

THE IMPACT OF SOCIODEMOGRAPHIC CHARACTERISTICS FOR INVESTMENT IN THE SPORT IN R. MACEDONIA

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(Original scientific paper)

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Abstract

The paper examines whether there is an influence on the attitude and opinions among our citizens on the general policies for investing and development of sports in the R. of Macedonia. For this purpose, 121 respondents with different gender, age and residential level, as well as their current marital status, were interviewed with a specifically constructed questionnaire. The sample of the respondents in this research was cured by the general population of the citizens of the Republic of Macedonia, while taking in consideration that some of them are active athletes, and a part of citizens who are not actively engaged in sports, but are passive supporters of the sport. The research was conducted on a part of the territory of the Republic of Macedonia. In the research, 5 socio-demographic variables were set up, depending on where most of the state should invest more precisely in which of the sports to direct the finances collected through the taxpayers.

Keywords: Sport, Respondents, R. Macedonia, Investing.

Introduction

This paper examines whether the opinions and opinions of our citizens influence the general policies for investment in certain sports in the Republic of Macedonia. For this purpose, 121 respondents with different gender, ethnic, adult, residential level, as well as their current status were interviewed with a specially constructed survey questionnaire. Sport as a social system in the last few years of the independence of our country is gaining momentum. From that aspect, the significance of this research as well as the analysis in all of its segments is even more significant. Especially the normative and institutional ownership in Macedonia. Because of these reasons, it is important to first deflect the very framework of the action of sport as a social phenomenon, and then to carry out a serious analysis of its institutional setup.

In the world languages, by Nešić, the word sport (and similar terms) comes from the word "disport" which means an activity that produces a game, entertainment, leaving work and care, good mood, hanging out, having fun, etc. (Nešić, 2007, quoted by Anastasovski-Stojanoska, 2010: 81). One of the classifications of the sport (Anastasovski-Stojanoska, 2010: 83-84) for which the authors write in their book is a classification that has been tested in terms of investment in this paper, and it is:

1. Recreational sports,
2. School sports,
3. Amateur Sports,
4. Sport for people with disabilities, and
5. Professional sport

Method of work in the research

Subject of the research

The subject of this research was the views and opinions of the respondents (citizens) of the republic of Macedonia, in terms of investments for the development of sports, with particular reference to socio-demographic characteristics and gender of the respondents.

Objectives of the research

The main goal of the research is to identify the latest phenomena for investing in sports, based on scientific knowledge through some socio-demographic characteristics of the respondents.

Research hypotheses

Based on the subject of study and the purpose of this research, the following hypotheses were set up:

Hypothesis 1: There are differences among respondents (citizens) of the Republic of Macedonia, for investing in sports regarding the gender of the respondents;

Hypothesis 2: There are differences among the respondents (citizens) of the Republic of Macedonia, for investing in sports regarding the AGE of the respondents:

Hypothesis 3: There are differences among respondents (citizens) of the Republic of Macedonia for investing in sports regarding to the marital status of the respondents:

Hypothesis 4: There are differences among respondents (citizens) of the Republic of Macedonia, for investing in sports regarding the residential status of the respondents.

Methods of research

The subject of this research was analyzed through several groups of questions in the questionnaire, which will be distributed to the respondents (citizens) of the Republic of Macedonia.

From the aspect of statistical data processing, χ^2 - test in two forms was applied. The tables were constructed by crossing on the one hand the variables for estimating the socio-demographic factors, numbered in frequency (f) and percentage (%), and on the other hand, along with socio-demographic characteristics, also in terms of frequencies (f) and percentage (%). The data received is presented in a neatly presented manner, as well as graphically in the analysis of the results.

The pads were processed with the SPSS for Windows Version 22.0 statistical package, in the Data Center at the Faculty of Physical Education, Sport and Health.

Sample of respondents

The sample of the respondents is drawn from the general population of the citizens of the Republic of Macedonia, while taking care that some of them are active athletes, and one part of citizens who actively involved in sports, but are passive supporters of the sport. The sample of respondents is 121. The questionnaire was constructed by eminent professors from this area (Anastasovski & Nanev). The questionnaire was leaked directly to the respondents in one section. But also one piece will be sent by e-mail to the printers i.e. via the internet.

Results of research

The results of this research were interpreted in accordance with the analyzes obtained from the survey of the respondents (citizens) of the Republic of Macedonia, that was randomly elected. The one that can be stated with certainty is that the emphasis will be placed on where the state would invest most in the development of sports, with particular reference to some socio-demographic characteristics of the respondents, which was tested with the question: "In your opinion, where should the state mostly invest and help the sport in Macedonia", and five frequencies of answers that are bound to the division of the dispute in this paper above: *a) That is recreational sport, b) That is school sport, c) That is amateur sport, d) That is sport for people with disabilities, e) That is professional sport, and f) State does not need to invest and help in sport.*

Variables that investigated the issues in this research are as follows:

- Sex of respondents (SR) - Male (No. 83), and (Female (No. 28).
- Age of respondents (AR) - 15 to 25 years (No. 23), 26-35 years (No. 26), 36 to 45 years (No. 20), 46 to 55 years (No 6), 56 to 65 years (No. 20), and over 65 years (No. 16).
- Marital status of respondents (MSR) – Unmarried (No. 69, Married (No. 46), and Widow (No. 6).
- Residential status of respondents (RSR) City (No. 72), and Village (No. 46).

Analysis of the impact of the GENDER of respondents (GR) for investing in sport in the Republic of Macedonia

First of all, in the survey pole of the respondents from the total survey population, 121 examinees, 83 are male and 38 are female, which through this question, there is a statistically significant difference

according to the sexes of the respondents about the country's investments in the development of the sport in Republic of Macedonia at the level of 0.01 ($p < 0.01$), (see below, Tables 1 and 2). We estimate that over-average high percentage was confirmed with the answer "It's a professional sport", where the male responded with 45.8 percent, while the female population responded with 21.1 percent, it can be noticed that the male population is more inclined to professional or top sports for a simple reason, they follow sports and are inclined to see, comment and participate in sports more closely. While among the female population, the largest percentage of the respondents think that the state should invest in school sports, 31.6 percent of them, while the male population responded with 7.2 percent. This is due to the fact that the female population is more inclined towards the pedagogical profession as a kind of educational process where the school sport itself belongs. Namely, the female population by default is more responsible than parents, and as educators. The fact that the female population determined that a country should invest in school sports suggests that through investment in school sports there will be a benefit for the young population in terms of good health and proper psycho-physical development, and therefore those same young people will be responsible citizens in society. While certain differences occur in the sub-sex responses of respondents divided by sex, the male population responded that the state does not need and does not need to invest in any of the unconventional sports, with 3.6 percent, while the female population responded here with 7.9 percent. In the sub-polar answers, there is identical thinking among the female population, in the part that the state should invest in amateur sport with 7.9 percent.

Table 1: A tabular overview of the answers to the question: "In your opinion where the state should mostly invest and help the sport in Republic of Macedonia" compared with GENDER of respondents

In your opinion where the state should mostly invest and help the sport in Macedonia	Answers						Total number of respondents
	That is recreational sport	That is school sport	That is amateur sport	That is sport for people with disabilities	That is professional sport	State does not need to invest and help in sport	
Gender							
Male	10 12.0 %	6 7.2%	16 19.3%	10 12 %	38 45.8%	3 3.6%	83 100%
Female	8 21.1%	12 31.6%	3 7.9%	4 10.5%	8 21.1%	3 7.9%	38 100%
Total partial number	18 14.9%	18 14.9%	19 15.7%	14 11.6%	46 38.%	6 5,0%	121 100%

Table 2: An overview of the statistical processing of data on the question "In your opinion where the state should mostly invest and help the sport in Republic of Macedonia" compared with GENDER of respondents

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.169 ^a	5	.002
Likelihood Ratio	18.801	5	.002
Linear-by-Linear Association	6.723	1	.010
N of Valid Cases	121		

3 cells (25,0%) have expected count less than 5. The minimum expected count is 1,88

Analysis of the impact of the AGE of respondents (AR) for investing in sport in the Republic of Macedonia

In the tested variable AGE of respondents, is a statistically significant difference in comparison with the state's investment in the development of the dispute at a level of 0.01 ($p < 0,01$), (see below, Table 3 and 4). Namely, above-average high responses to this issue were with "It's a professional sport", where the category from 15 to 25 years answered with 42.4 percent, and the category from 36 to 45 years answered with 40.0 percent. This points out to the fact that a large part of the young population who sincerely loves and participates in sports is of the opinion that the state should invest in professional sport for reasons they want to see and even participate in a quality sport that will have its positive results both for the individual and for the country itself, which can be promoted through good sports results. The same attitude with the young population is shared by respondents aged between 36 and 45 who responded with a high 40.0 percent.

The adult categories are 26 to 35 years old, with 50.0 percent, and adults between 56 and 65 who answered with 33.3 percent. In contrast, age groups between 56 and 65 answered with "it's school sport", 50.0 percent of them. This reflects the fact that older categories consider that the state should invest in school sports. The attitude of the elderly categories of respondents to the young population that is part of the school system for which there will be benefits from the aspect of good health and proper psycho-physical development will be responsible, and therefore those same young people will be responsible citizens in the society in future. While the oldest category i.e. pensioners over the age of 65 responded with a high 75.0 percent with "it's a recreational sport" which suggests that this category takes care of its own psychophysical health and would like to spend their free time (having it) in rehearsal and enjoyment that will surely prolong their lifespan. The differences occur in mature respondents of the respondents divided by age, and most of the age categories from 26 to 35 years old, from 46 to 55 years old, between 56 and 65 years old, as well as those over 65 with 0.0 percent answered "The state should not invest and assist in sports," in contrast, adults between 15 and 26 years old gave a low percentage of answers with "it's a recreational sport", that's 0.0 percent. The youth are of the view that the state should not direct its investments in recreational sports because it is a personal sport activity for each of us and which each of us should finance with our own finances, and thus they will diversify their health and psycho-physical condition. At the end of this analysis, the data for the oldest age category over 65 years, with 0.0 percent, is between two categories of sports: "It's a school sport," "It's a sport for people with disabilities", as well as among the elderly who think that "the state should not invest and help in sports".

Table 3: A tabular overview of the answers to the question: "In your opinion where the state should mostly invest and help the sport in Macedonia" in comparison with AGE of respondents

In your opinion where the state should mostly invest and help the sport in Macedonia	Answers						Total number of respondents
	That is recreational sport	That is school sport	That is amateur sport	That is sport for people with disabilities	That is professional sport	State does not need to invest and help in sport	
Age							
15 -25 year	0 0.0%	3 9.1%	3 9.1%	10 30.3%	14 42.4%	3 9.1%	33 100.0%
26-35 year	4 15.4%	3 11.5%	6 23.1%	0 0.0%	13 50.0%	0 0.0%	26 100.0%
36-45 year	0 0.0%	0 0.0%	5 25.0%	4 20.0%	8 40.0%	3 15.0%	20 100.0%
46-55 year	2 33.3%	2 33.3%	0 0.0%	0 0.0%	2 33.3%	0 0.0%	6 100.0%
56-65 year	0 0.0%	10 50.0%	3 15.0%	0 0.0%	7 35.0%	0 0.0%	20 100.0%
Up then 65 year	12 75.0%	0 0.0%	2 12.5%	0 0.0%	2 12.5%	0 0.0%	16 100.0%
Total partial number	18 14.9%	18 14.9%	19 15.7%	14 11.6%	46 38.0%	6 5.0%	121 100.0%

Table 4: An overview of the statistical processing of data on the question "In your opinion where the state should mostly invest and help the sport in Republic of Macedonia" compared with AGE of respondents

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	111.018 ^a	25	.000
Likelihood Ratio	108.910	25	.000
Linear-by-Linear Association	25.661	1	.000
N of Valid Cases	121		

Analysis of the impact of the MARITAL STATUS of respondents (MSR) for investing in sport in the Republic of Macedonia

In the tested variable MARITAL STATUS of respondents, is a statistically significant difference compared to the country's investment in sport development in the Republic of Macedonia. Macedonia at the level of 0.01 ($p < 0.01$), (see below, Table 5 and 6). Namely, above-average high responses to this issue were with "It's a professional sport", where unmarried responded with 43.5 percent and married with 34.8 percent. This points out to the fact that regardless of the marital status of the respondents, to the opinion that the state should invest in the professional sport for reasons they wish to see and even participate in a quality sport that will have its own positive results for both the individual and the country itself, which can be promoted through good sports results. In contrast, the majority of respondents declared as widowers with 66.7 percent answered "It is a recreational sport", which points out to the fact that those respondents who live only without a partner are inclined to recreation and healthy life and for that reason it is the state that should have invested in recreational sports. At the below average percentage of answers, we have a condition where each of the categories of marital status has a different attitude, single-married and married - the wives with 4.3 percent answered "The state should not invest and assist in sports" for no one of them has given a single answer, or 0.0 percent to "It's School sports"

Table 5: A tabular overview of the answers to the question: " In your opinion where the state should mostly invest and help the sport in Macedonia" compared with MARITAL STATUS of the respondents

In your opinion where the state should mostly invest and help the sport in Macedonia	Answers						Total number of respondents
	That is recreational sport	That is school sport	That is amateur sport	That is sport for people with disabilities	That is professional sport	State does not need to invest and help in sport	
Marital status							
Unmarried/a	4 5.8%	6 8.7%	14 20.3%	12 17.4%	30 43.5%	3 4.3%	69 100%
Married/a	10 21.7%	12 26.1%	3 6.5%	3 6.5%	16 34.8%	2 4.3%	46 100%
Widow / a	4 66.7%	0 0.0%	2 33.3%	0 0.0%	0 0.0%	0 0.0%	6 100%
	18 14.9%	18 14.9%	19 15.7%	15 11.6%	46 38.0%	5 5.0%	121 100%

Table 6: An overview of the statistical processing of data on the question "In your opinion, where would the state need to invest and help the sport in the Republic of Macedonia" compared with MARITAL STATUS of participants

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	35.544 ^a	10	.000
Likelihood Ratio	35.931	10	.000
Linear-by-Linear Association	15.057	1	.000
N of Valid Cases	121		

Analysis of the impact of the RESIDENTIAL STATUS of respondents (RSR) for investing in sport in the Republic of Macedonia

In the tested variable RESIDENTIAL STATUS of respondents, there is a statistically significant difference in the state investment and the development of sport in the Republic of Macedonia at the level of 0.01 ($p < 0.01$), (see below, Table 9 and 10). Namely, the highest percentage of answers to this question was with "It is a professional sport", where the respondents from the urban part answered with 34.7 percent, and the respondents living in the rural part with 43.5 percent. This indicates that regardless of the place of residence of the respondents whether they are in a city or village, they are all of the opinion that the state should invest in the professional sport for reasons they wish to see and even participate in a quality sport that will have their positive results for both the individual and the country itself, which can be promoted through good sports results. The difference in the mid-day answers is as follows: respondents from the city (urban part) with 1.3 percent answered "The state should not invest and help in sports", while the respondents from the village (rural part) with 4.3 percent answered "it is amateur sport".

Table 9: A tabular presentation of the answers to the question: " In your opinion where the state should mostly invest and help the sport in Macedonia " compared with RESIDENTIAL STATUS of respondents

In your opinion where the state should mostly invest and help the sport in Macedonia	Answers						Total number of respondents
	That is recreation at sport	That is school sport	That is amateur sport	That is sport for people with	That is professional sport	State does not need to invest and help in sport	
Presidential status							
City – Urban part	12 16.0%	10 13.3%	17 22.7%	9 12.0%	26 34.7%	1 1.3%	75 100%
Village – Rural part	6 13.0%	8 17.4%	2 4.3%	5 10.9%	20 43.5%	5 10.9%	46 100%
Total partial number	18 14.9%	18 14.9%	19 15.7%	14 11.6%	46 38.0%	6 5.0%	121 100%

Table 10: An overview of the statistical processing of data on the question "In your opinion, where would the state need to invest and help the sport in the Republic of Macedonia" compared with RESIDENTIAL STATUS of respondents

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.419 ^a	5	.029
Likelihood Ratio	13.651	5	.018
Linear-by-Linear Association	2.502	1	.114
N of Valid Cases	121		

Conclusion

Based on the obtained results from this research in which certain socio-demographic characteristics of the respondents (citizens) of the Republic of Macedonia who are compared with investing and assisting the state for the development of sport in the Republic of Macedonia, based on views and opinions, resulted in the following conclusions in this research:

Conclusion 1: According to the views of the respondents irrespective of their gender, age, marital status and place of residence, it is necessary to point out that there is a need for a wider and expert debate about the situation in sports, especially in the part for possible future investments in sports, as by both the state and the private sector;

Conclusion 2: According to the views of the respondents irrespective of their gender, age, marital status and place of residence, the state must rely heavily on the knowledge and scientific knowledge of the faculties of sports in the field his scientific analysis, in order to improve the sport with a special emphasis on management;

Conclusion 3: According to the views of the respondents irrespective of their gender, age, marital status and place of residence, it is necessary to change the status of sports in the Republic of Macedonia and provision of material support is the result to which the forces for action should be streamlined. The legal regulation that creates the development of sports in the Republic of Macedonia implies acting within the executive branch, where in strictly defined principles, in symmetrical forms, the budget and the material support of the sport are created. To discuss the situation, the possibilities and the development of the sport in the Republic of Macedonia, to discuss the legislative power, which should adopt a development document and a Program for development of sport in the Republic of Macedonia, supported by the legislation for its materialization, and

Conclusion 4: According to the views of the respondents irrespective of their gender, age, marital status and place of residence, we can logically conclude, and in that way we are in accordance with the attitudes of our citizens regardless of their gender, age, marital status and place of residence that it is necessary to organize institutional and sport more investments in professional or top sport, essential reforms in the sports organizations themselves with an emphasis on professional sports professionals, much more information for everyone in the Republic of Macedonia.

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DEPENDENCIES ON FITNESS ABILITIES AND BODY COMPOSITION OF CHILDREN IN YOUNGER SCHOOL AGE

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(Original scientific paper)

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Abstract

In this contribution, we present the results of selected fitness abilities and body composition of children in younger school age. The aim of this research is specification of dependence of fitness abilities and the parameters of body composition of 6-7 years old children. The sample consisted of 60 probands (40 boys and 20 girls) with decimal average age 6.73 ± 0.3 year. We used the following tests to diagnose fitness abilities: standing long jump, kneeling overhead medicine ball toss, 4 x 10 m shuttle run, frequency of lower limbs during 6 s, endurance shuttle run. We used direct analysis of the segmented multi-frequency bioelectrical impedance (BIA) to find out the parameters of body composition. The results of measurements were compared to each other and evaluated using statistical methods. When comparing the parameters of fitness abilities in intersexual comparison, we found out that the boys had achieved better average results in all performed tests, but not statistically significant. In some parameters showing a nutritional status were confirmed intersexual differences also statistically in favor of boys. In parameters of body composition, we recorded statistical significance with kneeling overhead medicine ball toss, 4 x 10 m shuttle run and with endurance shuttle run. We also recommend detecting the level of parameters of body composition, when testing mentioned fitness abilities.

Key words: *physical abilities, body composition, 6-7 years old children, dependencies*

Introduction

The period of six to seven years is defined by Batchel (2003) as the degree of maturation within the initial phase of motor development of an individual. This developmental stage is characterized by improving the ability of differentiation tactile-kinesthetic stimuli and the concentration of nervous processes. Kučera et al. (2011) state that at this age improves the overall ability of perception, response and control.

Gallahue and Donnelly (2007), Laczo et al. (2014) indicate minimal differences between girls and boys, which can be already seen in the age period 3 – 8 years in relation to body weight and height. Kirchengast (2010) states statistically insignificant differences in intersexual comparison of children at the age 6-7 years in the level of obesity. In this research Čillík et al. (2014) recorded statistically significant difference in body height and body weight in favour of boys from 7 years, as well as in the indicators of general physical performance, except for joint flexibility in the indicators of physical development.

Wiarth and Darrah (2001) reported that in the early stage of younger school age are in children already created the necessary assumptions for managing combined physical activities, although boys dominate in mastering these skills. Laczo et al. (2014) state that significant sensitivity for speed frequency begins between the ages of 6-7 years, while less significant sensitivity begins at the beginning of the age of 6.

