentnih dimenzija. Istraživanje koristi nacrt ne-eksperimentalnih istraživanja, tj. korelacioni ex post facto. Ukupan uzorak je sačinjen od 211 djece od toga djevojčica (n=103) i dječaka (n=108) koji su bili polaznici grupa u Predškolskoj ustanovi "Čukarica" u Beogradu, podijeljeni u tri homogene skupine prosječne starosti 6.21 ± 0.56 godina. Uzorak morfoloških mjernih instrumenata sastavljen je prema smanjenom modelu Kurelić, Momirović, Stojanović, Šturm, Radojević i Viskić-Štalec, (1975). Rezultati istraživanja pokazuju značajne razlike među skupinama ispitanika. Naime, djeca I skupina su više voluminozna u odnosu na djecu drugih skupina, a djeca II skupine za nijansu su teža u odnosu na djecu III skupine. Sagledavanjem vrijednosti ITM za sve tri skupine ispitanika uočava se da se te vrijednosti kreću u granicama normalnog stanja uhranjenosti, te da ispoljene razlike u ovom period života ne predstavljaju bitan odnos i mogu se zanemariti. Nalazi istraživanja ukazuju da postoji zadovoljavajući postotak normalno uhranjene djece, te da rast i razvoj djece ne teče linearno, još uvijek prevladava dominacija antropometrijskih mjera za procjenu mekog tkiva, a intenzivniji rast kostiju u dužinu je sljedeća faza koja će nastupiti. Autori smatraju da bi se trebale očekivati veće razlike i varijabiliteti u pogledu stanja prehrane u razdoblju prije puberteta.

Ključne riječi: BMI, predškolski uzrast, razlike.

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THE EFFECT OF SWIMMING WITH DOLPHINS ON THE SELECTED BALANCE AND STRENGTH GROSS MOTOR SKILLS OF EIGHT-YEAR-OLD CHILDREN WITH AUTISM SPECTRUM DISORDER

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ABSTRACT

Autism, the neuro-developmental disorder, usually appears in early childhood. Motor weakness is one of the most prominent impairments of autism. Several therapeutic methods have been proposed to improve motor skills for autistic individuals, out of which swimming with dolphins is the most prominent. The current study investigated the effect of swimming with dolphins on the selected balance and strength gross motor skills of eight-year-old children with autism spectrum disorder. 10 participants were randomly divided into an experimental ($n=5$) and a control ($n=5$) group. All participants completed the Bruininks-Oseretsky test as a pre-test at the beginning of the experiment and then took part in the SPARK motor programme consisting of 16 training sessions. The experimental group swam and trained with dolphins, while the control group spent an equal amount of time training in water without dolphins, after participating in the SPARK motor programme. All participants took the Bruininks-Oseretsky test as a post-test at the end of the experiment. A significant difference was found between groups in the balance (0.002) and strength (0.001) factors. The significant differences in balance and strength confirm that swimming with dolphins improved the balance and strength gross motor skills of children with autism spectrum disorder.

Keywords: Autism, swimming with dolphins, gross motor skills, animal assisted therapy, motor impairment.

INTRODUCTION

Autism spectrum disorder (ASD) is a neuro-developmental disorder that appears during early childhood, characterized with severe damage in social interactions, poor communication skills, stereotyped behaviours, emotions and speech impairment (Ashtari, 2014; Jansiewics, Goldberg, Newschaffer, Denckla, Landa, Mostofsky,

2006), gross and fine motor deficits (Jansiewics, Goldberg, Newschaffer, Denckla, Landa, Mostofsky, 2006; Rinehart, Tonge, Bradshaw, Iansek, Enticott, McGinley, 2006; Williams, Goldstein, Minshew, 2006) and weakness in motor learning (Freitag, Kleser, Schneider, Von Gontard, 2007; Haswell, Izawa, Dowell, Mostofsky, Shadmehr, 2009). Motor weakness is one of the most important challenges for children with autism spectrum disorders.

The weakness, according to neurophysiological science is based on abnormalities in the cerebellum (D Cruz, Mosconi, Steele, Rubin, Luna, Minshew, 2009), basal ganglia (Fatemi, Aldinger, Ashwood, Bauman, Blaha, Blatt, 2012), with poor sensory input (Fournier, Hass, Naik, Lodha, Cauraugh, 2010) and poor multi-sensory integration (Gowen, Hamilton, 2013).