According to Belej and Junger (2006) in pre-school age and younger school age, fitness physical abilities (strength, endurance, partly speed) are determined by energetic and morpho-structural processes. Fitness and coordination abilities (partly speed, partly coordination and flexibility) are ambiguously determined by energetic, morpho-structural, adaptive and control processes.

Kučera et al. (2011) state that between the age 6 and 7, the preference of one side is reduced in acyclic skills. This improves e.g. the quality of the run.

According to the results of national anthropometric measurements of PHASR (2013), BMI is gradually increased from 7 years. Laczo et al. (2014) state different dynamics of growth within individual accelerated

growth waves which is attached to increasing of secretion of adrenal androgens between the age of 6-8 years, when the percentage of total body fat starts to increase.

In children, it is also used but mostly through percentile distribution's curves that are age specific (2 - 20 years) and gender specific, obtained by measuring huge population of children, and providing the specifics and periods of children's growth (Stojmanovska, & Georgi, 2016).

Feč and Feč (2013) state the proportion for inheritance body height 90 %, body weight 65 % and amount of fat 70 %.

Monitoring anthropometric characteristics of children and their changes promotes early detection of certain children's deviations from the average growth curve of their peers. More significant deviation from normal, either one or the other side, can highlight the prevalence of more serious diseases, mental health problems, incorrect eating habits of the child and help to prevent the growth disorders and obesity (de Onis et al. 2004). More significant deviations of children from the average growth curve of their peers may have an impact on the level of motor skills.

This contribution is a part of Grand project VEGA 1/0571/16 The impact of training on physical abilities, physical and functional development of 5-6 years old children.

Methods

Younger school-age children participated in this research. Monitored sample consisted of 60 probands (40 boys and 20 girls) at the age of 6.73 ± 0.3 years.

Testing of physical abilities and measuring of physical development were implemented in standard conditions in October 2016.

We found out basic somatic parameters: body height, body weight, BMI. We used the following tests to diagnose fitness abilities: standing long jump, kneeling overhead medicine ball toss, 4 x 10 m shuttle run, lower-limbs frequency during 6 s, endurance shuttle run. Standing long jump, a test of lower-limbs explosive strength was performed according to the methodology of the authors Moravec et al. (2002). We modified a test kneeling overhead medicine ball toss for determining of upper-limbs explosive strength and trunk (Šimonek, 2015) with respect to the children's age, because we were using the volleyball instead of 1 kg medicine ball. The test 4 x 10 m shuttle run (Čillík et al. 2014) was used for testing running speed with changes of direction.

Brown (2001) recommends to use the test for diagnosing selection of talents in given age category. The frequency of lower limbs was diagnosed by device FiTRO tapping check (FiTRONiC, Bratislava, Slovak Republic). The role of tested subject is to do as many alternate touches by a lower limb with the contact mats as possible in 6 s. The system measures the frequency and the number of individual touches, as well as contact time with a mat and flight time in milliseconds. Better of two attempts is counted. We used endurance shuttle run test to find out endurance abilities according to the methodology Moravec et al. (2002).

We used the device InBody 120 (Biospace Co., Ltd.; Seoul, Korea) for diagnosing the parameters of body composition. We obtained the results of parameters of body composition using a direct analysis of segmental multi-frequency bioelectrical impedance (BIA). InBody is used mainly because of its ability to analyze a broad spectrum of values of body composition, but also because of its clinical reliability. Using the method of 8 point tactile electrode the device diagnose the body segments using the most accurate technology DSM-BIA. The history of measurements was recorded using a database software Lookin'Body120 version 1.2.2.7 from company Biospace. Then, we analyzed the percentage of body fat (PBF), the skeletal muscle mass (SMM), visceral fat level (VFL), waist- hip ratio (WHR), total body water (TBW), proteins (PM) and minerals (MM) from the measured values of impedance and other corrections according to Kyle et al. (2004).

Bioelectrical impedance analysis (BIA) is a relatively simple, quick and non-invasive method for evaluating body composition, in particular, it is a reliable and widely used method. This method detects the parameters of body composition using conductivity of a small alternating current (Kim et al. 2004).

We used basic statistical characteristics in this contribution: arithmetic mean (M), standard deviation (SD), maximum (X_{max}) and minimum (X_{min}).

The statistical significance of differences between genders in the parameters of physical abilities were determined using a t-test for independent samples. Furthermore, the data were processed using correlation analysis to determine relationships between individual parameters. Statistical significance was evaluated at the level of significance $p < 0.05$ and $p < 0.01$.

Results and Discussion

Basic age characteristics and somatic parameters (body height, body weight and BMI) indicate a relatively high homogeneity in intersexual comparison (Table 1).

Table 1 Characteristics of age indicators, somatic parameters in the group of boys and girls

		Decimal age [years]	Body height [cm]	Body weight [kg]	BMI [i]
Boys (n = 40)	Mean	6.77	124.56	24.81	15.88
	SD	0.3	5.69	4.13	1.7
	X _{max}	7.3	137	40.4	21.5
	X _{min}	6.25	112	19.8	13.2
Girls (n = 20)	Mean	6.64	122.08	23.09	15.92
	SD	0.28	5.38	3.67	1.3
	X _{max}	7.15	134	32.4	19.5
	X _{min}	6.27	113	18.2	13.3

Based on the results of physical development, we state that boys are about 0.13 year older, 2.48 cm taller and 1.72 kg heavier when compared with the girls. Although, we recorded differences in intersexual comparison, in parameters of age and physical development, these differences were not statistically significant.

Table 2 Characteristic of indicators of Fitness abilities and parameters of body composition in intersexual monitoring

			Mean	SD	t-test
Fitness abilities	SLJ [cm]	B	118.59	19.89	0.697
		G	116.61	11.78	
	MBT [m]	B	4.11	0.94	0.591
		G	3.97	0.88	
	4 x 10 m [s]	B	14.27	1.36	0.821
		G	14.36	1.03	
TF [n]	B	35.56	7.13	0.139	
	G	32.28	9.02		
ESR [n]	B	15.93	9.98	0.559	
	G	14.44	5.76		
Body composition	PBF [%]	B	16.82	5.68	0.128
		G	19.33	5.88	
	SMM [kg]	B	10.1	1.59	0.078
		G	9.33	1.36	
	VFL [i]	B	1.39	0.74	0.519
		G	1.56	1.2	
	VHR [i]	B	0.72	0.03	0.915
		G	0.72	0.03	
	TBW [L]	B	15.02	1.95	0.032*
		G	13.87	1.55	
	PM [kg]	B	4.01	0.52	0.039*
		G	3.72	0.42	
MM [kg]	B	1.47	0.16	0.04*	
	G	1.38	0.12		

Legend: SD – standard deviation; SLJ – standing long jump; MBT – kneeling overhead medicine ball toss; 4 x 10 m – shuttle run 4 x 10 meters; TF – tapping frequency; ESR – endurance shuttle run; PBF – percentage of body fat mass; SMM – skeletal muscle mass; VFL – visceral fat level; VHR – waist to hip ratio; TBW – total body water; PM – protein mass; MM – mineral mass; * – statistical significance $p < 0.05$

When comparing the parameters of fitness abilities in intersexual comparison, we conclude that boys reach better average results in all performed tests (Table 2). In intersexual comparison, we did not record any statistically significant differences, so we can state homogeneity in performance.

In body composition, we recorded 2.51 % more body fat in girls. Skeletal muscle mass (SMM) was higher by 0.77 kg in boys. Visceral fat level (VFL) was higher in girls by 0.17. We recorded the same waist-to-hip ratio (WHR) in boys and girls.

In boys, we recorded more body water (TBW) by 1.15 l, more proteins (PM) by 0.29 kg, more minerals (MM) by 0.09 kg. These parameters showing nutritional status were also statistically confirmed.

We recorded 11 statistically significant correlates between fitness abilities and parameters of body composition (Table 3). A significant statistical dependence in somatic indicators was found between body height and body weight, as well as between body weight and body mass index, which we consider as a natural developmental indicator.

Table 3 Correlation matrix of significant correlates between the variables in the group of 6 and 7 – year-old boys and girls

	<i>SLJ</i>	<i>MBT</i>	<i>4 x 10 m</i>	<i>TF</i>	<i>ESR</i>
PBF	-0.239	-0.118	0.162	-0.081	-0.344
SMM	0.232	0.378	-0.250	0.117	0.284
TBW	0.233	0.381	-0.252	0.053	0.277
PM	0.242	0.381	-0.259	0.079	0.293
MM	0.112	0.288	-0.149	-0.021	0.171
VFL	-0.142	-0.010	0.117	-0.142	-0.202
WHR	-0.120	0.053	-0.014	0.057	-0.026

Legend: SLJ – standing long jump; MBT – kneeling overhead medicine ball toss; 4 x 10 m – shuttle run 4 x 10 meters; TF – tapping frequency; ESR – endurance shuttle run; PBF – percentage of body fat mass; SMM – skeletal muscle mass; VFL – visceral fat level; WHR – waist to hip ratio; TBW – total body water; PM – protein mass; MM – mineral mass; □ – $p < 0.05$; ■ – $p < 0.01$

In monitored group, we recorded significant dependencies in fitness abilities and selected parameters of body composition. Dependencies were statistically significantly confirmed in the parameters of the analysis of obesity and body mass parameters of active body mass with the explosive power of the trunk and upper extremities. Most likely, fitness abilities participate with an active body mass.

When comparing our results with those of Kirchengast (2010), we state lower levels of body fat percentage equally in boys and girls, equally differently in intersexual comparison.

L'Abe et al. (2010) state that in children aged 6.8 years they recorded an average body height 125.1 cm, weight 25.2 kg and body mass index 16.01. Based on the method of isotope dilution they recorded an average values of fat percentage in boys 15.9% and in girls 18.8%. At the same time they state the high correlation dependence between detection of body composition by isotope dilution method and BIA method. The lowest correlation dependence was found with BMI value, the problem is a diagnosis of obesity in children with a high fat rate, but normal weight. In our group, we measured higher levels of body fat in boys and girls.

Junger, Palanská and Čech (2014) found similar results as we did, that between preschool boys and girls there are not statistically significant differences in body composition parameters, except the parameters pointing to nutritional status (amount of minerals and proteins).

Conclusion

We recorded differences in intersexual monitoring in the parameters of physical development, but they were not statistically significant.

When comparing the parameters of fitness abilities in intersexual monitoring we conclude that boys reach better average results in all conducted tests, but it is not statistically significant. The parameters showing the nutritional status confirmed intersexual differences, even statistically in favor of boys in indicators of total body water (TBW), proteins (PM) and minerals (MM). Differences in other parameters were not statistically significant. Girls achieved a higher percentage of body fat (PBF) and a higher index of visceral fat (VFL).

We recorded a statistically significant dependence of body composition and explosive strength of torso and upper limbs, the running speed with changes of direction and aerobic endurance. Impact on explosive power of torso and upper limbs was positive in these parameters: skeletal muscle mass (SMM), total body water (TBW), proteins (PM) and minerals (MM). On the contrary, these mentioned parameters except for the weight of the skeletal muscles had a statistically negative effect on a running speed with changes of direction. Skeletal muscle mass (SMM), total body water (TBW), proteins (PM) statistically positively affected the level of aerobic endurance and percentage of body fat (PBF) negatively affected the level of aerobic endurance.

In the monitored group we did not record any statistically significant influence of body composition at the level of explosive power of lower limbs and the frequency speed of the lower limbs.

Based on our results we suggest to detect the indicators of body composition in children aged 6-7 years, when testing explosive strength of torso and upper limbs, the running speed with changes of direction and aerobic endurance.

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DIFFERENCES IN THE POSTURAL STATUS BETWEEN BOYS AND GIRLS BETWEEN 11 TO 13 YEARS OF AGE

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(Original scientific paper)

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Abstract

The study was conducted on a sample of 90 students of both genders, 11 to 13 years old. The participants were students from primary school "Tušanj" and "Brčanska Malta" located in Tuzla. The aim of the study is to determine postural differences between boys and girls, aged 11 to 13. The postural status was evaluated using 12 variables which reflected on the position of head, shoulders, hips, pelvis (frontal and lateral position) as well as neck pressure, the center of the body mass, Q angle of knees, loss of height from measured stature and posture number. For the purposes of the research, Posture Pro V software was used, whereas anatomical determinants of the body were selected bilaterally (head, torso, legs/hips, knees and ankles) through frontal plane (frontal position) and sagittal plane (lateral position). To determine the difference between boys and girls, aged 11 to 13, the Independent Samples t-Test was used. The acquired results indicate that boys had better postural status in comparison with girls. Poor posture could be explained by the fact that girls enter into puberty earlier than boys. It led to rapid height growth, when the muscular system is not developed enough to maintain a proper function/coordination between body segments. Also, it could be stated that disproportion between phase of the growth spurt, skeletal development and insufficient body activity could be a reason for poor posture girls have in comparison with boys, aged 11 to 13.

Key words: *body posture, Q angle, posture number, neck pressure*

Introduction

Most of their time preschool children spend playing and moving around which makes them the most active population. By the time they start going to primary school, children spend most of their time sitting. The time spent at home (doing homework, watching TV, using PC and playing video games) should be accounted for as well, as it significantly leads to discontinuity of physical activity. During the development period, i.e. from 6 to 18 years of age, children are exposed to different health issues/problems including a problem of poor posture (Bogdanović et.al, 2008). The beginning of the school and entrance into school environment represent a "fertile ground" for development of some postural disorders and due to school responsibilities, physical activity decreases about 50% (Vuković, 1999). Posture is defined as a position of body segments in a given time (Gangnet et.al, 2003) and it represents an important health indicator (McEvoy,2005). Posture must correspond to a specific body position in a space which reduces the influence of gravitational strain on the tissue (Grimmer et.al, 2002). Inadequate posture comprises of bad coordination of body parts (Shumway-Cook, Woollacott, 2001). Proper posture in upright position or some other position, either moving or resting, represents a state of good musculoskeletal balance (Protić – Gava, Šćepanović, 2014). Posture in children and young people, as extremely important segment of health status, is an interest of many researchers, due to increasing number of postural disorders in children and young people (Obradović, Milošević, 2008., Protić – Gava, Krneta, 2010., Sabo, 2006). The term proper posture implies a habit of keeping natural upright position or position while walking. With proper posture, the trunk profile forms a natural physiological curve of spinal column, with moderate neck curvature (lordosis), chest protrusion (kyphosis) and lordosis. In a clinical view, this is a corresponding head position with the look ahead, shoulders slightly backwards, chest slightly protruded to the front and arms close to the body. Abdomen contracted inwards, knees in a straight position and pelvis tilted forward for about 60°. The most common factors which influence posture are anatomical structure, inherited characteristics and external

influences (diseases, habits, work, profession etc.). Primary changes are usually first exhibited on the muscles, then on the ligaments, and finally on the skeletal system (Babiak, 1984). Today, children are less active in comparison to the children of earlier generations, either through games or organized physical activities. Taking into account muscular strength, physiological and anatomical differences, this paper will show if and to which extent are there postural differences between boys and girls.

Method

Participants

A sample of 90 students of both gender, 11 to 13 years old, participated in the study. The participants were students from primary school "Tušanj" and "Brčanska Malta" located in Tuzla.

Variables

Measuring variables used in the study:

- Frontal head position (FHeP)
- Frontal shoulder position (FSP)
- Frontal hip position (FHiP)
- Lateral head position (LHP)
- Lateral pelvis position (inclination position) (LPP)
- Total deviation of frontal and lateral position (TDFaL)

Using Posture Pro V software, anatomical determinants of the body were selected bilaterally (head, torso, legs/hips, knees and ankles) through frontal plane (frontal position) and sagittal plane (lateral position) where the following variables were derived:

- Neck pressure (expressed in N) (NPN)
- Position of the center of body mass (PCBM)
- Q angle in the upper thigh of the right leg (QaR)
- Q angle in the upper thigh of the left leg (QaL)
- Measured loss of height from measured stature (LHMS)
- Posture number (scale) (PN)

Procedure

Before the start of the research, after informing the participants about the procedure, we started gathering the data. In adequate clothes and after measuring the participants, markers, 8mm in diameter, were placed on a reference points on the participants. The participant was standing barefoot, taking a normal upright stance, faced towards the camera as well as with lateral stance where both stances were captured with a camera.

Equipment

The equipment needed for this research was Casio Exilim EX-F1 camera and reflective markers. Casio EX-F1 advanced High Speed photo-camera, capable of shooting videos up to 1200 frames per second and it comes equipped with powerful 12 x zoom (Casio Computer Co., Ltd.2017). HIGH SPEED EXILIM EX-F1 has CMOS sensor and high-speed LSI processor 6.0 million pixels which possesses a strength of optic zooming up to 12x. Reflective markers (Quintic Consultancy Ltd) are equipment and a tool used to mark reference points on the body of the participants. They have a possibility of reflecting light beams (photoflash when taking photos) so they are easily spotted during analysis.

Software „Posture Pro V“

The software used for the research was "Posture Pro V", fifth edition, designed by Dr. Joseph Venture. It allows effective analysis of the posture from frontal and lateral plane. Also, it provides information about cervical spine, center of gravity, Q angle as well as information regarding a deviation from normal stance.

Methods of data processing

Descriptive statistics and Independent T-test were used in this research.

Results

Table 1 contains data about basic descriptive parameters for analyzed variables of observed group of boys and girls aged 11 to 13, while Table 2. represents data related to procedures of independent T-test.

Table 1. Basic central and dispersal parameters of applied variables - postural status of boys and girls aged 11 to 13

	Group	N	Mean	Std. Deviation	Std. Error Mean
FHeP	Boys (m)	44	9.41	3.687	.556
	Girls (f)	59	8.78	3.543	.461
FSP	Boys (m)	44	9.75	1.942	.293
	Girls (f)	59	9.02	2.224	.290
FHiP	Boys (m)	44	8.75	2.712	.409
	Girls (f)	59	8.03	1.956	.255
LHP	Boys (m)	44	9.16	6.758	1.019
	Girls (f)	59	11.37	7.649	.996
LPP	Boys (m)	44	5.23	4.051	0.611
	Girls (f)	59	6.58	3.865	.503
TDFaL	Boys (m)	44	21.650	8.3115	1.2530
	Girls (f)	59	25.076	9.1507	1.1913
NPN	Boys (m)	44	39.907	28.7608	4.3359
	Girls (f)	59	50.042	33.8065	4.4012
PCBM	Boys (m)	44	1.48	.549	.083
	Girls (f)	59	1.14	.392	.051
QaR	Boys (m)	44	13.43	6.507	.981
	Girls (f)	59	17.25	5.935	.773
QaL	Boys (m)	44	17.64	6.513	.982
	Girls (f)	59	20.14	6.064	.789
LHMS	Boys (m)	44	.505	.3348	.0505
	Girls (f)	59	.680	.5486	.0714
PN	Boys (m)	44	20.30	8.974	1.353
	Girls (f)	59	24.59	11.800	1.536

Tabela 2. Independent Samples T-test Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
FHeP	.060	.808	-.876	101	.383	-.629	.718	-2.054	.795
FSP	.365	.547	-1.745	101	0.084	-0.733	.420	-1.566	0.100
FHiP	4.687	0.033	-1.557	101	.122	-0.716	.460	-1.628	.196
LHP	.386	0.536	1.526	101	.130	2.214	1.451	-.664	5.092
LPP	.350	.555	1.717	101	.089	1.349	.786	-.210	2.908
TDFaL	.861	.356	1.954	101	.050	3.4263	1.7535	-.0522	6.9048
NPN	.711	.401	1.715	101	.049	4.294	2.504	-.673	9.262
PCBM	28.672	.000	-3.684	101	.000	-.342	.093	-.526	-.158
QaR	.313	.577	3.103	101	.002	3.822	1.232	1.378	6.266
QaL	.111	.740	2.005	101	.048	2.499	1.247	.026	4.973
LHS	6.969	.010	1.872	101	.049	.1751	.0935	-.0104	.3607
PN	3.396	.068	2.019	101	.046	4.298	2.129	.074	8.521

Discussion

Results obtained in this study indicate that there are differences in certain variables of postural status between boys and girls aged 11 to 13. There are many reasons for such differences and one of them is that girls enter into puberty earlier than boys (Ugarković, 2001). Girls enter into puberty around the age of 10 to 11 and boys around the age of 12 to 13. Puberty represents a period of tumultuous changes and they also reflect in the posture. Tumultuous anatomical and physiological hormonal changes influence intensive growth and development of the body which as a consequence can result in posture degradation. Obtained results match with the results indicating that boys aged 10 years onwards have larger variable values than girls, in terms of shoulder assessment (research conducted on the population of 52 students - 20 boys and 32 girls) (Penha et.al., 2008). Equally, girls in comparison with boys (deviation of spinal column in frontal plane) have poor or very poor support of spinal column (Obradović, 2008). Poor posture is a common problem in children and adolescents and has a prevalence of 22-65% (Maghsoud et.al., 2012, Kopecký, 2004). If we take a closer look at variables TDFaL and PCBM, we could state that they are relating to maintaining a balanced posture. The control of the balance is a complex _____ and it includes maintaining posture. Also, it facilitates movement (Mancini and Horak, 2010). Further, balance control comprises of the control of the body mass center (PCBM) within boundaries of stability. The differences in the variables between boys and girls aged 11 to 13, TDFaL and PCBM, could be related to the fact that girls are taller and have more body mass than boys due to beginning puberty earlier than boys. Namely, we could state that by beginning puberty earlier and by increasing longitudinal skeletal system, the discord between phase of rapid growth and skeletal development, widening of hips (Ponorac et.al 2013), larger inclination of the pelvis (in comparison with men, by a few degrees) (Perović, 1966) as well as weakness of abdominal and back musculature could be attributed to these differences. Consequently, anatomical position and movement of lower extremities is changed (Ireland and Ott, 2004). Also, weakness of the muscles in the pelvic region and lower extremities could lead to secondary disorders in upper body parts (Terzija, 2015). Analyzing differences in the variables NPN - Neck pressure, it is shown that force occurring with girls (50 N) is more pronounced than with boys (39 N) and their skeletal system suffers more loading. This tells us that skeletal system is burdened to such extent that it could be potential indicator of deformity. The research conducted on 60 students of primary school (VI grade) shows that 38% of students had distinct deviation of head position, where perpendicular falls in front of sternum (Beganović et.al, 2012). Further, the data that 14.7% of students have a characteristic of head being bent forward, shoulders bent forward, increased stoop, chest contracted speaks in the favor of given results (Nikšić et.al, 2015). Analyzing variable Neck pressure and relating it to variables TDFaL and PCBM, we could state that spinal column works as kinetic chain because movement of one segment in a chain indirectly moves another, in this case head (Mikić, Bjeković, 2004). Although many studies are conducted regarding Q angle, relatively small number talks about differences between boys and girls. Many of those studies research the bilateral difference, so this requires a more serious approach to a research. The research which shows the differences between genders, and which can be correlated with ours, is done on the sample of 200 measurements (Bhalar et.al, 2013). They state that the mean Q value for boys age 11 - 12 is 18.3 ± 3.3 degrees, and for girls 16.8 ± 3 degrees. Although many studies were conducted regarding Q angle, relatively small number of them focused on Q angle in children (Bhalara et.al, 2013), which should be main focus in future studies. Variable GVIS is a derivative from other variables such as: TDFaL, PCBM, QaR, QaL. If anatomical determinants of the position of head, shoulder, hips (joints and knees included) are normal and if values are revolving around 0 degree for all indicators, then we do not have a loss of height. Every deviation will affect, to a greater or lesser extent, loss of height. (provjeriti smisao recenice) From the results of descriptive statistics (Table 1), we can see that values deviated from zero value which contributes to the fact that girls had greater loss of height perceptually in comparison with boys. Posture number represents a number resulting from the analysis of digital picture taken by software PosturePro®V. It captures key points such as shoulders, knees, hips, ankle and compares them with normal values. After that, posture number is allocated. It would be ideal if ear, shoulder, hip, knee and ankle are in vertical line and that would be zero posture. Average posture would be 18 while poor one more than 30. In order to explain the differences between boys and girls aged 11 to 13 in variable PN, we could say that it represents a sum of previously mentioned posture determinants. It is precisely this that tells us that girls had larger values and with that, moving toward values which indicated poor posture.

Conclusion

Proper posture should be a primary responsibility, because it is a prerequisite of good health, normal growth and development of every student. Poor posture could be an indicator of health issues and if not treated on time, it could become a serious problem. The ideal case would be to identify the first signs of poor posture at the very beginning and the most important role in forming and keeping proper posture are the muscles as active part of movement apparatus. Disorders or poor posture in children are commonly occurring as a consequence of weak musculature in the region of the back, chest or the abdomen. The obtained results indicate that boys had better postural status in comparison to girls. Quantitative indicators also show that with both genders we have deviations from normal postural status, which could lead to an active damage of the locomotor apparatus, and by that fact alone it could lead to poor posture. In order to avoid such issues, and to avoid any serious structural changes, it is necessary to react on time. Also, it is necessary that teachers, professors and other personnel dealing with this matter, start with preventative education, corrective exercises, and to stimulate children to pursue physical activity, especially in the period of puberty which represents the most sensitive period for development of postural disorders.

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SOME PHYSICAL FITNESS INDICATORS OF YOUNG ACADEMY FOOTBALL PLAYERS ACCORDING TO PLAYING POSITIONS IN UNITED ARAB EMIRATES

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(Original scientific paper)

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Abstract

Talent identification and early selection into a professional football academy have been reported to be very important for the long-term development of footballing expertise. Through football-specific research, a number of anthropometric and physical parameters have been linked to successful performance in football. The objective of the research study was to explore speed and agility tests of U15 and U16 academy football players according to playing positions, which can be used to predict their future success in football. The sample of research were 60 football players from academy in UAE (31 players age U15 and 29 players age U16), conferred by the position in the football field (playing positions) at the 4 subsamples: Goalkeepers (8), defenders (16), midfielders (20) and forwards (16). The study found out that of all the speed and agility tests assessed, the most discriminatory ones were: sprint speed 20-meter sprints. Results obtained in the testing can also contribute to control of the training process and the proper directing and selection of football players. Finally, this study allowed some normative data for football players to be established and provided a complete speed and agility picture than in earlier studies.

Keywords: *speed and agility tests, academy football players, playing positions*

Introduction

Football is one of the most widely played and complex sports in the world, where players need technical, tactical, and physical skills to succeed (Joksimović et al., 2009). Talent identification and early selection into a professional football academy have been reported to be very important for the long-term development of footballing expertise (Le Gall *et al.*, 2010). Several researchers in football have tried to evaluate factors that optimally contribute to successful football performance (Svensson and Durst, 2005; Wisløff *et al.*, 1998; Tumilty, 1993). Through football-specific research, a number of anthropometric and physical parameters have been linked to successful performance in football (Le Gall *et al.*, 2010). Ostojic (2002) indicated that a relationship exists between an athlete's body composition and functional fitness characteristics and pointed out that body composition and somatotype variables can greatly influence the attainment of functional characteristics such as strength, speed, power, and flexibility by an athlete. These variables are thus used by exercise physiologists and coaches during talent scouting. They measure both anthropometric characteristics and functional fitness in an effort to determine factors that indicate future talent. This was substantiated by Le Gall *et al.* (2010) who studied players at France's elite football academy (Clairefontaine) and found that youth players with significantly greater height, weight, jumping ability and maximal anaerobic power, were more likely to be selected for France's senior men national team game.

Gambetta (1996) defined speed as the ability to move the body or body segments in the shortest possible amount of time. Studies comparing sprint performances of junior and senior players, elite and non-elite, professional versus amateurs and premier league versus lower leagues, all reported better speed performances for higher level players (Wisloff *et al.*, 2004; Cometti *et al.*, 2001; Diallo *et al.*,

2001; Helgerud *et al.*, 2001; Kollath and Quade, 1993; Tumilty and Darby, 1992). This variation could be attributed to the level of training and competition demands for each category, the effect of age and maturity as well as the ability of the body to accommodate higher training loads and strength in leg

muscles in the case of juniors versus seniors. attributes namely; acceleration, velocity, and speed endurance. Nesser *et al.* (1996) propound that sprint tests are commonly used to predict athletic potential during talent identification and to reliably monitor changes in sprinting ability as it develops with maturation and changes in the level of competition. According to Malina *et al.* (2004) speed improves greatly between the ages of 5-8 years in both boys and girls, and that gender variations only become apparent during the adolescence growth spurt (14-18 years in boys and 11-14 years in girls). Thereafter speed increases steadily until early adulthood (22 years)

The game of football is characterized by low-intensity patterns inter-paced with short high intensity sprinting episodes which comprise high-speed movements, accelerations, decelerations and recovery periods (Helgerud *et al.*, 2001) and includes walking, jogging, and sprinting (Reilly, 1996; Bangsbo *et al.*, 1991). Wisløff *et al.*, (2004) estimated that the sprinting phase is performed every 90 seconds of play and last between 2-5 seconds, and constitute about 11% of the total distance covered during a 90 minutes match. Although the percentage seems to be insignificant, these periods of play directly contribute to winning of ball possession and creation of scoring chances and are therefore decisive in the final result of a football match (Duthie *et al.*, 2005). In any match, the attacking and counter-attacking phase demands high speed and acceleration from both strikers and defenders. These actions (attacking and counter-attacking) require a combination of high speed and agility (Little and Williams, 2005). Therefore it is of paramount importance for attackers and defenders to possess high-speed abilities. Single sprint effort tests over distances ranging from 5 - 60m are regularly used to assess running speed in both junior and senior football players (Young *et al.*, 2008; Veale *et al.*, 2008; Duthie *et al.*, 2006a; Pyne *et al.*, 2005). The most frequently used sprint tests are over 10m, 20m, 30m and 40m (Chamari *et al.*, 2004; Wisloff *et al.*, 2004; Hoff and Helgerud, 2003; Cometti *et al.*, 2001; Kollath and Quade, 1993) with less frequent use of 5m, 15m and 60m, (Dupont *et al.*, 2005; Helgerud *et al.*, 2001). This tendency is in line with the argument of Valquer *et al.* (1998) who reported that

96% of sprint bouts in a football match are of less than 30m and at least 49% of these are less than 10m. Cometti *et al.* (2001) measured ninety-five (95) French elite and sub-elite football players with the aim of finding the appropriate test that could discriminate between players' performances. Elite players had shorter 10m sprint time compared to sub-elite players (1.79 sec versus 1.90 sec; $p < 0.05$), but there was no difference in 30m sprint times for the two groups. These results imply that a 30m sprint test is not a good test to distinguish between different levels of players. Similarly, Stolen *et al.* (2005) reported that speed over 10m and 20m are good indicators of on-the-field performance and that these results can distinguish good performers from lesser performers. These observations concur with Valquer *et al.* (1998) who noted that 5m, 10m, and 20m sprint tests better resemble the actual short sprint bouts in the real game of football. Young *et al.* (2005) compared starters and non-starters of elite Australia club players using 10m and 40m sprint tests. The aim of the study was to determine whether speed can be used to select players who enter as starters or substitutes in a match. They reported a significant difference between the two groups ($p = 0.02$). Starters scored 1.86 ± 0.06 seconds in 10m sprint and 3.46 ± 0.06 in a 40m sprint against 1.94 ± 0.09 and 3.57 ± 0.13 seconds for non-starters. Pyne *et al.* (2005) measured sprint speed (5, 10 and 20m) of junior players selected for the final end of season draft camp in Australia and who were successfully selected into the elite senior team and those who were not selected. They found that those who were selected performed better compared to the non-selected. However, Veale *et al.*, (2008) used 10, 20 and 40m sprint and noted that there was no difference ($p = 0.16$) between sprinting performance of players selected into the senior team and those who were not selected. This could be that the group studied was more homogeneous that they performed at a similar level.

Agility is the ability of a moving body to accelerate and quickly change direction (Draper and Lancaster, 1985). It is the product of the interaction between speed, balance, strength, and coordination (Sheppard and Young, 2006; Farrow *et al.*, 2005). Running patterns of team sports athletes are characterized by rapid changes in direction, as compared to linear running in track and field athletes (Dawson *et al.*, 2004b; Young *et al.*, 2002; Gambetta, 1996). Agility can be categorized as planned agility and reactive agility, where the latter is actually similar to quickness. Planned agility describes the deliberate quick change in direction in a straight line along a designed agility course, while reactive agility is when a player moves the whole body rapidly with change of velocity or direction in response to a stimulus (e.g. the movement of an opponent or the ball) (Oliver and Meyers,

2009; Sheppard and Young, 2006; Farrow *et al.*, 2005; Reilly 2000). Reactive agility is a necessity in the game of football as the player is required to run with the ball at a fast pace and at the same time avoids

being tackled, as well as reacting quickly to the unexpected bounce of the ball and movements of the opponent. Therefore reactive agility can be said to be sport-specific and therefore a number of tests have been designed to test team sports players with a protocol that is functional to their specific sport. It has been documented that agility can successfully differentiate between athletes of different playing standards in rugby (Farrow *et al.*, 2005), netball (Sporis *et al.*, 2011) and football (Sheppard *et al.*, 2006). Young *et al.* (1996) examined elite and non-elite football players using the straight line sprint test and Illinois agility test. The results were similar between the two groups for straight line running, however, elite players showed better results in the Illinois test compared to non-elite players (15.3 ± 0.11 and 17.1 ± 2.01), ($p = 0.05$). These results substantiate the assertion of Reilly *et al.* (2000b) that agility can be used to differentiate between athletes of varying playing abilities. Malina *et al.* (2004) assert that agility increases sharply during the growth spurt in both boys and girls up to the age of 14 years for girls and 18 years for boys. Hastad and Lacy (1994) compared the agility status of young (13-15 years) and late adolescent football players (16-19 years) using the Illinois test. They found that young players were between 3%-27% slower compared to older players. The findings reflect a correlation between agility performance and increased age (maturity). They attributed the difference to the ability of older players to accommodate higher training loads and intensities that comes with an increase in age. However, the other factors such as playing experience, decision-making ability, and anticipatory skills cannot be ruled out as possible causes of a performance difference.

The majority of studies, therefore, indicated that sprint speed tests can successfully discriminate between players from a heterogeneous group and can be used to distinguish between talented and less talented football players. The objective of the research study was to explore agility and speed of U15 and U16 academy football players according to playing positions, which can be used to predict their future success in football. It is assumed that by realizing this objective, this study could subsequently add value to talent identification and in monitoring players' physical performance.

Materials and Methods

The sample of research were 60 football players from academy in UAE (31 players age U15 and 29 players age U16), conferred by the position in the football field (playing positions) at the 4 subsamples: Goalkeepers (8), defenders (16), midfielders (20) and forwards (16). Each participant will have to meet pre-defined conditions, to enter the sample: to regularly attend training sessions, that the respondents voluntarily attended training in the football academy. All the players had more than 3 years of experience that the participants are healthy, participants do not have physical defects, morphological aberrations damaged locomotor apparatus, and they do not possess greater pathophysiological abnormalities. The players were fully-informed of all the experimental procedures. All tests were performed on an indoor artificial grass pitch. It was assumed that players will not consume either excessive or very minimal amounts of water at least two hours before the tests. It was also assumed that the players will not train or partake in any vigorous exercises at least 24 hours before the testing day. The testing process started early in the morning until midday and were conducted at the academy's training fields. According to the recommendations of Gore (2000), the following testing order was observed: Body mass, Height and Body mass index. Mass is the quantity of matter in a body and is calculated through the measurement of weight. Body mass was measured using a digital scale. Body mass was recorded to the nearest 0.1kg. Values for height and weight measurements were used to compute Body mass index (BMI): $BMI = BM/height^2$. Field tests were conducted on day two of testing in the following order speed tests (sprint speed 10, 20 and 40-meter sprints) and agility test. Procedure for each of the three speed tests, the subjects covered the required distance from a static position in the shortest possible time. From a 'go' command the subject started running from a stationary position. Two cones were placed a meter before the first timing gate to mark the starting point and another one 1 meter after the last timing gate. The timing gates were adjusted accordingly for 10m, 20m and 40m and maximum encouragement was given to them so that they run up to the last timing gate. Trials: The fastest time from two attempts was recorded as the individual's score. Agility test. Agility is an important component of many team sports, which involve rapid changes of direction and speed of play. It is a vital component in the game of football which involves quick short runs with the ball, combined with dribbling and turning in various unanticipated directions. The length of the course was 10 meters and the width (distance between the start and finish points) was 5 meters. Four cones were used to mark the start, finish and the two turning points. Another four cones were placed down the center an equal distance apart. Each of the center cones was

spaced 3.3 meters apart (Fig 1). Procedure: Players assumed a prone position a meter behind the timing gates and hands by their shoulders. On the 'Go' command the player got up as quickly as possible and ran around the course in the direction indicated, without knocking the cones over, to the finish line, at which the time taken to complete the course was recorded on the timing gate. Trials: The best time score from two trials was taken as the final score.

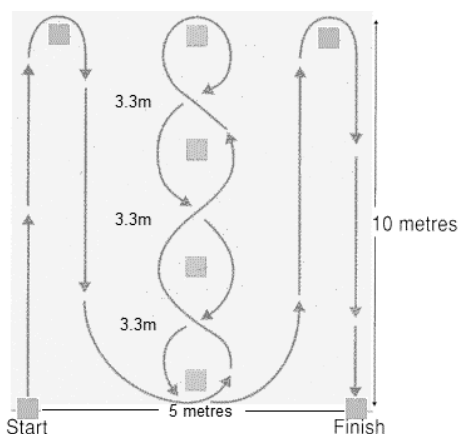


Figure 1 Illinois test course (Adapted from Semenick, 1979)

All results have been analyzed in the statistical program Statistics 7.0 for Windows. For all variables basic parameters of the descriptive statistics were calculated: the minimum score (Min), maximum score (Max), mean (Mean), standard deviation (Std. deviation). To determine a statistically significant difference between the groups for each variable was used a T-test, where for the statistically significant difference the value of the significance level to $P < 0.05$ was taken.

Results

Anthropometry of U15 according to positions of play. A statistically significant difference was observed in height of the players across playing positions ($P < 0.05$), with a greater difference existing between forwards and defenders. Defenders and forwards were of similar height, while goalkeepers and midfielders were slightly taller. No significant differences were observed in all other variables across playing positions (Table 1). Goalkeepers were the heaviest of all the other groups, also goalkeepers were the tallest and forwards were the lightest and shortest. Speed and agility U15 according to positions of play.

Table 1. Speed and agility performance of U15 players according to playing positions (values are mean + SD)

	Goalkeepers (n=4)	Defenders (n=7)	Midfielders (n=9)	Forwards (n=9)	P - value
Age (years)	15.2±0.065	15.1±0.71	14.8±0.73	14.8±0.67	> 0.05
Height (cm)	169.1±5.78	164.6±5.97	166.8±6.98	164.2±4.78	< 0.05
Body mass (kg)	62.4±7.07	57.3±12.9	57.4±9.19	53.9±6.9	> 0.05
Body mass index	21.1± 2.92	20.7± 3.21	20.5± 1.81	20.8± 1.99	> 0.05
10m sprint (sec)	1.82±0.06	1.77±0.09	1.78±0.81	1.76±0.16	> 0.05
20m sprint (sec)	3.23±0.28	3.08±0.16	3.21±0.14	3.18±0.16	> 0.05
40m sprint (sec)	5.93±0.17	5.83±0.28	5.95±0.19	5.73±0.22	> 0.05
Agility (sec)	16.91±0.84	16.75±0.46	16.37±0.41	16.87±0.33	> 0.05

There were no statistically significant differences across playing positions in terms of agility and sprint performance ($P > 0.05$) (Table 1). Table 1 shows that defenders, midfielders and forwards had highest and similar scores in 10m sprints while goalkeepers had the least scores. In 20m sprints, defenders were the fastest groups followed by forwards, while goalkeepers and midfielders were the slowest among the group. In Table 1 forwards recorded the best sprint performance in 40m, followed by defenders and

goalkeepers who had similar scores (5.8 seconds), while midfielders were the slowest. Midfielders were agiler than others were players in the U15 team, followed by defenders and forwards, while goalkeepers were the least agile among the group.