Various therapeutic methods have been introduced to improve ASD; one of the most prominent methods is animal assisted therapy (AAT); dolphins have recently been raised for therapeutic issues (Israel, Wicks-Nelson, 1983; Blue, 1986; Levinson, 1984). Swimming with dolphins turns to John Lilly's study (1956); he started to study and research the dolphins' interaction with children who suffered from neurological disorders, and the first pilot study was applied in Florida, in 1978 and 1979 (Nathanson, 1980). The beneficial effects of swimming with dolphins were explained by learning and attachment theories. Each type of activity, followed by a pleasant outcome, will be self-reinforcing and possible to occur in the future; this is the means of the learning theory (Brickel, 1985). Attachment Theory was introduced by an English psychologist John Bowlby. Throughout this theory, attachment refers to the regulatory system, and it supposed that this system exists inside the person, while its aim is the control over behaviours that led to be closed and touched a distinctive and supportive person or other species that called support (Bretherton, 1992). In swimming with dolphins, dolphins are the incentive, reinforcement and support in facilitating the relationship between the therapist and patient, and they make the patient exhibit special behaviours.

Swimming with dolphins and its influence in neurological, behavioural, psychological, emotional and motor skills have been researched in a relatively low number of studies (Lilly, 1956; Nathanson, 1980; Lukina, 1999; Salgueiro, Nunes, Barros, Maroco, Salgueiro, Santos, 2012). Nathanson (1980) claimed that swimming with dolphins significantly increases motivation, attention, speech skills and fine and gross motor skills of children with severe disabilities. Salgueiro et al (2012) carried out an exploratory research on the effect of a dolphin-interaction programme on children with autism spectrum disorders; the participants were 10 children (8 boys and 2 girls) with autism spectrum disorders, with the average age being nine years and six months. They applied CARS assessment Protocol which includes Childhood Autism Rating Scale (CARS), Psycho-Educational Profile Revised (PEP-R), Autism Treatment Evaluation Checklist (ATEC), Theory of Mind Tasks, and Interaction Evaluation Grid (IEG) for assessing children. The results from ATEC, Theory of Mind Tasks,

and CARS showed that interaction with dolphins does not have any advantages. The PEP-R showed significant statistical effects on the total progress, fine motor skills, cognitive function, and verbal cognitive development.

According to Samadie's report (2011), out of 10,000 children, 26.6 have an autism spectrum disorder in Iran. One of the major problems for people with autism spectrum disorder is their motor difficulties, so that they experience lots of motor limitations, weakness and delays in fine and gross motor skills relative to their age. According to these limitations, the present study, based on the potential benefits of unknown capacities of nature in various medical and treatment cases like saving costs, lack of side effects, willingness of the patient to cooperate, and because of a deficit in literature review, focuses on the effect of swimming with dolphins on the selected balance and strength gross motor skills of eight-year-old children with autism spectrum disorder.

METHODS

Participants

Ten children with ASD and the average age 8.32 ± 0.46 were registered in September 2013 at the special needs school in Kish Island (a small island in the south of Iran). Their families agreed to participate in the swimming with dolphins programme at the Dolphin Park in Kish Island. The participants were randomly divided into experimental (5 boys) and control groups (5 boys). The CARS test, standardized in Iran, composed of 15 items, was used for assessing ASD (Ahmadi, Safari, Hematian, 2009).

Research Tools and Tasks

The motor proficiency Bruininks-Oseretsky test was used for assessing the selected balance and strength gross motor skills of 4.5 to 14-year-old children. This test is composed of 8 subtests. The reliability and validity value of the Bruininks-Oseretsky test was 0.87 and 0.89 respectively. Scoring was based on particular and standard tests; every participant repeated them twice and the examiner recorded the highest point out of two trials (22). In accordance with the aim of the research, researchers applied some Bruininks-Oseretsky subtests such as: balance and strength (Salehi, Zarezadeh, Salek, 2012).

Procedure

Ethical approval for this research project was obtained from the Tehran University Kish International Campus research director, the Department of Education Kish and the Dolphin Park administration.

Before the interaction period, a personal information questionnaire, which included general information, history of illness and the child's medical records, as well as the question whether the child has had any interactions with dolphins or not, were completed. In order to diagnose ASD, the Gilliam Autism Rating Scale test (GARS) was applied to all participants by a child specialist.