Anthropometry of U16 according to positions of play. There was no significant difference between playing positions for any anthropometric variables ($P > 0.05$). Defenders, midfielders and forwards were of similar height, while goalkeepers were slightly taller. No significant differences were observed in all other variables across playing positions (Table 1). Goalkeepers were the heaviest of all the other groups, also goalkeepers were the tallest and forwards and defenders were the lightest and shortest. Speed and agility U16 according to positions of play. There were no significant statistically significant differences according to positions of play ($P > 0.05$) for the U16 team in terms of agility and all sprint performance tests. Defenders and goalkeepers were the fastest in the 10m sprint, while midfielders and forwards were the slowest (with similar score). Midfielders were the fastest in 20m sprints followed by goalkeepers and defenders, while forwards were the least of all the playing positions. Table 2 shows that forwards were the fastest over 40m, while all the other positions had similar times. From Table 2, in agility, midfielders were the quickest followed by defenders while goalkeepers and forwards were the slowest.

Table 2. Speed and agility performance of U16 according to playing positions (values are mean + SD)

	Goalkeepers (n=4)	Defenders (n=9)	Midfielders (n=10)	Forwards (n=8)	P- value
Age (years)	15.7±1.38	15.7±0.93	16.2±0.85	16.1±0.71	> 0.05
Height (cm)	175.3±4.73	168.3±3.36	170.5±6.39	168.9±3.21	> 0.05
Body mass (kg)	64.8±5.33	60.8±4.23	62.2±4.79	60.8±5.39	> 0.05
Body mass index	21.7±0.52	21.1±0.89	21.8±1.55	21.9±1.69	> 0.05
10m sprint (sec)	1.71±0.22	1.74±0.24	1.75±0.20	1.75±0.12	> 0.05
20m sprint (sec)	2.98±0.25	3.01±0.41	2.97± 0.22	3.07±0.35	> 0.05
40m sprint (sec)	5.82±0.34	5.74±0.43	5.77±0.23	5.64±0.38	> 0.05
Agility (sec)	16.65±0.97	16.43±0.75	16.34±0.81	16.68±0.93	> 0.05

Table 3 Speed and agility performance of U16 (n=41) and U15 (n=33) players (values are mean + SD)

	Total	U16	U15	P-value
10m Sprint (sec)	1.76±0.11	1.73±0.12	1.78±0.23	< 0.05
20m Sprint (sec)	3.09±0.28	3.01±0.23	3.17±0.11	> 0.05
40m Sprint (sec)	5.74±0.32	5.68±0.33	5.78±0.21	< 0.05
Agility (sec)	16.62±0.57	16.52±0.79	16.72±0.42	< 0.05

Table 4 Speed and agility performance of the total group according to playing positions (values are mean + SD)

	Goalkeepers (n=8)	Defenders (n=16)	Midfielders (n=19)	Forwards (n=17)	P-value
10m sprint (sec)	1.76±0.11	1.75±0.18	1.76±0.12	1.75±0.11	> 0.05
20m sprint (sec)	3.11±0.21	3.04±0.27	3.09±0.18	3.12±0.21	> 0.05
40m sprint (sec)	5.83±0.24	5.78±0.37	5.86±0.21	5.68±0.19	> 0.05
Agility (sec)	16.78±0.52	16.56±0.68	16.35±0.72	16.77±0.64	> 0.05

U16 players performed statistically had significantly better in the 10m sprint test, 40m sprint test, and agility test, compared to the U15. Table 3 shows that there was no statistically significant difference in 20m sprint test among the two groups ($P > 0.05$). When U16 and U15 players were combined into one group according to playing positions, there were no significant differences observed in agility or sprint performance ($P > 0.05$) (Table 4). Table 4 shows that goalkeepers and forwards had similar scores in 10 and 20m sprint test and agility test (1.76 and 16.78 seconds). In the 40m sprint test, defenders and

forwards scored better than goalkeepers and midfielders. However, midfielders were the agilest group while goalkeepers and forwards were the slowest in terms of agility.

Discussion

Height and weight are reportedly determined more by heredity (Malina *et al.*, 2004; Bouchard *et al.*, 1997) and to some extent by environmental factors and lifestyle. The use of height and weight in talent selection in football is limited, as football players are known to have varying heights and weights, however, it was reported that height and weight of players have a positional advantage (Reilly *et al.*, 2000a). Tall and heavy players were noted to feature as goalkeepers and central defenders, while short and light players play as midfielders and forwards (Reilly *et al.*, 2000a; Bangsbo, 1994a). When mean height and weight scores found in this study is compared to data of young football players of similar age groups from the literature in other studies, they reflect that players from U15 and U16 compared well with players from China elite under 17 football team studied by Wong and Wong (2009); the Brazilian under 16 football team reported by Pittoli *et al.* (2010) and the Canadian under 16 team reported by Leatt *et al.* (1987). However, it was noted that the height and weight results of young football players in this study are significantly lower to those of young football players from Tunisia and Senegal studied by Chamari (2004) and those of young players from Finland reported by Rahkila and Luthanen (1989), as well as those from Europe reported by Hegerud *et al.* (2001). It was noted that young players from these countries are taller and heavier than those in the current study. In the current study 10m, 20m and 40m sprints were used to assess sprinting abilities of young players. There were statistically significant differences between the U16 and U15 teams in 10m sprints ($P < 0.05$) and 40m sprint ($P < 0.05$) but no significant difference was observed for 20m sprint performance tests ($P > 0.05$).

The results show that U16 players were better performers compared to U15 players. Lack of differences in 20m speed test scores between the U15 and U16 teams is inconsistent with the findings of Valquer *et al.* (1998) who noted that short sprint bouts of less than 30m can best distinguish performance in football because they resemble the actual sprints in a football match. When comparing different playing positions, the current study found that there were no significant differences between players in all positions of play. Strikers and midfielders were noted to be the fastest, whilst defenders and goalkeepers were the slowest in the 10m and 40m sprints - similar observation to Sporis *et al.* (2011). However, in 20m sprint goalkeepers had similar top scores with strikers. Sporis *et al.* (2011) reported that playing positions do not differ significantly in straight-line sprint tests. However, they noted that attackers displayed better speed, while goalkeepers were the slowest. Speed tests were found to discriminate good performers from lesser performers (Stolen *et al.*, 2005; Valquer *et al.*, 1998) and speed scores were reported to be good indicators of on-the-field performance for heterogeneous groups (Young *et al.*, 2005). The 10m and 40m sprint tests successfully discriminated between U16 and U15 young football players. The findings are consistent with those of Wong *et al.* (2005) who studied Australian junior football players and found differences in sprint time ($P < 0.05$ in 10m; $P < 0.05$ in 40m) between starters and substitutes, Commetti *et al.* (2001) who studied elite and sub-elite French players and Pyne *et al.* (2005) who studied selected and non-selected (from an academy to upper levels of play) Australian junior football players. There are various studies which used different instruments to measure agility (Chaleh-Chaleh *et al.*, 2012; Sporis *et al.*, 2011; Svensson and Drust, 2005; Buttifant *et al.*, 1999; Moreno, 1995). The current study used the Illinois agility test. The test incorporates both the aspect of acceleration and change of direction that characterize the actual running during a football match. U16 players scored statistically significantly better on the agility test compared to the U15 ($P < 0.05$). This shows a difference in performance capabilities between the two groups. When comparing different playing positions, the current study found that there were no statistically significant differences between players in all positions of play ($P > 0.05$). Midfielders were noted to be the agilest group, whilst goalkeepers and forwards were the least agile group. Sporis *et al.* (2011) reported similar findings in a group of elite Serbian under 16 National team football players that they analyzed according to playing positions. They similarly reported no significant differences between players in different playing positions.

Conclusion

The study found that out of all the speed and agility tests assessed, the most discriminatory ones were: sprint speed 20-meter sprints. Height and weight are important in allocating positional roles, but cannot discriminate successfully from less successful performers. The mean weight and height for youth

football players (14-19 years) as reported by various authors range from 49.9 ± 0.4 - 71.3 ± 6.8 kg and 163.9 ± 0.3 - 178.6 ± 6.3 cm, respectively and for adult players range from 72.1 ± 8.0 - 78.4 ± 7.4 kg and 177.2 ± 4.5 - 190 ± 6.0 (Joksimović, A. (2017; Pittoli *et al.*, 2010; Stolen *et al.*, 2005; Chamari *et al.*, 2004; Rahkila and Luthanen, 1989; Leatt, *et al.*, 1987). According to Malina *et al.* (2004), the weight and height of a football player are important contributors to functional test performance such as speed, vertical jump, and to football-specific skill performance such as heading, shooting, passing and goalkeeping. Coaches, demonstrators, and experts involved in football should consider the speed and agility tests in the development of football players and that these characteristics can vary according to playing positions, which can be used to predict their future success in football. Results obtained in the testing can also contribute to control of the training process and the proper directing and selection of football players. Finally, this study allowed some normative data for football players to be established and provided a complete speed and agility picture than in earlier studies.

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LEVELS OF ANXIETY AND DEPRESSION IN ELITE KARATE ATHLETES

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(Original scientific paper)

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Abstract

The aim of the study was to assess the levels of anxiety and depression, in elite karate athletes on the beginning of the summer preparatory period. The investigation was carried out as part of regular periodical systematic physical check-up of athletes. Twenty nine elite male karate athletes (most of them members of the Macedonian national karate team) aged 15 to 29 years, were asked to fulfil the Beck Anxiety Inventory (BAI) and the Beck Depression Inventory (BDI). The BAI questionnaire consists of 21 questions related to various aspects of anxiety. The intensity of perceived anxiety for every question in BAI is scored from 0 to 3, with 0 representing the least serious and 3 the most serious symptoms. The sum of all items is calculated at the end. BAI scores from 0-7 were ranked as a normal anxiety level; 8-25 as moderate; and 26-63 as high anxiety. The degree of depressive symptoms was measured by the 21-item-revised form of Beck Depression Inventory. The BDI statements for each question are ranked from 0 to 3, with 0 representing the least serious and 3 the most serious symptoms. Scores of BDI ≤ 10 indicate absence of depressive symptoms, BDI scores from 11-20 indicate mild depressive symptoms, while BDI scores from 21-30 indicate moderate depressive symptoms. BDI scores higher than 30 indicate clinically manifest depressive episode. Mean value of the acquired BAI scores in elite karate athletes was $4,1 \pm 3,8$. One seventh of all athletes showed moderate levels of anxiety. Mean value of acquired BDI scores was $6,1 \pm 5,5$. Four athletes showed mild depressive symptom, while one athlete showed moderate depressive symptoms. There was a positive correlation between the degree of depressive symptoms and the age of the athletes ($r=0,575$).

Key Words: anxiety, depression, karate athletes

Introduction

Many studies have confirmed positive connection between physical activity (PA) and psychological well-being in young people, especially adolescents, as well as in other age groups (Pluncevic, & Mancevska, 2012). The importance of regularity, amount and the intensity of physical activity has also been addressed within this correlation. Additionally, physical activity is often determined as a non-pharmaceutical agent for treatment of anxiety and depression in adults, based on reports that aerobic exercise can reduce depression and state anxiety in clinical population (Lau, & Lau, 2010, Silva, et al., 2017).

Sports is a specific, complex, institutionalized and competitive physical activity with the frequency of training from two to six times per week. This type of PA improves person's physical features and is aimed for competition among athletes. However, competition and combat rivalry in sports require maximal effort from an athlete, often accompanied by mental stress and great physical tiredness. A higher level of stress and negative emotions are induced during tournament rivalry compared to training. Emotions are fundamental factor in both situations, because they determine arousal and influence the performance (cognitive as well as physical) of the athlete. Furthermore, negative emotions such as anxiety and depression are connected to severe musculoskeletal injuries, pain and fatigue in athletes (Weber, et al., 2018) Therefore, the phenomenon of anxiety is of particular interest for sports psychologists and coaches.

Anxiety is a multidimensional construct which is very closely connected to performance in athletes, as well as in non-athletes. High levels of anxiety which are always followed by excessive arousal (with accompanying cognitive, behavioural and vegetative symptoms) have harmful effects on performance. The

processing capabilities of the brain are always engaged by the excessive arousal and therefore limiting the informational intake and the efficiency during the task (Hardy, 1990). In every sports, anxiety is an essential component of each rivalry, for that reason its' level must be adequate to produce best results.

As a personality trait, anxiety is relatively stable feature which determines person's motivational and emotional response when coping with different situations. During stressful situations, individuals with high levels of trait anxiety become more anxious and show strong emotional response which does not correspond with the objective reality, with an anticipation of failure and or threats to self-esteem, which can have negative prolonged effects on the efficiency of their cognitive performance and can enhance further development of clinically manifest anxiety disorders (Hardy, 1990). As opposed to them people with low anxiety in stressful conditions show more efficient behaviour. Different factors such as age, gender, socioeconomic status, cultural precipitating factors and the way of manifestation influence the level of person's anxiety (Andrade, Caraveo, & Berglund, 2000). Our data on the prevalence of high anxiety and depression in university students with sedentary lifestyle show that over 20 % of medical, dentistry and law students suffer from high anxiety levels, while over 10% of them suffer from depression (Mancevska, et al., 2008).

Many reports show positive effects of regular physical exercise on cognition and mental wellbeing of university students (Walsh, 2011). Athletes are suggested to be less anxious and more self-confident than those who are not involved in sport. Furthermore, Bitonte et al, 2014 suggest that mandatory physical exercise should be prescribed for university students in order to enhance performance and prevent from mental illness (Bitonte & Santo, 2014). Our earlier study suggested that athletes engaged in different club sports such as soccer, basketball and handball showed significantly lower levels of manifest anxiety compared to their peers with sedentary lifestyle (Mancevska, et al., 2008). However, athletes are not immune to psychological distress and mental health issues and yet there are few studies that have investigated the prevalence of common mental disorders (CMD - anxiety, depression and adverse substance use) among elite athletes. Recent studies have shown a prevalence of symptoms of CMD in range of 17-45% among Australian and French elite Olympic athletes. (Gouttebarga, & Kerjhoffs, 2016).

In combat sports, such as karate, an effective attack on an opponent's body is the main assumption. It is very often is accompanied with the risk of pain and injury, which can cause psychological discomfort of competitors. This kind of sports competition requires extensive mental strength, rapid and tactically corrects reactions, as well as precision and imagination (Wong, Thung, & Pieter, 2006). Anxiety is particularly important in combat sports and the athlete's ability to maintain an optimal level of his anxiety during fight is essential for successful performance. Considerable deviations of this level (both increases and decreases) will lead to lower efficiency and reduced probability of success (Bali, 2015). General anxiety has rarely been measured in combat sports athletes. The existing reports suggested that karate athletes showed low to moderate anxiety levels (Tiric- Campara, et al, 2012).

To our best knowledge until now, in the Republic of Macedonia, there are no available data regarding the rates of high anxiety and depression among karate athletes and no available data regarding levels of depression among athletes in different sports, so far. This data is crucial for planning the strategies for prevention of mental health disturbances in children, adolescents and young adults as well as for planning mental preparation and successful performance of athletes. It is also necessary for the prevention of athletes' physical and mental health.

The aim of the study was to assess the levels of anxiety and depression in elite karate athletes on the beginning of the summer preparatory period and to determine the correlation between level of anxiety and depression with the age of athletes, sports experience duration and the intensity of the active training regime.

Material & methods

The study was performed at the Institute of Physiology and Anthropology, Medical Faculty, Ss. Cyril and Methodius University in Skopje on twenty nine male elite karate athletes. All athletes, aged 15-29 years, were members of Makpetrol karate club and most of them (18) had been or still were members of the Macedonian national karate team.

The total duration of their active physical training was between 8 to 20 years, with the mean value of 12.5 ± 3.3 years. The duration of the training estimated in hours per week was between eight and fifteen hours, with mean value of 11.2 ± 1.9 hours. The athletes were divided in two groups. The first group (U18 – under 18) consisted of 14 athletes, aged 15 to 18 years, mean age 17.2 ± 1.1 , while the second group (O18

– over 18) consisted of 15 athletes older than 18 years (19 to 29), mean age 22.5 ± 3.5 .

The investigation was carried out as part of regular periodical systematic physical check-up. At the time of the analysis neither respondent was at the stage of recovery from injury, or was previously treated by a psychiatrist or psychotherapist. For the purpose of clinical and psychological evaluation of the levels and perceived symptoms of anxiety and depressive symptoms, they were asked to fulfil the Beck Anxiety Inventory – BAI and the Beck Depression Inventory, respectively. The Macedonian versions of the questionnaires were administrated to the athletes in a form of self-rating questionnaire in ambulatory settings.

BAI consists of 21 questions related to various behavioural, emotional, cognitive and physiological symptoms of anxiety. The intensity of perceived anxiety for every question in BAI is scored from 0 to 3, with 0 representing the least serious and 3 the most serious symptoms. It is a short, simple and very popular tool which is used as a pre-screen for presence of an anxiety disorder in both clinical and non-clinical population. It has excellent internal consistency and high test-retest reliability. The sum of all items is calculated at the end. BAI scores from 0-7 were ranked as “normal anxiety level”; 8-25 as “moderate”; and 26-63 as “high anxiety”.

The degree of depressive symptoms was measured by the 21-item-revised form of Beck Depression Inventory. The BDI statements for each question are ranked from 0 to 3, with 0 representing the least serious and 3 the most serious symptoms. The description of the symptoms includes mood change, social withdrawal, hopelessness, irritability, cognitions such as guilt or feelings of being punished, suicidal intentions, as well as physical symptoms such as fatigue, weight loss and lack of interest in sex. It is a simple, highly sensitive and one of the most widely used instruments for the evaluation of depressive symptoms in clinical as well as non-clinical population. It has excellent internal consistency ($\alpha = 0.86$). Similarly to BAI, the sum of all items was calculated at the end. Scores of $BDI \leq 10$ indicate “absence of depressive symptoms”, BDI scores from 11-20 indicate “mild depressive symptoms”, while BDI scores from 21-30 indicate “moderate depressive symptoms”. BDI scores higher than 30 indicate “clinically manifest depressive episode”.

All participating subjects gave a written informed consent and completed the questionnaire anonymously, using code names.

For statistical evaluation of the data, SPSS 16 software (SPSS Inc., Chicago, IL) was used. The results are represented by mean values and their standard deviations as measures of central tendency; the analysis was performed with the Student t test, Pearson coefficient of correlation and chi-square test. The level of significance was $p < 0.05$.

Results

The description of our sample is shown in table 1. There was no difference in active training regime between the two groups of athletes ($p = 0.471$). All athletes spent in average 11 hours per week in active training. Two thirds of the subjects were members of the Macedonian national karate team.

Table 1. Demographic variables of the elite karate athletes included in the study

Subjects	Group U18 N=14	Group O18 N=15	T-test
Mean age	17.2 ± 1.1	22.5 ± 3.5	$p < 0.001$
Years of active training regime	10.5 ± 1.4	14.2 ± 3.7	$p = 0.003$
Weekly hours of active training regime	10.9 ± 1.8	11.5 ± 2.2	$p = 0.471$
Members of the Macedonian national karate team	8	10	

Mean value of the acquired BAI scores in elite karate athletes was 4.1 ± 3.8 with minimal BAI score = 0 and maximal BAI scores = 15. One seventh of all athletes showed moderate levels of anxiety. As can be seen from figure 1, the mean BAI score obtained from the U18 group was 3.9 ± 3.8 while in athletes older than 18 years it was 4.4 ± 4.1 . There was no statistically significant difference between groups ($p = 0.7$).