After diagnosing ASD, the participants took part in the Bruininks-Oseretsky test as a pre-test and the results were recorded. Then, the participants from both the experimental and control groups joined the SPARK motor programme, which contains pleasure movements along with play and fun, for 16 sessions. The experimental group applied the SPARK motor programme and experienced

interaction and swimming with dolphins along with researchers and the dolphins' private coach, while, at the same time, the control group was also playing and doing activities in shallow water along with researchers and clerks. At the end of the 16th session, the Bruininks-Oseretsky test was applied as a post-test and the results were recorded. Upon the completion of the training sessions, the results were analysed.

Statistical Method

A Shapiro-Wilk test was used for considering the normal data distribution. The scores of the pre-test and post-test for both groups were analysed by the analysis of covariance in the MANCOVA test. Data analysis was carried out with SPSS (v.20, SPSS Inc) and a statistically significant level was assumed for $p \leq 0.05$.

RESULTS

According to the statistical data analysis (table 1), swimming with dolphins showed significant differences between the experimental and control groups in the post-test of balance (0.002) and strength (0.001) factors (Figure 1).

Table 1: Descriptive statistics for the selected balance and strength gross motor skills

Groups	Variables	Pre-test		Post-test	
		M	SD	M	SD
Experimental	Balance	3	0.81	4.3	0.52
	Strength	7.14	0.53	9.4	0.43
Control	Balance	3.1	0.58	3.6	0.73
	Strength	7.3	0.44	8.3	0.40

The data are presented as the means and SD

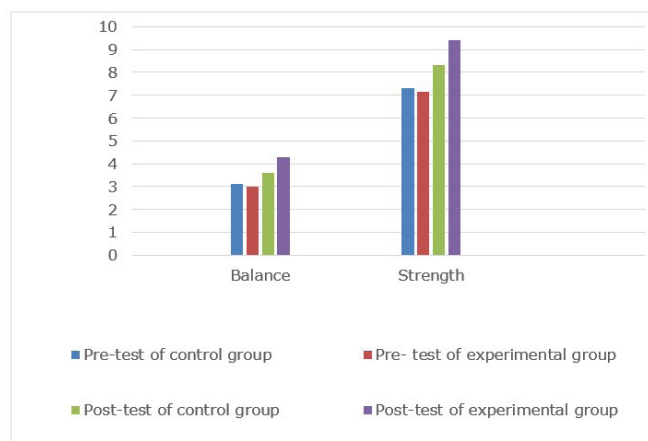


Figure 1: Pre-test and post-test results for experimental and control groups

CONCLUSION

Although a number of research indicated contradictory outcomes about the effects of complementary treatments, particularly physical activities, playing, water training, swimming and interaction with dolphins, on different aspects of individuals with special needs such as: behavioural, cognitive and psychological (Nathanson, 1980; Salgueiro, Nunes, Barros, Maroco, Salgueiro, Santos, 2012; Nathanson, 1998; Nathanson, 1989), the effect of swimming with dolphins on motor aspects, particularly balance and strength, was a sort of ambiguity and it seems necessary to investigate the presented research further. Therefore, according to this vacuum, the purpose of the research was to investigate the effect of swimming with dolphins on selected balance and strength gross motor skills of eight-year-old children with autism spectrum disorder.

According to the results of this research, swimming and interaction with dolphins improved the selected balance and strength gross motor skills in children with ASD. The results of the current research are consistent with the results of Nathanson (1980, 1989, 1998), Lukina (1999), Hyson and Newland (2003). According to the results of the mentioned research, swimming and interaction with dolphins improve the selected balance and strength gross motor skills in children with special needs (Salgueiro, Nunes, Barros, Maroco, Salgueiro, Santos, 2012; Lukina, 1999; Nathanson, 1998; Nathanson, 1989; Hyson, 2003). On the other hand, if swimming with dolphins was observed in terms of physical activities, playing and training, it can be said that the research is consistent with the results of Kosari et al. (2010), Bakhshipur et al. (2011), and Harvey and Reid (2003).

Training and physical activities improve the selected balance and strength gross motor skills in children with autism spectrum disorders and the only difference between this and other, previously mentioned, research is the variable of swimming with dolphins; the effect can be explained on the basis of learning and attachment theories that regulate the selected behaviours and make the subject feel close to the support, i.e. the dolphin. Therefore, it can be said that attachment creates security for participants. Through this investigation, a child felt attached to the dolphin, the attachment activated the behavioural controlling system and caused some particular reactions that the person can achieve which would be different if the controlling system was not active (Besharat, Sharifi, 2001). On the other hand, the effect of swimming with dolphins could be explained by the learning theory. So, animal-assisted therapy and interaction with animals would divert the attention away from the stimuli which cause stress and anxiety, and people could face them. Therefore, animal-assisted therapy reduces and controls anxiety and stress, and it also facilitates relationships between the therapist

and the patient (Fine, 2006). In this investigation, a dolphin plays the role of reward and reinforcement. It means that, whenever the participants showed a pleasant performance experience, the interaction and swimming with dolphins went in line with the participants' serenity.

Moreover, the results are in controversy with the research of Salgueiro et al. (2012) in the case of swimming with dolphins, and with that of Mackenzie et al. (1998) and Hodg et al. (1999) when it comes to training and activities. The results of the present study are in controversy with those obtained by Salgueiro et al. (2012). The applied test could be one of the reasons why. While Salgueiro et al. (2012) used the Psycho-Educational Profile Revised (PEP-R) test to assess the gross motor skills, this research used the Bruininks-Oseretsky test. Furthermore, the other reason could be the number of interactions with dolphins during sessions.

Salgueiro et al. only held six sessions of swimming with dolphins and maybe six sessions were not enough to see the effect on the selected gross motor skills. But, the present research held sixteen sessions and the effects were indicated. The other possible reason can be the participants' age in the research of Salgueiro et al., since the age difference between participants was very high; it means that the age range was from 3 years and six months to thirteen years and six months, while the subjects' age range in the present research was eight years. This difference can be the reason of controversy. In terms of training and physical activities, the reason why there are differences between this and the research of Mackenzie et al. (1998) and Hodg et al. (1999) could be the number of sessions, participants' age, and the type of programmes and training activities, i.e. the number of sessions in this research was sixteen, but it was lower in the mentioned research, the subjects' age is lower than in the other mentioned research, and, as it stated, the present research contains sixteen sessions of the Spark Motor Programme with swimming and interaction with dolphins, while, in the mentioned research, trainings consisted of aerobics or a selected program (McKenzie, Alcaraz, Saliis, Faucette, 1998; Hodge, Murata, Porretta, 1999).

Finally, according to the present research and a few studies that have been conducted in this regard, it could be concluded that swimming with dolphins can improve gross motor skills in children with autism spectrum disorders. Therefore, we suggested to therapists, physicians, coaches and trainers of exceptional children to remedy some problems present in this developing community through a continuation of such investigations with different age groups, other sorts of disorders, other aspects and apply other unknown natural potentials.

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EFEKAT PLIVANJA SA DELFINIMA NA ODABRANE OSNOVNE MOTORIČKE SPOSOBNOSTI RAVNOTEŽE I SNAGE OSMOGODIŠNJE DJECE SA POREMEĆAJEM AUTISTIČNOG SPEKTRA

Autizam, neurorazvojni poremećaj, se obično pojavljuje u ranom djetinjstvu. Motorička slabost je jedna od najizraženijih oštećenja izazvanih autizmom. Plivanje sa delfinima je najizraženija od nekoliko terapijskih metoda predloženih za poboljšanje motoričkih sposobnosti autističnih pojedinaca. Ova je studija istražila efekat plivanja sa delfinima na odabrane motoričke sposobnosti ravnoteže i snage osmogodišnje djece sa poremećajem autističnog spektra. 10 učesnika je nasumično podijeljeno u eksperimentalnu (n=5) i kontrolnu (n=5) grupu. Svi učesnici su podvrgnuti Bruininks-Oseretsky testu koji je služio kao pretestiranje na početku istraživanja, te su onda učestvovali u SPARK motoričkom programu koji se sastojao od 16 treninga. Nakon učešća u SPARK motoričkom programu, članovi eksperimentalne grupe su plivali i trenirali sa delfinima, dok su članovi kontrolne grupe provodili isto vrijeme trenirajući u vodi bez delfina. Svi učesnici su podvrgnuti Bruininks-Oseretsky testu koji je služio kao posttestiranje na kraju istraživanja. Značajna razlika je uočena između grupa po pitanju faktora ravnoteže (0.002) i snage (0.001). Značajne razlike u ravnoteži i snazi potvrđuju da je plivanje sa delfinima poboljšalo osnovne motoričke sposobnosti ravnoteže i snage djece sa poremećajem autističnog spektra.

Ključne riječi: Autizam, plivanje sa delfinima, osnovne motoričke sposobnosti, terapija uz pomoć životinja, motorička oštećenja.

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