Mean value of acquired BDI scores in all elite male karate athletes was 6.1 ± 5.5 with minimal BDI score = 0 and maximal BDI = 24. Four athletes showed mild depressive symptom, while one athlete showed moderate depressive symptoms. The mean value of BDI scores obtained from the U18 group was 3.5 ± 2.4 , while in athletes from the O18 group, it was 8.5 ± 6.6 . Athletes older than 18 years (group O18) showed

significantly higher BDI scores than athletes younger than 18 years ($p=0.01$). Nevertheless the average BDI scores of both groups of athletes were within the range labelled as “absence of depression”. (fig1)

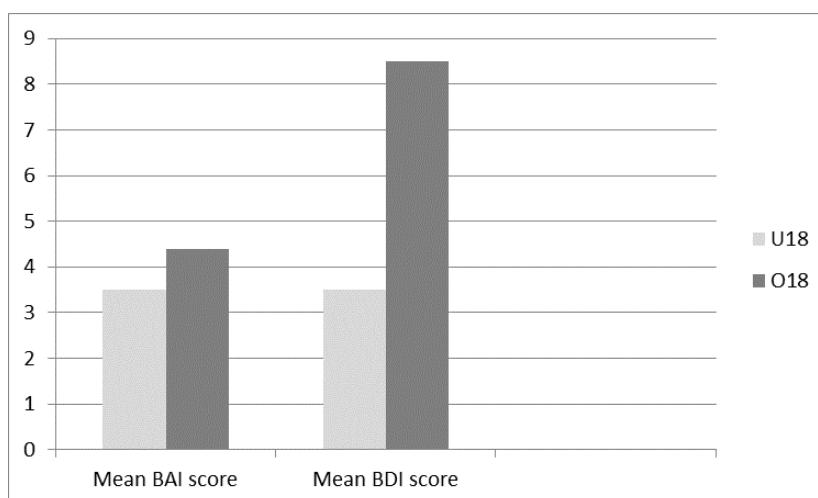


Figure 1. Mean BAI and mean BDI scores obtained in both groups of elite karate athletes

As can be seen from table 2, all elite male karate athletes from the two age groups showed normal to moderate anxiety levels (chi square = 0.007; $df=1$; $p = 0.933$). There was no linear correlation between the values of BAI scores and the age of the athletes ($r=-0.11$), while there was a weak negative correlation between the BAI scores and the total hours of active training regime during the week ($r = - 0.21$).

All athletes aged under 18 showed no symptoms of depression compared to two thirds (10 out of 14) of the athletes older than 18 who also showed no symptoms of depression (chi square = 3.5; $df=1$; $p= 0.059$). One third (four athletes) of the athletes from the second group (O18) showed symptoms of mild depressive mood and one showed moderate depression. No one showed clinically manifest depression. There was a positive correlation between the degree of depressive symptoms and the age of the athletes ($r = 0.575$) and a weak positive correlation between the BDI scores and total hours of training during the week ($r = 0.229$) (table 2).

Table 2. Distribution of athletes based on the obtained BAI and BDI scores

Variables	Subjects	Group U18 N=14	Group O18 N=15
BAI scores			
0-7 Normal anxiety		12*	12
8-25 Moderate anxiety		2	3
>25 High anxiety		0	0
BDI scores			
0-10 No depression		14**	10
11-20 Mild depression		0	4
21-30 Moderate depression		0	1
>30 Clinically manifest depression		0	0

*chi square =0.007; $df=1$; $p= 0.933$

** chi square = 3.59; $df=1$; $p= 0.059$

Discussion

The results obtained in our study, to our best knowledge, represent the first results regarding the levels of anxiety and depression in karate athletes in our country. All, elite male karate athletes from Makpetrol, one of the two internationally most awarded karate clubs in our country, showed low to mild anxiety levels, and there was no association with the age ($r=0.11$) and the duration of the sports experience. This is in accordance with the reports from other studies, which suggest that elite karate athletes show lower levels of anxiety compared to athletes from other sports and to general population (Piskorska, et al, 2016). Furthermore, reports suggest that levels of anxiety are lower in winner elite karate athletes compared to

defeated ones, as well as compared to non-elite karate athletes (Soltani, & Surender, 2013). It is argued that the observed relationship is probably a result of athlete's experience and derives from the impact of long-term adequate mental preparation (self-control and self-awareness training). Tiric - Campara et al. (2012) reported that the type of practiced combat sport influenced the obtained levels of anxiety in combat athletes. Thus, the highest average level of general anxiety was noticed in kick boxers (moderate anxiety) followed by karate fighters (mild anxiety), with the lowest levels in boxers (minimum anxiety) with no correlation between the levels of anxiety and the age and the duration of sports experience. Such data regarding different types of combat sports until now is insufficient in our country. Considering the importance of the level of anxiety for the performance of karate athletes during competition and also for the health of the athletes, it is suggested that preliminary determination of the anxiety level should be carried out and the results should be taken into account during the selection and continuation of practice of certain sport discipline (Tiric - Campara, et al, 2012). Individualization of sports training by coaches and sports psychologists can enable maintenance of optimal individual levels of anxiety in combat athletes. Results from different studies suggest that an ability to control particular types of anxiety seems to be one of the most important psychological skills, which highly affect the competition results of combat sports athletes.

Our results are also in line with the results from our earlier study on levels of trait anxiety in athletes from different team sports such as soccer, basketball and handball in our country. They showed low levels of trait anxiety compared to medical students (Mancevska, et al., 2008). Collective sports are considered to be a protective factor against the presence of psychological disorders, particularly in adolescents. Silva et al., (2017) reported that adolescents aged 11-19 years, who were involved in individual sports, such as swimming and judo, obtained more chances of presenting symptoms of anxiety, stress and depression compared to their peers involved in collective sports. They argued that the social nature of collective sports (collective goal) has the protective role against psychological distress compared to individual sports during the earlier stages of adolescence.

The levels of depressive mood in older athletes in our study were significantly higher compared to the ones obtained in younger athletes (under 18), although the average value of BDI scores in older athletes was still low. One third of athletes older than 18 years (five athletes) showed signs of mild depressive mood to moderate subclinical depressive symptoms. There was a positive correlation between the degrees of depressive symptoms and the age of athletes.

All athletes aged 15 to 18 years showed no signs of depression. Other researchers who used different self-evaluation instruments for the assessment of depressive symptoms showed that 20% of student athletes suffer from signs of depression (Weber, et al., 2018). Nevertheless, social relations (friendship and collective identity) during early and mid adolescence are considered protective factors against depression. In our study, the O18 group consisted of athletes aged 19 to 28 years. It is a period of late adolescence and young adulthood when many important life events happen. Late adolescence is a sensitive period of transition from high school to academic environment in which several processes of personal maturation occur. The definitions of personal – individual (opposed to collective) identity and professional identity, which sometimes could be traumatic experiences, are among those processes. During early adulthood, the life period after the age of 25, essential processes such as employment, career development and definition of emotional relationships and formation of family, occur. Many stressors are present during these life events and can negatively influence the athletes' mood and their satisfaction with the quality of their life. The highest BDI score was obtained in athletes aged 28 years. In this study we did not explicitly investigate the impact of different risk factors such as socio-economic status or emotional relationships on levels of depression in karate athletes. Depressed mood has negative impact on athletes' performance and is likely to activate anger and confusion and to increase physical pain and fatigue (Wong, Thung, & Pieter, 2006). Compared to high anxiety, which is always connected to high arousal and in some sports and in non-athletes can have a positive impact on performance (the role of anxiety as an inner drive), depression is a negative set of emotions which can be connected to low arousal as well as to high arousal, depending on the mechanisms of its origin and their clinical manifestation. Regardless of the origin, depression never shows positive impact on performance neither in athletes nor in non-athletes. There are few studies that have investigated the prevalence of common mental disorders (CMD - anxiety, depression and adverse substance use) among elite athletes. Recent studies have shown a prevalence of symptoms of CMD in range of 17-45% among Australian and French elite Olympic athletes. (Gouttebauge, & Kerjhooffs, 2016).

In addition to the growing body of evidence that prove the positive impact of physical activity on mental health in general population and in athletes, it is essential to gather data on mental health of athletes from

different sports (individual and collective). Regular mental health monitoring should be performed as conscientiously as it is done for their physical health, especially in experienced senior athletes. Excessive exercise and training can be associated with masked symptoms of anxiety disorders and depression in non-athletes as well as in athletes and their continuation could be harmful (Weinstein, Maayan, & Weinstein, 2015).

Conclusions

The results from our study are the first of this kind in our country, from the best of our knowledge. They show that elite karate athletes maintain low levels of anxiety. However, the levels of depression were higher and showed positive correlation with the age. It is essential to gather additional data on the influence of different risk factors on mental health in athletes from different sports in order to make a substantial data base for further research of the impact of psychological parameters on performance in athletes and on the impact of physical activity and sports on the mental health of athletes, and of general population especially of young and senior population.

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LOW BACK PAIN, INFLUENCE OF ANXIETY IN ITS TREATMENT

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(Original scientific paper)

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Abstract

Background: The low back pain is a huge problem nowadays, and it is experienced by a majority of the population during their whole life. Chronic low back pain is a state that is affected by biological, psychological and social factors that interfere among themselves and together affect each other, these factors influence increase and duration of complaining time. Material and Methods: The research was conducted in Physiotherapy Institute of Occupational Medicine (IOM) in Obiliq, Kosovo, during the period of one year, from January 2016 until the end of December 2016. The research was long-term and prospective. 63 patients participated in this research. All of them were treated with physical therapy, depending on examination and findings on patient. Results: Based on the obtained results, it can be concluded that the intensity of pain in patients before and after the treatment affects anxiety. Respectively, the patients who had high intensity pain also manifested higher level of anxiety. Conclusion: Anxiety influences the rehabilitation of low back pain, the patients who suffer from low back pain and have psychological problems such as anxiety, their level of pain prior and following the physiotherapy treatment remains without significant difference.

Keywords: *Low Back Pain, Anxiety and Chronic Pain*

Introduction

The low back pain is a huge problem nowadays, and it is experienced by the majority of the population during their whole life. Around 70-80% of the population suffers from this problem, or have experienced low back pain at least once during their life (Chou, 2017). The newest data shows that in different places of the world, more than half of the population, during a one year period, have problems with low back pain (Gourmelen J, 2007).

More than 85% of the causes of low back pain are idiopathic and the cause is unknown, and they are classified as non-specific with unknown background (Angela Searle M. S., 2015). Low back pain is known as pathology that has multifactorial etymology with characteristics (age, physical fitness), psychosocial factors (stress, anxiety and depression) plus work factors (heavy physical work, bend and twisting motions and vibration) which affect its development.(G., 2008) (Mauritz van Todler, 2002).

Management and prognosis of treatment change, and should be based on duration and symptoms (Koes BW, 2010). Most of low back pain is eliminated by conservative treatment during a certain period of time. There are some patients that experience continuous pain which does not decrease nor can be eliminated by conservative treatment, and in such cases surgery should be performed.(Chou R, 2007). Proper awareness for the relation of disability must be established until the level of pain and cognitive knowledge of the patient's profile can be used in order to come to a conclusion and to choose the treatment, and achieve better results. (Helmouhout, 2010), (Smeet, 2009). Physical activity is always recommended for the treatment of LBP (Hendrick P M. S., 2011). For the acute pain, according to the data from publications supporting walking (Hendrick P T. W., 2010), the treatment that is considered to be effective for acute LBP is McKenzie's method, but it is seen as a short term benefit and does not last forever (Casazza, 2012). There are some data which support application of hot (warm) procedures as a therapy for the acute phase and sub-acute phase of LBP. (French, Cameron, Walker, Reggars, & Esterman, 2006), but we have less data for chronic phase in relation to application of hot and cold therapy (Van Middelkoop M R. S., 2011).

Physical exercises are the most effective therapy for decreasing pain and for increasing the function for chronic LBP (DG, 2012). These exercises help to lower the chances of repetition of problem until 6 months after completing the exercise program (Smith C, 2010) and they help to increase the duration of functionality (Van Middelkoop M R. S., 2011).

The exercises are good but we cannot say which group of exercises is more effective compared to the others (Van Middelkoop M R. S., 2010).

Chronic pain, the pain is defined as “unpleasant sensoric and emotional experience which associates with acute or potential damage of a tissue” and becomes chronic when it continues to exist after the usual treatment and passes the time that belongs to acute phase of illness or injury (in general 3-6 months)(Twomey LT, 1987)(H Merkey, 1994)(Merkey, 2011). The chronic pain is a phenomenon that includes biological, psychological, social and cultural aspects (Kristina Janzen, 2016).

The studies show that patients with pain have more affinity to be affected by chronic problems such as depression and anxiety. It is often said that we should be careful during diagnostics and treatment of these illnesses. The next research should be concentrated on modalities of treatment of these phenomena with the joint pain in general.(Marloes Gerrits, 2012).

Anxiety is a general feeling in relation to a possible risk, that prepares the body to undertake back reaction. Normal anxiety is a mechanism of adaptation while pathological anxiety is characterized by excessive level of anxiety and damage of general functioning of an individual. The symptoms of anxiety are not diagnosed, they are symptoms of many mental disorders and symptoms of many different general medical illnesses (Lala, 2016).

The patients that were diagnosed as sick from low back pain or at risk of this illness are more mentally upset comparing to the general population. Description of the signs of anxiety or other mental problems are more expressed in persons suffering from low back pain comparing to the rest of the population in general. (J, 2015)

The patients with anxiety disorders who come for a checkup in the primary health care service, have a high level of co-morbidity with physical medical illnesses. (Lala, 2016).

It is important that some researchers have found that anxiety can appear together with inflammatory processes in the organism in addition to depression and neuroticism, and this explains in the best way the specific influence of relationship between emotions and biological response of the organism. (Aoife O Donovan, 2010)

The new studies present that the anxiety is expressed together with appearance of chronic pain and they suggest that the patients with chronic pain should be assessed – tested with tests for anxiety, because it is caused by low back pain (Steilen, 2016). An American study of patients with chronic body pain that reported at primary health care service, confirmed that almost half of the patients, 45% of them, fulfilled the criteria of one or more disorders of anxiety (Kroenke K, 2013).

Connection of low back pain was very often presented with mental illnesses such as anxiety, and according to authors it presents a key factor for the low back pain (Karp, 2016). Psychological profile at patient with low back pain is a very important part as an indicator in therapy of spine illnesses. (Lai C, 2007).

Material and Methods

The research was conducted in Physiotherapy Institute of Occupational Medicine (IOM) in Obiliq, Kosovo, during the period of one year, from January 2016 until the end of December 2016.

The research was long-term and prospective.

63 patients, diagnosed with the acute and chronic low back pain, participated in this research. All of them were treated with physical therapy, depending on examination and findings on the patient.

All patients who applied for treatment with physiotherapy in the IOM were diagnosed with the acute and chronic low back pain and were involved in the research.

The patients were firstly informed of the reason of the research and the procedures that will be followed in order to use the data for scientific reasons, and those who accepted to take part of this research have signed the information template and the consent of involved person in the research. General data as, personal data of the patients are the initials of the name and last name, diagnose, date of birth, working experience, occupation, level of education, duration of illness, forced working position, if the pain is located along the leg, which leg, dominant side, were collected from the anamnesis of the patient. The patients were examined for the anxiety in the Psychiatric service within the IOM. The questionnaire Test Anxiety

Inventory (TAI) was used in relation to their personal assessment of how they felt in general. TAI test was developed by Spielberger (1980) (Spielberger C. D., 1980). The pain was measured with Visual Analog Scale (VAS), when starting with application of physiotherapy and after completing the first sessions for that patient. VAS was used in the manner of vertical vector with the height of 100 mm described as the highest peak or the highest level of the pain and the lowest level as the level without pain or 0 pain. Physiotherapy was applied at patients on individual basis at each patient in adopted manner depending on the needs and findings, it was based with the intention of managing the pain, increase of movement amplitude, increasing the force and flexibility of muscles, education of the patient for the prevention of repetition and techniques of raising balance in low back pain. The physiotherapy was applied according to the diagnose. The number of sessions of physiotherapy was determined by physiotherapist in cooperation with the patient. The number of session ranged from ? to ?. The physiotherapy was based according to the diagnose. In all diagnosis, the aim of the physiotherapy was for the patient to achieve performance in the best possible state, free of pain and without obstacles in all daily life activities.

The license for research was approved by the management of the IOM and afterwards by the Committee (board) for professional ethics at the Ministry of Health of Kosovo in 2016, the license holds the following number 04/2016 date 19.04.2016.

Selection criteria

To be considered for the study, patients had to have specific low back pain. If the patients had undefined low back pain or had different diagnosis, if they were pregnant, they were not considered to be part of this study.

Patients with low back pain who applied for physiotherapy at OMI and the ones who signed to be a part of research, were included in the study. Patie

Criteria to be excluded from the research

- The patients who had undefined low back pain or with differential diagnose.
- Pregnant woman,
- Illnesses of cardiac non-stability
- Vertebral fractures,
- Lumbar Arthrodesis or lumbosacral.
- Methods for statistical data processing,

For variables that in measurable intervals are compatible there will be set.

Basic statistical parameters arithmetic mean (X), standard deviation (SD), variability coefficient (V), minimal result (MIN), maximum result (MAX) ;

- Assymetry skewness of result distribution
- Extension, repsectively - kurtosis of result distribution;
- Method Kollmogorov-Smirnov for testing normality of distribution of results (KS)
- In remaining variables following will be applied:
- frequency;
- percentage (%);

The data will be processed with statistical packages SPSS for Windows Version 22.0 and STATISTICA for Windows Version 10.0.

Results

Table 1.Descriptive statistic and normality of distribution on variables of whole sample

Variables	N	Mini	Max	Mean	SD	CV	s.e.	Skewn	Kurtos
ITS	63	30.00	66.00	44.70	9.56	21.38	1.20	0.56	-0.64
Pain beginning treatment	63	3.00	10.00	7.65	1.81	23.61	0.23	-0.19	-0.86
Session therapy	63	5.00	21.00	10.76	3.05	28.36	0.38	1.36	3.12
Pain end treatment	63	0.00	6.00	2.14	1.78	82.91	0.22	0.37	-1.02
ITS	63	30.00	66.00	44.70	9.56	21.38	1.20	0.56	-0.64

Table 2.

	ANXIETY			Total
	NORMAL	ANXIETY	HIGH LEVEL OF ANXIETY	
HERNIATED DISC	5 71.4%	2 28.6%	0 0.0%	7 100.0%
LUMBOISCHIALGIA	19 40.4%	22 46.8%	6 12.8%	47 100.0%
CHRONIC SYNDROMELUMBAR	4 44.4%	5 55.6%	0 0.0%	9 100.0%
Total	28 44.4%	29 46.0%	6 9.5%	63 100.0%

$\chi^2 = 4.00 p = .405$

Table 2 presents the relation of level of anxiety and diagnosis of low back pain. With χ^2 test we didn't find any statistically significance.

Table 3.

	Frequency	%
NORMAL	28	44.4
ANXIETY	29.00	46.0
HIGH LEVEL OF ANXIETY	6.00	9.5
Total	63.00	100

Table 3 presents the frequency of anxiety at patients with low back pain. It is important to specified that 46% of them are qualified with Anxiety with TAI test.

Table 4.

	N	Mean	SD	F	sig
NORMAL	28	10.93	2.39	5.08	.009
ANXIETY	29	9.93	2.84		
HIGH LEVEL OF ANXIETY	6	14.00	4.77		

With the aim to establish whether the number of therapies is related with anxiety, one-factorial analysis of variance was applied. The results of the analysis of variance are shown in the Table 4. By reviewing the table, it can be seen that uni-variance statistical significant differences were established within the number of therapies and level of anxiety. (F=5.08; p=0,000).

Table 5.

(I) ANXIETY		Mean Difference (I-J)	Std.Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
NORMAL	ANXIETY	.99754	.76002	.194	-.5227	2.5178
	HIGH LEVEL OF ANXIETY	-3.07143)*	1.29047	.021	-5.6528	-.4901
ANXIETY	NORMAL	-.99754	.76002	.194	-2.5178	.5227
	HIGH LEVEL OF ANXIETY	-4.06897)*	1.28654	.002	-6.6424	-1.4955
HIGH LEVEL OF ANXIETY	NORMAL	3.07143*	1.29047	.021	.4901	5.6528
	ANXIETY	4.06897*	1.28654	.002	1.4955	6.6424

With the aim to get additional information, the test post hoc test was applied (LSD-test) Table 5. Based on the obtained results from the test it can be seen that a group of respondents which were classified as HIGH LEVEL OF ANXIETY statistically significantly differs in average number of therapies comparing to the group defined as NORMAL and ANXIETY. Among the groups NORMAL and ANXIETY no statistically significant differences were established in average number of therapies. In the group classified as HIGH LEVEL OF ANXIETY the average number of therapies is higher comparing to the group classified as NORMAL and ANXIETY.

Table 6.

	N	Mean	SD	F	Sig
Pain beginning treatment					
NORMAL	28	7.96	1.77	.764	0.470
ANXIETY	29	7.38	1.92		
HIGH LEVEL OF ANXIETY	6	7.50	1.38		
Total	63	7.65	1.81		
Pain end of treatment					
NORMAL	28	1.11	1.17	15.792	0.000
ANXIETY	29	2.69	1.71		
HIGH LEVEL OF ANXIETY	6	4.33	1.37		
Total	63	2.14	1.78		

With the aim to determine whether the level of anxiety affects the intensity of pain in patients before and after physiotherapy treatment, one-factorial analysis on variance was applied. In Table 6, it can be seen that before the treatment there were not established statistically significant differences on level of anxiety and intensity of pain. In the Table x, it can be seen that after treatment there were established significant statistical uni-variance differences on variable intensity of pain. (F=15.792; p=0.000).

Discussion

Trend and tendency in treatment of pathologies requires multidisciplinary approach, Kamper SJ, et al. the cases when treatment of low back pain fails due to uncoordinated approach between health professionals, hence conservative treatment fails as well. They recommend multidisciplinary approach for adequate rehabilitation of problems with the low back pain (Steven J Kamper, 2014). Low back pain is a heterogeneous condition, their treatment may give significant improvement results, whereas the similar clinical syndromes will be determined as appropriate treatment guideless. (Hamilton Hall, 2009).

Low back pain is one of the leading causes of limitations of daily activities (disabilities), in comparison to other **conditions**. With the aging population, the importance of urgent research becomes more apparent in order to have an approach for the low back pain in various directions (Damian Hoy, 2014).

The anxiety influences the treatment of the patients with low back pain, according to William Shaw the conclusion is that based on the consistency of the study with valid measurements they represent the consistent data that psychological anxiety is increased in acute low back pain (William Shaw, 2016). These data are presented by Gatchel R, et al. where the conclusion is that psychosocial disability factors are linked to employee's injuries, injuries that influence the onset of low back pain (Robert Gatchel, 1995).

Karp J, et al. in their paper present the need of testing with specific tests for each patient with low back pain, given that the early link based on records must be placed in daily routine of application of these anxiety tests (Jordan F Karp, 2016). The same information is shown in our results where anxiety was present in patients with low back pain, the level of pain was visibly higher in the end of physiotherapy treatment, in addition to those whose level of anxiety was normal, the level of pain was much lower in the end of physiotherapy treatment for this pathology.

(Silje Endresen Reme, 2011) reached the conclusion that 31% of the population that have low back pain complaints fulfill the criteria that they had at least once a psychological disorder during the diagnostic examination. Whereas our results show that only 44,4% (according to TAI testing for anxiety) give the normal condition results, while 46.0 % as anxiety level and 9.5% as high level of anxiety. Thatjana O'Trocoli et al presents similar results to ours, out of all examined patients 41.5 % present condition without anxiety (normal), 24.6% present level of anxiety and differently from us they present the information that 33.9% present with high level of anxiety (Thatjana O'Trocoli, 2015). In their paper Gerrits Marloes et al. prove that patients with chronic pain are more prone to depression and anxiety problems (Marloes Gerrits, 2012). Aoife O'Donovan et al. in their paper present the effect of anxiety on inflammatory process and

reach the conclusion that the anxiety influences inflammatory activity and envisages the pathway through which anxiety increases the risk for inflammatory diseases (Aoife O Donovan, 2010), where acute low back pain is associated with inflammation of the surrounding tissue.

On the other hand, Kristina Janzen et al. in their paper cannot prove the influence of anxiety on low back pain, so they present that anxiety does not have any influence on low back pain (Kristina Janzen, 2016).

We have proven that the patients that have normal level of anxiety (NORMAL) show statistically lower values of pain intensity in comparison to the patients that have anxiety or high level of anxiety. Also, the interviewees with anxiety show lower statistical values of pain intensity in comparison to the interviewees that have high level of anxiety.

The rehabilitation process was easier in the patients with the level of anxiety, during their testing, with normal values, in addition to those with increased level of anxiety. Our main hypothesis is proven in our results that anxiety influences the rehabilitation of patients with low back pain.

Mareike R. in his research comes to a conclusion that psychological aspect of terminating employment contracts due to stress, presents high risk of developing the diseases and influences health (Mareike Reimann, 2017).

Conclusion

Anxiety influences the rehabilitation of low back pain, the patients who suffer from low back pain and have psychological problems such as anxiety, their level of pain prior and following the physiotherapy treatment remains without significant difference.

The patients who had positive signs of anxiety disorder, the level of pain description was much higher in comparison to other patients even following the treatment for relieving the pain.

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EYE INJURIES IN SPORTS

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(Original scientific paper)

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Abstract

Nowadays participation in sports and recreational activities is an important part of healthy, physical and active lifestyle. Sports have become increasingly popular and account for numerous eye injuries each year. Sports are classified as high risk, moderate risk, low risk and eye safe. Most of sports-related eye injuries are preventable. The use of eye protection has helped to reduce the number and severity of eye injuries. The American Society for Testing and Materials has established performance standards for selected eyewear. Also education for recognition of the risks of eye injury playing sports of athletes, coaches, trainers and parents can help in prevention of this type of injuries.

Keywords: *eye injuries, sports, eye protection*

Introduction

The eye injuries have extraordinary meaning, because it is a matter of a single organ, whose parts and specific construction are fitting for the eyesight function. Despite the fact that only 0,27% of the total human body surface and 4% of the face area are contributed to the eyes, they represent the third most affected organ by injuries, after hands and feet (Nordber, 2000, Omolase et al., 2011).

With the increase of popularity of sports and the tendency for a healthy way of life throughout the world, the importance of eye traumatism is also increasing. In different countries of the world, especially the developed ones, one of the leading places are occupied by eye injuries caused by different types of sports (Hoskin et al., 2016).

Every year more than 600,000 people suffer eye injuries while participating in sports or recreational activities, out of which roughly 13,500 result in permanent loss of sight (Mishra and Verma, 2012). Thirty percent of eye injuries, among children younger than 16 years, are sports related (Rodriguez et al., 2003).

The prevalence of specific sport activities varies depending on the country, that is, depends on the customs and culture of the country's citizens (Moon et al., 2016). Football, basketball, cricket, boxing, racquet sports and full contact martial arts are very popular and thus most commonly associated with eye injuries (Kim et al., 2011, Leivo et al., 2015).

Tennis, golf, basketball and various other sports can lead to major eye damage, reduction of visual acuity and sometimes even lead to blindness.

Numerous publications have reported that the type of sport in which the most frequent and severe injuries occur is not the same with different populations and nationalities (Goldstein, 2011, Nemet et al., 2016). In the study MacEwen and McLatchie (2010) have concluded that a small number of sports, such as soccer, rugby, hockey and the racquet sports are responsible for the most occurred injuries. Baseball and basketball have been implicated in most sports eye injuries in the United States, soccer in Portugal, Norway and Israel and soccer or racquet sports in Britain (Capão Filipe et al., 2003). The results, presented in the study of Bar et al. (2000), suggest that football was the single most common sport associated with ocular trauma being responsible for 32,5% of cases. In the United States for an example, the most common eye-injured-causing sports are baseball and softball, racquetball, soccer (European football) and American football (Cass, 2012).

Sports classification

American Academy of Pediatrics (AAP) and American Academy of Ophthalmology (AAO) have developed a classification of sports according to the risk of eye injuries (table 1) (Vinger, 2000).

Table 1. Classification of Sports According to the Risk of Eye Injuries, if Protective Means are not Used

High Risk	Moderate Risk	Low Risk	Eye Safe
Small, fast projectiles	Tennis	Swimming	Track and field
Air rifle	Badminton	Diving	Gymnastics
BB gun	Soccer	Skiing (snow and water)	
Paintball	Volleyball	Noncontact martial arts	
Hard projectiles, close contact	Water polo	Wrestling	
Basketball	Football	Bicycling	
Baseball/softball	Fishing		
Cricket	Golf		
Lacrosse			
Hockey (field and ice)			
Squash			
Racquetball			
Fencing			
Intentional Injury			
Boxing			
Full contact martial arts			

Eye injury risk in sports

Before playing any given sport, the athlete must know the risks of that sport. Loss of sight, even in one eye, involves changes in lifestyle for the individual and serious financial and social consequences both for the individuals and for the society as a whole (International Federation of Sports Medicine -FIMS, 1989).

Eye examination should play an important part in the screening physical examination for every athlete prior to sports participation. The athlete deserves a careful explanation of the risk of eye injury, both with and without various types of eye protectors in the proposed sport. For each athlete, physicians should obtain an ocular history, paying special attention to prior conditions such as a high degree of myopia, retinal detachment, eye surgery and injury or infection. Athletes with any of these conditions may be at a higher risk for serious eye injury (Jeffers, 1990). It is important to assess athletes who have a strong family history of retinal detachment, retinal tears and diabetic retinopathy (Locke et al., 1997). Athletes with such risk factors should be evaluated by an eye care professional before engaging in any high risk or very high risk sport (Christensen, 1997).

The one-eyed athletes should be checked by an ophthalmologist before participating in any sport.

One-eyed athletes should never participate in a very high risk sports such as boxing, wrestling and full-contact martial arts, because there is no adequate eye protection available for these types of sports.

Other risk factors

Beginners are more prone to injuries in comparison to intermediate or advance players because beginners still have not learned or refined the necessary skills to master the sport. On the other hand, highly qualified athletes play faster, play with greater aggressiveness and therefore may be at greater risk of sustaining a serious injuries of the eye.

Basic mechanisms for the occurrence of eye trauma

The basic mechanisms for the occurrence of eye injury during participation in sports are the following:

- The eye can be injured by something sharp – the most common causes are fragments from personal glasses (Herzum et al., 2001), which are not protective glasses designed for sports and are the most probable reason for occurrence of perforative injury,
- An impact from a blunt object, smaller than the opening of the orbit – golf ball, hockey stick, ping-pong ball, golf stick (Jayasundera, 2003), which can even lead to a rupture of the eyeball due to high energy impact on a small area, with a possibly harmful functional result,
- An impact from a blunt object, bigger than the opening of the orbit, such as tennis ball, elbow etc. In the course of impact, a part of the energy is transferred to the soft tissue, bones or the orbit floor, which can become fractured,
- An impact to the skull can be a cause for direct or indirect trauma of the eyeball or sight pathways

with transient or permanent loss of sight. The frontal bone is very sturdy and resistant to blows, three times more in comparison to the zygomatic bone and mandibula. These injuries usually occur during sports such as football (Leivo et al., 2015) and hockey.

In the course of baseball and golf (Jayasundera et al., 2003, Mishra et al., 2014), the density and velocity of the ball can become a reason for severe orbital, ocular or facial trauma (Zagelbaum et al., 1994). The situation is also similar in tennis, where the ball moves at a very high speed, which is why, in some cases, the protective glasses cannot protect the eye.

The most common eye injuries in sports involve closed globe, open globe and radiation injuries.

Closed globe injuries account for most sports related eye injuries. According to Napier et al. (1996), the sport-related eye injuries, although frequent in occurrence, they are rarely serious injuries. In large number of cases, it is related to corneal erosions, lighter contusions and hyphemas. In rare cases, with closed globe injuries, serious results can occur, such as vitreous hemorrhage and retinal ablation, traumatic macular hole or traumatic optic neuropathy (TON) which refers to an acute injury of the optic nerve secondary to trauma.

Open globe injuries are relatively uncommon. This type of injuries are very serious, must be treated quickly because they can lead to total loss of vision and blindness.

Radiation eye injuries occur as a result of prolonged exposure to ultraviolet rays of the sun in snow skiing, water skiing and other water sports.

Eye protection

Up to 90% of sports related eye injuries are preventable by using adequate eye protection equipment (Mishra and Verma, 2012, FIMS, 1989). Eye protection has reduced the number and severity of eye injuries and it is strongly recommended that protective eyewear be worn by all participants in sports which have a risk of eye injury. Athletes should be educated by team physicians about proper eye and facial protection and encouraged to use protective devices.

The American Society for Testing and Materials (ASTM, 2003) has established performance standards for selected eyewear. Each sport has a certain type of recommended protective eyewear, as determined by the ASTM (2003). Protective eyewear is made of polycarbonate, a highly impact-resistant plastic which is now easily available as prescription and non-prescription eyewear and all players should be encouraged to use them (FIMS, 1989). Protective eyewear should also sit comfortably on the face. Poorly fitted equipment may be uncomfortable, and may not offer the best eye protection.

Wearing a helmet or faceguard cannot protect the eyes, because the eyes are still exposed to the opponents fingers or other sport equipment. The face mask may consist of metal wire, coated wire or a transparent polycarbonated shields.

Face masks attached to a helmet should be used in sports such as hockey, football, baseball and lacrosse. In these sports, athletes must wear eye protectors under the face mask.

Athletes who are functionally one-eyed must have their status diagnosed and wear appropriate eye protection. If a one-eyed person decides to participate in a particular sport, then they should wear maximum protection for all trainings and competitions.

Conclusion

Sports and recreational activities have become increasingly popular and an important part of healthy, physical and active lifestyle.

Eye injuries in sports can cause severe and permanent visual loss. Because up to 90% of sports related eye injuries are preventable. All participants in sport activities must wear adequate eye protection equipment.

Education for recognition of the risks of eye injury, while playing sports, for athletes, coaches, trainers and parents, can also help in prevention of this type of injury.

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SAGITAL PLANE POOR POSTURE AMONG SEVEN – YEAR - OLD CHILDREN

UDC: 616.711-007.5-053.4

(Original scientific paper)

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Abstract

In preschool children ages postural disorders and spinal deformities are among the most common diseases. Without timely detection, poor posture in preschool and school children may cause extremely serious health problems in adulthood. In order to determine the “real picture” of sagittal plane poor posture among preschool children a research was realized on a sample of 68 children aged 7. In order to evaluate the state of the postural status of the spinal column in sagittal plane, the device “Spinal Mouse” (IDIAG, Fehraltdorf, Switzerland) was used. Based on the results, in sagittal plane 39.13% boys and 17.39% girls have thoracic spine bad posture, 30.43% boys and 17.39% girls have lumbar spine bad posture and 17.39% boys and 2.87% girls have inclination bad posture. Also, multivariate statistical analysis found that between the observed subsamples, there is a statistically significant difference of all examined characteristics of the postural status in relation to gender at the level Wilks` Lambda 0.595, $F = 6.927$, $p = 0.000$.

Key Words: *postural disorders, seven-year-olds, poor posture*

Introduction

The postural alignment starts its development of the spine and its curvature in the early period of life. Physical development is correlated with their physical growth regime. Children build their posture by development of movements and by muscles growth. When the body is in correct balance, all its parts, including the internal organs, are held in good position and function normally (Markovska, 2012).

Poor posture is a position resulting from any deviation from ideally aligned erect posture (Shimaa, 2012). Poor posture may cause one or several of the following dysfunctions:

1. Defects in bones, joints, muscles;
2. Bad habits: either from early childhood or from occupational positions;
3. Pain, fatigue or bad psychological state;
4. Secondary deformities and compensatory postural defects.

Bad posture puts strain on your body. Bad posture can limit range of movements, cause headaches, muscle aches and joint aches, affect circulation and breathing, and even inhibit your inner organs functioning optimally (Gibson, 2013).

In the preschool and early school age the functional disorders of posture are most common, while the adolescent age is characterized by the occurrence of the structural deformities of the spine (Živković, 2000; Demeši, 2007; Bogdanović, 2008; Bogdanović and Milenković, 2008; Beganović and Bešović, 2012). The posture of boys and girls in preschool and lower primary school period is characterized by head protrusion, bent shoulders, winged scapula, anterior pelvic tilt, which is often accompanied by pronounced lumbar lordosis and abdomen protrusion. Given the fact that the attention of experts and scientists is increasingly occupied by children obesity, poor posture and lack of physical activity, there is an intense need for monitoring obesity and improving postural status among children (Burdyukova et al., 2012). Therefore, identifying, defining and monitoring postural status is of utmost importance for lifelong normal body functioning, as well as for the establishment of predispositions for good health of an individual.

Precisely, because of the above, the primary goal of this research is to define postural status in the sagittal plane among 7 year old children in Belgrade.

Material & methods

Subjects

The total sample consisted of 68 children aged 7, of which 46 were boys and 22 were girls. All subjects were attendees of children's sports school in the City of Belgrade.

Measurement procedure

The most objective method for evaluating the postural status is the X-ray scan, but it is not recommended for mass testing purposes, especially in early childhood (particularly for its potential harm to the organism). That is why alternative tests and techniques were used. In order to evaluate the state of the postural status of the spinal column in the sagittal and frontal plane, we used the "Spinal Mouse" (IDIAG, Fehrltdorf, Switzerland, www.idiag.ch) measuring instrument. It is a non-invasive method of measuring postural status, along with the use of the appropriate software. The validity and reliability of this instrument was evaluated in the research of (Bedogni et al., 2013; Milenkovic et al., 2011; Bubanj et al., 2012; Topalidou et al., 2014). This method of determining the state of the postural status of the spinal column was already used in studies carried out on the population of preschool and school age children (Jorgić et al., 2015; Bubanj et al., 2012; Bubanj et al., 2010; Milenkovic et al., 2011, Bićanin et al., 2017).

The sample of variables

To assess the characteristics of postural status in the sagittal plane we used the following variables:

- The degree of curve in the thoracic region of the spinal column - Thoracic spine, expressed in degrees
 - Reduced value of the curve – TSHipo
 - Increased value of the curve – TSHiper
 - Normal value of the curve – TSNormal
- The degree of curve in the lumbar region of the spine - Lumbar spine, expressed in degrees
 - Reduced value of the curve – LSHipo
 - Increased value of the curve – LSHiper
 - Normal value of the curve – LSNormal
- The inclination of the spine column - Incl., expressed in degrees
 - Normal value – IncNormal
 - Increased value – IncOver
 - Markedly increased value – IncHiper

Statistical analysis

In the data processing, basic descriptive statistics were used that establish the measures of central tendency (mean) and of variability (standard deviation, range, maximum and minimum scores). The data about level, frequency and structure of postural disorders were processed through basic statistical analysis. The research results are shown in tables, expressed in numbers and percentages. In order to determine the differences in arithmetic means according to gender Multivariate Analysis of Variance (MANOVA method) were used. All statistical methods were implemented using software package SPSS for Windows Release 20.0 (Copyright © SPSS Inc., 1989-2011).

Results

The results of descriptive statistics are shown in Table 1.

Multivariate statistical analysis found that between the subsamples observed there is a statistically significant difference of all examined characteristics of the postural status in relation to gender at the level Wilks' Lambda 0.595, $F = 6.927$, $p = 0.000$.

Furthermore, it was found that there are statistically significant differences for the following examined subspaces compared to the observed subsamples in relation to gender (the results are shown in Table 2).

Discussion

The percent of postural disorders in seven year olds in Belgrade is very high. Based on the results we can conclude that in sagittal plane almost 40% of boys have kyphotic poor posture; more than 30% of boys have lordotic poor posture; and almost 20% of boys have inclination bad posture. Based on the results, it can be concluded that poor posture is more common among boys than girls (Table 1, 2, Figure 1). The results showed that almost 20% of girls have thoracic and lumbar spine bad posture, and almost 3% of girls have inclination bad posture.

Table 1. The results of the sagittal plane measurements descriptive statistics

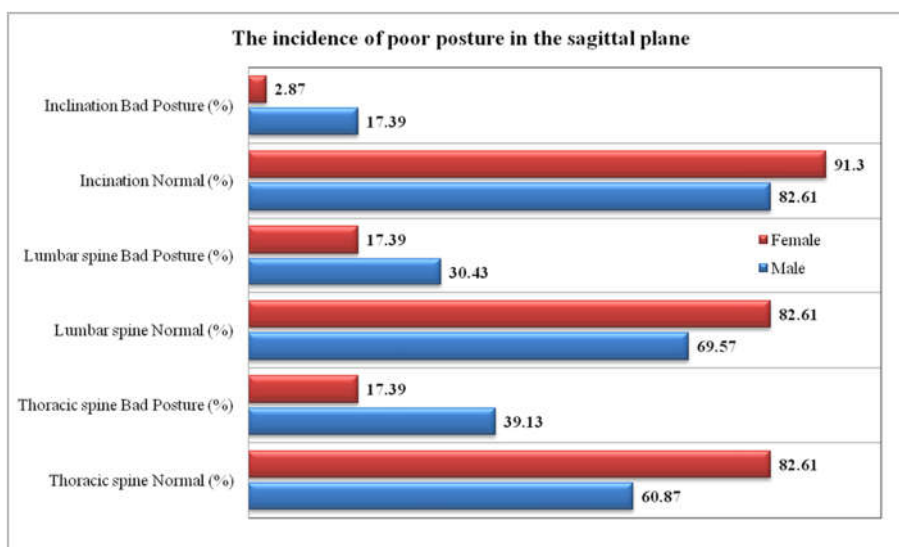
	Male	Female
Thoracic spine Mean±SD	36.26±9.74	28.87±7.47
Thoracic spine Cv%	26.87	26.87
Thoracic spine Min-Max	14–58	14–41
Normal value of the thoracic curve (absolute / percentage value)	28/60.87	19/82.61
Reduced value of the thoracic curve (absolute / percentage value)	1/2.17	3/13.04
Increased value of the thoracic curve (absolute / percentage value)	17/36.96	1/4.35
Lumbar spine Mean±SD	27.13±8.32	33.09±7.92
Lumbar spine Cv %	30.68	30.68
Lumbar spine Min-Max	10–45	18–51
Normal value of the lumbar curve (absolute / percentage values)	32/69.57	19/82.61
Reduced value of the lumbar curve (absolute / percentage value)	8/17.39	1/4.35
Increased value of the lumbar curve (absolute / percentage value)	6/13.04	3/13.04
Inclination Mean±SD	2.8±2.19	1.87±1.69
Inclination Cv %	77.99	77.99
Inclination Min-Max	0–10	0–6
Normal value of the inclination (absolute / percentage value)	38/82.61	21/91.3
Increased value of the inclination (absolute / percentage value)	8/17.39	2/8.7
Markedly increased value of the inclination (absolute / percentage value)	0/0	0/0

Mean ± SD - mean value and standard deviation, cV% - coefficient of variation, Min-Max - minimum and maximum values

Table 2. The differences in the examined characteristics of the postural status in relation to gender

	F value	Significant
Thoracic curve in the sagittal plane	11.230	0.001
Lumbar curve in the sagittal plane	7.531	0.008

Figure 1. The incidence of poor posture in the sagittal plane (% percentage values)



The greatest differences between genders were determined in the thoracic region of the spine (a difference of 21.74%, statistically significant at the level of $F = 11.230$, $p = 0.001$) (Table 1, 2 and Figure 1).

Research on physical deformities in children of preschool age have not often been the subject of interest of researchers, thus a more comprehensive comparative analysis with the results of this research is limited. The results of the available studies are somewhat different, although still largely similar. The postural disorders incidence and their frequency percentage in preschool children significantly varies with different

authors, and it depends on samples, age, environment, methodology of disorder detection etc. The research results of Živković and Milenković (1995) on a sample of children who attended kindergarten in the municipality of Niš show that there are incipient forms of deformity on: spine in 52%, chest in 24%, feet in 61% and that there is observed obesity in 61%, and malnutrition in 9% of children. Research (Tot 2001; Sabo, 2003) on the postural status of preschool children in Novi Sad shows that there are minor deviations in the posture of the head in 27.9%, shoulders in 51.8%, scapulae in 45.6%, abdomen in 54.3%, legs in 24.9% and feet in 39.8% of children. The boys had a better posture of the head and abdomen and the girls better foot instep.

Research Jorgić et al. (2015) shows that in the preschool age and young school age groups, there is more than 50% or more precisely 52.2% of children with a postural disorder of the spinal column in the sagittal plane. Postural disorders of the sagittal plane were also determined for the children of preschool age in the study of Romanov and associates (2014), in as many as 45.86% of children. Contrary to the current study, Simov, Minić, & Stojanović (2011) determined that, based on their analysis of a sample of 968 preschool children, only 10.3% of the children had postural disorders. In the case of distribution in relation to gender, among the boys, there were evidence of a greater frequency of lordotic posture, while among the girls, kyphotic posture was more pronounced. These results partly match those of Romanov et al. (2014). These authors also determined more extensive lordotic postures among boys.

Results from longitudinal investigation Basarić et al. (2006) indicate that every third child at East Serbia has bad spine posture before 1st grade of elementary school. They also noticed that the postural disorders have a growing trend and suggesting establishing active influence of physical activity with aim to create balanced musculoskeletal system, which would be preventive action to avoid structural deformities in later period of life.

Conclusions

The results from our investigation show that the postural status among the preschool children in Belgrade is more harmful than expected. The general conclusion is that sagittal plane poor posture is present in all segments of the spinal column. This situation suggests a more serious approach from all responsible subjects at all levels of society. Postural deformities are not a common subject of interest among the researches, especially in preschool children. Only in the last couple of years a higher interest in this field has appeared, and was inspired by the increasing level of this phenomenon. What is positive is the fact that over the last year, more and more researches examine these problems on regional bases, which gives a more reliable and a more complete insight into the real situation. The results of this study can be compared with results of other researches in this field.

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DOPING ATTITUDES AND DOPING BEHAVIOR IN MACEDONIAN PROFESSIONAL WRESTLER

UDC: 796.81.011.5:178(497.7)

(Original scientific paper)

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Abstract

The idea that sport should provide children and adolescents with an unwavering moral compass is commonly held, and is mirrored in the extensive list of personal and social benefits attributed to sport involvement. Numerous studies have reported that an athlete's drug use in sport could be credited to a complex interaction of personal and environmental circumstances. Possible contributing environmental factors include attitudes of peer groups, parents, coaches, accessibility to drugs, and cultural norms and values. The main goal of the research was to determine whether there are differences in doping attitudes and doping behavior among wrestlers who compete in junior and senior rank. The survey was conducted on a sample of 48 examinees between the age of 15 to 34 from the Republic of Macedonia. The sample is divided into two subpopulations in terms of age, that is 26 respondents aged 15 to 18 years and 22 respondents aged 19 to 34 years. To determine the differences in doping attitudes and doping behavior, T-tests for small independent samples were applied between the two groups of examinees. The results of the study suggest that wrestlers over 18 years of age are more prone to use doping, and have more experience or are currently using unauthorized stimulants to improve their physical performance, rather than the wrestlers from 15 to 18 years of age.

Key words: *Doping Attitude, Doping Behavior*

Introduction

The idea that sport should provide children and adolescents with an unwavering moral compass is commonly held, and is mirrored in the extensive list of personal and social benefits attributed to sport involvement (White et al., 1998). Due to the fact that success in sport is typically coupled with fame and financial rewards, the use of banned performance enhancing drugs (PEDs) to gain a competitive edge is tempting. According to the International Olympic Committee's (IOC's) official statistics, annually 1–2% of all doping tests are found positive for illegal PED use (Mottram, 2005). It is possible that the real prevalence of doping among athletes is considerably higher (Bents et al., 2004; Laure, 1997; Mottram, 2005; Scarpino et al., 1990; Yesalis, & Bahrke, 1995). Use of PEDs is not just limited to adult athletes, but also includes adolescents. In 2006, the New Jersey Interscholastic Athletic Association was the first state to enact random drug testing of high school athletes. More recently, the University Interscholastic League (UIL) within the state of Texas, spent nearly \$6 million for its high school athlete steroids testing program, the most comprehensive in the nation. Athletes utilizing unhealthy doping habits at this crucial age may experience more negative health effects, and athletes starting the doping process at a younger age may use the substances for longer periods of time raising the potential for negative health consequences (Judge et al., 2010). Most children and adolescents are involved in athletics for fun, skill development, fitness, and to build positive relationships (Chambers, 1991). These positive outcomes may not occur in outcome-oriented situations; however, sport participation may lead to problematic results such as doping. Studies concerning children and adolescents report a doping prevalence between 3% and 5% (Laure, 1997). Irving et al. (2002) reported higher percentages of use of PED among young males as compared to females. Wroble, Gray, and Rodrigo (Wroble et al., 2002) conducted a survey of 1553 pre-adolescent (10–14-year-old) athletes from 34 states and found a much lower anabolic steroid (AS) usage percentage among 10–14

year olds (0.9% male and 0.2% female). In an investigation by Stigler and Yesalis (1999) that surveyed 873 Indiana high school football players, 6.3% admitted to using AS. Among adult athletes, in self-reported-use studies, doping prevalence has been estimated to be 5–15% (Laure, 1997).

Numerous studies have reported that an athlete's drug use in sport could be credited to a complex interaction of personal and environmental factors (Dodge & Jaccard, 2007; Nicholson & Agnew, 1989; Tricker et al., 1989). Possible contributing environmental factors include attitudes of peer groups, parents, coaches, accessibility to drugs, and cultural norms and values (Polich et al., 1984; Tricker & Connolly, 1997). Participants in Diacin, Parks & Allison (2003) study supported athlete drug testing and identified factors that influenced their perceptions of the use of performance-enhancing substances. Their data showed that female athletes were more supportive of testing programs than males, testing by schools and the NCAA was supported but conference-wide testing programs were not, and finally that in general the athletes questioned were indifferent to drug testing (Diacin, Parks & Allison 2003). It seems that researchers are unanimous with undesirability of doping in sport. It must be clarified that the reason behind doping prohibition was initially concerned for the enhancement of the athlete's health (Todd & Todd, 2001). Doping emerged as an unethical matter afterwards (Petróczi, 2007). Although gender, cultural and competitive level differences among athletes have been scrutinized since the late '80s (Gill, 1988; Gill et al., 1991) the relationship between these factors and doping behavior has not been empirically tested, except in one project.

The main purpose of the research was to determine whether there are differences in doping attitudes and doping behavior between wrestlers who compete in junior and senior rank.

Materials and Methods

Participants

The survey was conducted on a sample of 48 examinees among the age of 15 to 34 from the Republic of Macedonia. The sample is divided into two subpopulations in terms of age, 26 examinees aged 15 to 18 and 22 examinees aged 19 to 34 years. The sample was extracted from several martial clubs in the Republic of Macedonia.

Measures

Doping Use Belief measures: The DUB were operationally defined as expressions of presumed opinion regarding doping use, namely whether doping should be allowed for top and all level athletes (2 separate questions). Participants were asked to select one of the three answers: 'yes, without restrictions', 'yes, with restrictions' and 'absolutely not'. The Doping behavior latent variable was defined by two self-reported measures of doping behavior: current use of and past experience with performance enhancing substances. The internal consistency coefficients for both variables were reported 0.94 (Petróczi, 2007). In the present study, the observed internal consistencies of the DUB were: Doping behavior ($\alpha = 0.713$) and Doping belief ($\alpha = 0.734$).

Methods

Descriptive statistics were used for describing and categorizing raw data and for measuring Mean, frequency, SD and table drawing. Independent (T) test was used for measuring attitude difference between groups. The SPSS software was applied for the analysis of the data and a 95% of confidence level was considered.

Results and Discussion

The survey was conducted on a sample of 48 examinees dealing with the aging of 15 to 34 years old from the Republic of Macedonia. The sample is divided into two subpopulations in terms of age, 26 examinees aged 15 to 18, with an average age of 16.04 (± 1.31) year, wrestling time of 4.8 years and 59 average number of battles. And 22 respondents aged 19 to 34 years, with an average age of 23.54 (± 1.31) year, average wrestling time of 11 years and 151 average number of battles. From the overview of Table 1 it can be seen that 7.7% of wrestlers aged 15 to 18 years answered yes on the first question: "Do you believe that performance enhancing drugs/methods should be allowed for top level athletes", without restrictions, 30.8% answered yes, but "with restrictions", 61.5% answered absolutely not. The second question: "Do you believe that performance enhancing drugs/methods should be allowed for all athletes", 23.1% answered yes, without restrictions, 26.9% answered yes, but with restrictions and 50.0% answered absolutely not.

Table 1. Describing the Doping Believe queries in wrestlers up to 15 to 18 years old

<i>Queries</i>	Yes, without restrictions	Yes, but with restrictions	Absolutely not	Mean	SD
Do you believe that performance enhancing drugs/methods should be allowed for top level athletes	2 7.7%	8 30.8%	16 61.5%	1.09	0.53
Do you believe that performance enhancing drugs/methods should be allowed for all athletes?	6 23.1%	7 26.9%	13 50.0%	0.95	0.79

From the overview of Table 2 it can be seen that wrestlers aged 15 to 18 years old on the first question „Have you ever had personal experience with banned performance-enhancing drugs and/or methods?“ 19.2% answered yes, without restrictions, 0.0% answered yes, but with restrictions, 76.9% answered absolutely not and 3.8% answered I do not wish to answer. The second question “Do you currently use banned performance enhancing drugs?“ 7.7% answered yes, without restrictions, 11.5% answered yes, but with restrictions, 76.9% answered absolutely not and 3.8% answered I do not wish to answer.

Table 2. Describing the Doping Behavior queries in wrestlers up to 15 to 18 years old

<i>Queries</i>	Yes, without restrictions	Yes, but with restrictions	Absolutely not	I do not wish to answer	Mean	SD
Have you ever had personal experience with banned performance-enhancing drugs and/or methods?	5 19.2%	0 0.0%	20 76.9%	1 3.8%	1.32	1.25
Do you currently use banned performance enhancing drugs?	2 7.7%	3 11.5%	20 76.9%	1 3.8%	1.00	1.27

From the overview of Table 3 it can be seen that wrestlers over 18 years of age on the first question “Do you believe that performance enhancing drugs/methods should be allowed for top level athletes?“ 18.2% answered yes, without restrictions, 72.7% answered yes, but with restrictions and 9.1% answered absolutely not. The second question “Do you believe that performance enhancing drugs/methods should be allowed for all athletes?“ 27.3% answered yes, without restrictions, 40.9% answered yes, but with restrictions and 31.8% answered absolutely not.

Table 3. Describing the Doping Believe queries in wrestlers older than 18 years old

<i>Queries</i>	Yes, without restrictions	Yes, but with restrictions	Absolutely not	Mean	SD
Do you believe that performance enhancing drugs/methods should be allowed for top level athletes	4 18.2%	16 72.7%	2 9.1%	0.46	0.65
Do you believe that performance enhancing drugs/methods should be allowed for all athletes?	6 27.3%	9 40.9%	7 31.8%	0.73	0.83

From the overview of Table 4 it can be seen that wrestlers over 18 years of age on the first question “Have you ever had personal experience with banned performance-enhancing drugs and/or methods?“ 22.7% answered yes, without restrictions, 27.3% answered yes, but with restrictions, 40.9% answered absolutely not and 9.1% answered I do not wish to answer. The second question “Do you currently use banned performanceenhancing drugs?“ 22.7% answered yes, without restrictions, 9.1% answered yes, but with restrictions, 54.5% answered absolutely not and 13.6% answered I do not wish to answer.

Table 4. Describing the Doping Behavior queries in wrestlers older than 18 years old

<i>Queries</i>	Yes, without restrictions	Yes, but with restrictions	Absolutely not	I do not wish to answer	Mean	SD
Have you ever had personal experience with banned performance-enhancing drugs and/or methods?	5 22.7%	6 27.3%	9 40.9%	2 9.1%	0.62	1.20
Do you currently use banned performanceenhancing drugs?	5 22.7%	2 9.1%	12 54.5%	3 13.6%	0.50	0.99

In order to determine whether there are differences in belief in doping and its use among wrestlers aged 15 to 18 years and over 18 years, T-tests for small independent samples have been reported. The results of the analysis are shown in Table 5. From the analysis of the results it can be seen that there are statistically significant differences in the three variables. From the values of the arithmetic environments and the level of statistical significance, it can be concluded that wrestlers over 18 years more believe in the use of doping and have more experience, or at the moment use the unauthorized stimulus to suppress their physical performance.

Table 5. Differences in doping attitudes and doping behavior wrestlers who compete in junior and senior rank

Variables	From 15 to 18		Over 18 years		T-test	df	sig
	Mean	SD	Mean	SD			
Doping Believe	0.83	0.92	1.57	0.79	2.97	46.00	0.01
Doping Behavior	0.56	0.80	1.16	1.16	2.11	46.00	0.04

In adult athletes, research in self-certification found that the prevalence of doping ranges from 5-15%. A number of studies suggest that the use of doping in sports is conditioned by the interaction of personality and the influence of factors from the environment surrounding the athlete. From everything that has been stated, there is an unequivocal conclusion that doping and sports (where sport is a noble activity that is focused on building the body and spirit) are completely incompetent. The results of our research are different with the results obtained in the research Tsorbatzoudis, et al. (2009) and Atkinson (2011) who found that there were no statistically significant differences in attitudes towards performance enhancing drugs (PEDs) in athletes who compete in different ranks. On the other hand, from the research of Breivik, Hanstad and Loland (2009) Smitha et al. (2010), unlike the research of Atkinson (2011), it can be concluded that the level of competing can predict the changes of research variables (Doping Behavior) in elite martial artists. Calfee, Fadale (2006) suggested that in recent years, researches indicate that younger athletes are increasingly experimenting with these drugs to improve both appearance and athletic abilities, which is confirmed in this research.

Therefore, an anti-doping program is needed, which should aim at preservation and promotion of the sport spirit. What prevents the full doping from doping from the sport is the pressure that the business community is doing, that is, the fact that sports becomes one only in the product range, a product that generates high profits, and for that reason is the subject of a ruthless struggle.

Anti-doping can be seen as a philosophy, as a lifestyle that is aimed at protecting the basic rights of athletes to participate in non-doping sports activity, thus promoting health, fair play, respecting other participants as well as their own body and spirit.

Anti-doping can also be seen as a program consisting of several steps: A promotion aimed at prevention; Adoption of rules of conduct; Adoption of a list of prohibited methods and substances; Manner of conducting control; Taking measures and implementing sanctions against violators; Ensuring fair conditions for athletes who are controlled; Coordination and cooperation, as well as other necessary measures and steps.

The anti-doping should be seen as a complex process, such as philosophy, that is, a lifestyle and program, or a set of rules that enable that lifestyle to be carried out in a work, that is, to become a reality.

Antidoping as a phenomenon is based on the idea of Olympism, depending on the idea that it does not matter if you have won, what matters here is how you fought. The anti-doping movement was created by

the proponents of the idea that the victory of the spirit above the body is the biggest victory that can be realized and at the same time is the goal of sporting, not vice versa. The purpose of sports is certainly the preservation of health, and the use of doping prevents the pursuit of a healthy life. In addition to this, the Anti-doping Agency presents a set of activities aimed at preserving the health of all participants in sports competitions.

Antidoping is not an end in itself, nor is it an "unexpected force that suddenly appears and solves the work." The sense of anti-doping is the return of values that are rejected. The question arises as to what is the return of the values that are lost and whether it is possible?

Perhaps the problem lies in one of the human qualities, and that is the constant tendency to win in the inability to satisfy the already accomplished.

Some theorists (some call them supporters of the general conspiracy theory) believe that the media are the stimulators of the use of doping, while the business has allowed to put a "point of and" when it comes to the given question (as an example one is stated one of the most common wrongly translated sentences, and the translation essentially forced the journalist *altius, citius, fortius* – which were most often translated „Faster, higher, stronger“, and it needs to be translated and much more correct „Faster, higher, braver!“ The brave do not need additional incentives, courage is something that a person has or does not have in himself, and which is shaped and directed through sports activity. When we take into consideration everything previously stated (regarding physiological predispositions for sport engagement) it can be concluded that the answer to the question: What is the significance of anti-doping movements and anti-doping rules? - is imposed by itself. Hence, the problem is not only that the individual deliberately inflicts damage on his own health, but that that lifestyle (in) is directly propagated as something normal, as one of the ways of achieving success. According to an unofficial survey conducted among young people aged 16 and 23, success is identified with money, and this is because the message that is communicated to them is by people like Florence Griffith, Joyner Lance Armstrong, or Mike Tyson... people who portray an image with a negative model. A particular problem is the fact that the messages that these people convey mostly affects people belonging to the poorer layers of society, thus making the problem even bigger and spread in other fields. In addition, the motto that monitors the use of unauthorized stimulants (substances and/or methods), which states "superiority or death", makes the modern sport more uncivilized and more and more approaches to gladiatorial struggles. We agree that economic laws support rational thinking: give people bread and games - if it is an economically viable investment, then the sport should be given a new dimension and the first doping league for athletes formed. Who knows, perhaps such an undertaking would have a counter-effect, and maybe this would lead to depopulation of this lifestyle.

Conclusion

Based on the results obtained, it can be concluded that a large percentage of athletes (both wrestlers), young and elderly, believe that banned stimulants that increase sports performance should be allowed for top athletes. Also, a large percentage of athletes said they had personal experience or are currently using stimulants. The results of the research further suggest that wrestlers older than 18 years believe in the use of doping and have greater experience or are currently using the invulnerable means to suppress their physical performance in relation to wrestlers from 15 to 18 years old. The results indirectly indicate that most athletes are against the use of doping, but are forced to use it. All of this suggests that since the earliest age athletes should start with anti-doping education, which should be directed towards prevention, adoption of rules of behavior and getting acquainted with prohibited methods and substances. Sports should be focused on health preservation, and the use of doping means impedes the pursuit of a healthy life.

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THE CONNECTION OF MENARCHE BETWEEN SPORTSWOMEN AND THEIR MOTHERS

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(Original scientific paper)

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Abstract

The aim of the research is to determine whether there is difference in the age at menarche between daughters and their mothers, whether there is difference in terms of discomfort which is related to training (before, during and after menstruation) and whether there is mitigation of the menstrual symptoms among sportswomen who train actively in comparison to the period when they did not train actively. The research has been carried out on sportswomen from the Judo Club "Pujanke" from Split, Croatia, at the age from 12 to 17 (+/- 6 months) and their biological mothers. Two anonymous closed type questionnaires were given to the respondents. The first questionnaire consisting of 19 questions was given to the sportswomen and the second one consisting of 18 questions was given to their mothers. The questionnaire which was given to the sportswomen included questions about their menarche and the symptoms, and questions about their physical activity. The questionnaire which was given to their mothers had instructions on how to answer the questions; the questions should be answered in two ways: for 'the past' and for 'today'. 'The past' refers to the period when the mothers were the same age as their daughters are today. The questionnaire includes questions about their menarche and the symptoms, and questions about their physical activity in the past and today. In the research, the ratio is calculated with χ^2 test for both samples, as well as their representation in terms of frequency for each question. From the results, we can conclude that the average age at menarche among sportswomen is 12, regarding their mothers, for almost half of them, the age at menarche is 12 and 14. 46.67% of the sportswomen do not experience painful menstruation, therefore 93.33% attend training during menstruation. Only a small percentage of the respondents wrote that the discomfort and the menstrual bleeding affected their competition results.

Key Words: *menarche, questionnaire, sportswomen, judo, χ^2 test*

Introduction

A large number of girls in the world are aware of the fact that the symptoms of the menstrual cycle vary individually. Some girls do not experience any kind of symptoms, whereas others suffer from strong premenstrual and menstrual symptoms. Moreover, the changes in training performance during the menstrual cycle can vary individually. The changes in training occurring in one month are considerable for a lot of girls, whereas for others, the changes are not noticeable. There are a lot of girls who win Olympic medals during menstruation but, on the other hand, there are girls who feel light discomfort in their bodies and they are incapable of reaching their own limits.

The research by Петрушевска Л., and Шукова Стојмановска Д. (2011) carried out on a sample of 264 students, from 4th to 8th grade, at the age from 10 to 14 (+/- 6 months), aiming at determination of the frequency, the characteristics and the positions regarding menarche among female students at the age from 10 to 14, resulted in the following conclusions: the age at menarche has moved to younger age, female students usually have regular and normal menstruation. In addition, the lack of information about their first menstruation has led to a situation where female students who are menstruating are inactive at Physical and Health Education classes despite the fact that they have regular and normal menstruation.

Premenstrual syndrome (PMS) is a cyclic phenomenon consisting of different kinds of discomfort which is usually experienced 5-10 days before menstruation. The symptoms and their intensity are different. The most common symptoms are: anxiety, irritability, enhanced psychological sensitiveness, crying, constant

hunger, bloating, tender breasts, craving for sweet food. Additionally, there are other symptoms which can occur often: acne, headache, pain in the throat, nausea, rash, pain in the lower part of the spine, stomachache etc. Premenstrual pain usually stops on the first day of the menstruation. During that period, sportswomen generally show lower level of motivation for training and their sleep might be restless which could lead to collecting more water in the body and therefore greater body weight as well as lower energy.

Hewett T.E., et al. (2005), tried to understand the reason for the bigger number of injuries among girls during menstruation and they came to the conclusion that their knees move differently during menstruation in comparison to their mobility during ovulation which is a result of bad muscles control during menstruation. Nevertheless, the authors believed that the neuromuscular control could become better with training and they managed to ease the weight on the knees and joints and to strengthen and improve the coordination on both sides of the female body. After the implemented procedures women experienced fewer knee injuries by 50 to 60%.

The research conducted by Adair L.S. (2001) in the Philippines, included several thousand girls who were followed from their birth to the age of 15. They analyzed their growth and development (weight, length and later, height), the age of the first menstruation, the socioeconomic conditions, the diet, the age at menarche of the mothers and their weight gain during pregnancy as well as their diet. The author came to the conclusion that the girls who lived in the cities in better socioeconomic conditions, in better-off families and those who had more educated mothers – had earlier age at menarche (12.1 on average, and between 12.4 and 13.9). It is interesting that this research showed that the weight at birth could affect the age at menarche of girls. So, the babies who were long (> 49cm), and thin (<3 kg) had menarche earlier than baby girls who were short (<49 cm) and thin (<3 kg). The effect of the birth weight of the girls on the age at menarche is even greater if we take into consideration the weight of the mother before giving birth. This means that the growth and development of the baby is determined intrauterine.

Material & methods

Participants

In this research the sample of respondents are the sportswomen from the Judo Club “Pujanke” from Split, Croatia, at the age from 12 to 17 (+/- 6 months) and their biological mothers. This sample of respondent is divided into two subsamples based on whether the sportswomen have had menarche or not. The first subsample consists of 15 sportswomen who have had menarche and their 15 mothers, while the other subsample consists of 5 sportswomen who have not had menarche and their 5 mothers.

Questionnaire

The questionnaire was conducted in the period from 22-30.11 2018. The mothers signed consent forms for the questionnaires for their daughters. Two anonymous closed type questionnaires were given to the respondents. The first questionnaire consisting of 19 questions was given to the sportswomen and the second one consisting of 18 questions was given to their mothers. The questionnaire which was given to the sportswomen included questions about their first menarche, the frequency and the symptoms their bodies experience before, during and after the menstrual cycle, as well as questions about their physical training, i.e. how many times a week they have training sessions, how long the training sessions last and if they feel any kind of symptoms or changes in their bodies before, during and after the menstrual cycle when they train and compete. It should be mentioned that sportswomen who had not had their first menstruation did not answer questions (2,3,4,5,6,7,13,14,15,16,17,18 and 19) about menstruation, they answered only questions about their training. The questionnaire which was given to their mothers had instructions on how to answer the questions; the questions should be answered in two ways: for ‘the past’ and for ‘today’. ‘The past’ refers to the period when the mothers were the same age as their daughters are today. The questionnaire includes questions about their menarche and the symptoms, and questions about their physical activity in the past and today. Further analysis will be carried out regarding the answers of the mother who menstruated when she was same age as her daughter is today.

Statistical analysis

The results of the anonymous questionnaire are calculated with the representation of frequency in percentage and χ^2 test for each question.

Purpose of the research

The aim of this research is to find out:

- if there is difference in the age at menarche between daughters and their mothers;
- if there is difference in the discomfort related to training (before, during and after menstruation)
- if there is mitigation of the menstrual symptoms among sportswomen who train actively in comparison to the period when they did not train actively.

Results

The results from the questionnaire calculated with the representation of frequency and χ^2 test are shown in two tables divided according to the defined subsamples, i.e. based on whether the respondents have had menarche or not. The data and the results of the respondents who have had menarche and their mothers are shown in Table 1 and the results of the respondents who have not had menarche and their mothers are shown in Table 2. In the discussion about the results we will pay more attention to the frequency of the answers.

Table 1. Questions and frequency of the answers from the anonymous questionnaire for the sportswomen who have had menarche and their mothers calculated with χ^2 test.

Questions Daughters who have had menarche	Possible answers	Number		Percentage (%)		χ^2 test	r
		daughters	mothers	daughters	mothers		
1. Do you menstruate?	yes	15	15	100	100	15	.00
	no	0	0	0	0		
	Total	15	15	100	100		
3. How many days does it last?	less than 3 days	0	0	0	0	19.6	.00
	from 3-7 days	13	12	86.67	80		
	more than 7 days	2	3	13.33	20		
	Total	15	15	100	100		
8. Are you an athlete? *8. Were you an athlete?	yes	15	7	100	46.67	10.91	.00
	no	0	8	0	53.33		
	Total	15	15	100	100		
10. How long have you been training? * 10. How long did you train?	3 years	2	1	13.33	6.67	16.87	.03
	4 years	3	2	20	13.33		
	5 years	2	0	13.33	0		
	6 years	3	1	20	6.67		
	7 years	2	1	13.33	6.67		
	8 years	3	0	20	0		
	9 years	0	1	0	6.67		
	10 years	0	1	0	6.67		
	I do not train	0	8	0	53.33		
Total	15	15	100	100			
12. How long does one training session last?	30 min to 1 hour	0	/	0	/	25.8	.00
	from 1 hour to 1h and 30min	3	/	20	/		
	1h and 30min to 2 hours	12	/	80	/		
	longer than 2 hours	0	/	0	/		
	Total	15	/	100	/		

*15. Do you exercise when you menstruate at present?	yes	/	9	/	60	13.53	.00
	no	/	5	/	33.3		
	I avoid exercising	/	0	/	/		
	no answer	/	1	/	6.67		
	Total	/	15	/	100		
* 17. Presently, do you feel any discomfort when you exercise/do recreational activities?	yes	/	2	/	13.33	10.8	.00
	no	/	11	/	73.33		
	no answer	/	2	/	13.33		
	Total	/	15	/	100		
15. How can you describe the discomfort when you menstruate and train actively in comparison to the discomfort when you menstruate but do not train actively for whatever reason (when you are not active in the training program, due to illness, injury...)?	worse	1	/	6.67	/	10	.04
	the same	6	/	40	/		
	better	1	/	6.67	/		
	reduced	1	/	6.67	/		
	no discomfort	6	/	40	/		
	other	0	/	0	/		
Total	15	/	100	/			
16. How can you describe the discomfort when you menstruate and participate in a competition in comparison to the discomfort when you menstruate and you are in training sessions?	worse	3	/	20	/	12	.02
	the same	6	/	40	/		
	better	0	/	0	/		
	reduced	0	/	0	/		
	no discomfort	6	/	40	/		
	Total	15	/	100	/		
17. What are your results at competitions during the days when you bleed (especially the first days of menstruation) in comparison to the other days of the month?	worse	3	/	20	/	11.2	.00
	equally good	11	/	73.33	/		
	better	1	/	6.67	/		
	Total	15	/	100	/		

*legend of Table 1

-in the question column, the questions written in black were given to the daughters, but they were also given to the mothers; if there are two questions (in black and in red), the question in red was given to the mothers. Mothers answer all questions about the time when they were the same age as their daughters are now and today

Based on the results from the questionnaire for the sportswomen who have had menarche and their mothers presented in Table 1, we can say that for 11 questions there are statistically significant differences in the answers of the two subsamples, i.e. at the level of $<.01$ for questions numbered 1, 3, 8, 12, *15, *17 and 17, and at level $<.05$ for questions numbered 10, *10, 15 and 16.

Discussion

The results from questions 1 and 2 lead to the conclusion that 40% of the interviewed sportswomen experienced menarche when they were 12 years old. The age at menarche for 13% of the sportswomen was 11 and 14. Unlike the sportswomen, the age at menarche for most of their mothers, around 33%, was 14 and 26% of them answered that the age at menarche was 12. According to Milojević M., and Berić B. (1983) the menarcheal age of the mothers can affect the age at menarche for their female children. Furthermore, according to the same author, girls who are physically active begin to menstruate later although in this research there is difference in terms of the years women have spent practicing sport. However, we need to take into consideration the acceleration, or the early occurrence of menstruation which according to Medved R., et al. (1987), is 4 months every 10 years. It means that if the average age of their mothers is 40, the acceleration is 16 months i.e. a year and a half and certainly, there is the effect of the regular training which prolongs the occurrence of menarche. According to Drobñjak P. et al. (1990), due to the acceleration and the improved economic situation, puberty occurs earlier by 2.5 to 3 years in comparison to the last century. Some authors claim that the age at menarche for sportswomen is prolonged for about a year. Unlike them, other authors believe that there is no difference between girls who do sports and girls who do not do any sports.

Concerning the answers to question number 3, we can say that 86.67% of the sportswomen and 80% of the mothers answered that their menstruation lasted from 3-7 days which is considered a normal period for menstrual bleeding. 66.67% of the sportswomen and 73.33% of the mothers have regular menstruation (question 4).

46.67% of the sportswomen answered that they had painless menstruation (question number 6), and 33.33% answered that they experienced a little pain during menstruation, whereas 20% of mothers who trained when they were at their daughters' age have painless menstruation, 53.33% experience a little pain during menstruation and 13.33% have very painful menstruation. The sportswomen and their mothers have similar intensity of menstrual bleeding (question 7), therefore 66.67% of the sportswomen and 73.33% of their mothers described the menstrual bleeding as medium, and only 6.67% of the sportswomen and 13.33% of their mothers have excessive menstrual bleeding.

Although this research has been carried out among sportswomen who train actively, they all spend different number of hours of different days on training. Using the questionnaire, we found out how much they are physically active. The answers to question 10 have revealed that the respondents – sportswomen have been training this sport (judo) from 3-8 years. 20% have been training judo for 4 years, 20% have been training for 6 years and 20% have been training for 8 years, while the rest 13.33% have been training actively (for 3 years, for 5 years, for 7 years) too. The results in Table 1 show that almost half of their mothers when they were at their daughters' age trained actively, the other half did not do any sports. 13.33% of the sportswomen attend 1-3 training sessions a week, 40% attend 3-5 training sessions a week, 26.67% attend 5-7 training sessions a week and 20% attend more than 7 training sessions in a week. 80% i.e. 12 sportswomen answered that the training sessions lasted from 1h and 30min to 2 hours and only 3 i.e. 20% answered that the training sessions lasted from 1h to 1h and 30min. It is certain that the effect of the duration of training sessions on a daily and yearly basis is great.

40% do not experience any discomfort and 40% of the sportswomen experience menstrual discomfort when they compete and train during menstruation (question 16), but only 6.67% have said that their results are worse. 73.33% of the sportswomen have the same results when they compete during menstruation in comparison to the results when they do not menstruate, 20% have worse results and only 6.67% have better results (question 17). This is very important and it should be pointed out to sportswomen and all the female students so that they do not feel afraid to exercise at Physical Education classes. Borić N. (2013), conducted research on 241 professional sportswomen. Although, 3 out of 4 sportswomen felt worse during menstruation than before menstruation, 63% of the respondents pointed out that the pain reduced during training and competitions, and 62.2% believed that their results were equally good during the bleeding and the rest of the month.

According to Hristov N. (1992), 25% of the observed sportswomen showed poor performance, 25% showed better performance and 50% did not show any differences. Čupić S., Stanoević S. (1970), did research on the problem of menstrual cycle and the activity of 65 top athletes from Belgrade and Sarajevo. Based on the results, the authors concluded that during menstruation, 60 athletes trained constantly, 5 trained occasionally, 8 abstained occasionally, and only two did not train at all. In terms of the achieved results during menstruation, 14 had better results, 21 had worse results, and 30 female athletes had variable

results. Kral (stated by Stojanvić S. (1977)) did research on the course of the cycle of female athletes during training and competitions. He came to the conclusion that 64% of the female athletes did not show any changes in the flow of the menstruation, for 20% of the female athletes the flow of the menstruation was better but it was accompanied with discomfort and for 16% of the female athletes the menstruation was aggravated and accompanied with fatigue. Jovicević R., Stanić R. (1986), had similar results from the research they did on 45 sportswomen (15 female handball players, 10 female volleyball players, 12 female basketball players and 8 female athletes who competed in the federal league) and they concluded that neither of the sportswomen experienced disruption of the menstrual cycle.

From that perspective, it is interesting to mention the research on endurance done by Noack N., Tittel N. (1968). The authors claim that the poorest performance was recorded before menstruation, the performance was somewhat better during menstruation and the best performance was recorded right after menstruation. Kliment V. (1986) came to similar results.

Conclusion

From the set goals and the analysis of the results, the following can be concluded:

- the sportswomen's average age at menarche is 12, and the age at menarche for half of the mothers is 12 and for the other half is 14
- the respondents' menstruations last from 3-7 days which is considered as normal menstrual bleeding period. Almost half of the sportswomen answered that they had painless menstruation
- a large percentage of the sportswomen, as many as 93.33% (14 of them) train during menstruation and only one does not train during menstruation. This number of training attendance during menstruation is justified because the sportswomen answered that they did not experience any discomfort during menstruation when they trained.
- the largest percentage of 73.33% said that they had equal results, 20% said that they had worse results and 6.67% said that they had better results.
- according to the results of this question, 40% of the sportswomen experience the same discomfort when they train and when they do not, and 40% do not experience any discomfort
- the mothers of the sportswomen gave answers similar to their daughters' answers. At present, they exercise or do recreational activities regardless of the menstruation and 60% of them are active during menstruation. Hence, we can conclude that the large percentage of training attendance during menstruation depends on the advice and personal experience of the mothers who encourage their daughters to attend training sessions during menstruation.
- It can also be concluded that the discomfort before, during and after menstruation when sportswomen train or compete differs individually, and for a large number of girls the discomfort is the same when they train and compete meaning that there is no deterioration of the symptoms, the pain, the bleeding, the uneasiness of the body which accounts for the answers that they achieve equally good results on competitions during the first days of menstruation and the other days when there is no menstrual bleeding. This is very important and it should be pointed out to sportswomen and all the female students so that they do not feel afraid to exercise at Physical Education classes.

The results of this research will contribute to the allocation of volume and quality of the training, the connection and ensuring continuity of the training and the competing process, timely planning and organizing of competitions and thereby proper and more useful allocation of financial resources. Hence, the opportunity to apply the results of this research to certain theoretical knowledge and practice which will lead to improved and modernized clubs and it will make the job of sports coaches and associates in clubs easier. It will also be easier for Physical Education teachers to deal with their female students at primary schools.

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POSSIBILITIES FOR CATEGORIZATION OF MOUNTAIN RUNNING COURSES ON THE EXAMPLE OF THE COURSE FOR "HRISTO BOTEV CUP" - VRATSA, BULGARIA

UDC: 796.422.093.56.015.2(497.2)
(Original scientific paper)

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Abstract

Mountain running, as an athletic discipline, which differs from other so-called trek-trails running with specific, defined requirements to the parameters of the courses on which races are held. However, each route has its own uniqueness. Explaining the specific features of a particular course can help the planning for the specialized training. A complex characteristic of the course for mountain run "Hristo Botev Cup" is made in accordance with the system of difficulty level, covering the main criteria showing the nature of the courses. Exploring a greater number of race courses with the help of the system will make it possible to create a categorization for mountain running.

Key words: mountain running, planning

Introduction

Over the last 10 years, mountain running has been one of the most rapidly developing athletic disciplines, both in terms of increasing number of races, as well as the great increase in the number of participants, and also the diversity of race course on which the competitions are held.

The racing rules initially had specific requirements for the parameters of the course on which the races are held. Subsequently, these requirements have become with more principled character, given that each route has its own uniqueness. In connection with this, along with the research of the nature of the kinematic characteristics of the mountain running [1, 2, 4], the courses under which competitions and training work in mountain running are done, are also a subject of science investigation [5, 6, 7, 8, 9]. In order to gain a clearer and more objective view of the uniqueness of each mountain running route, a system to categorize the degree of their difficulty was developed [3]. It is based on 7 key criteria, each with its own regulatory indicator. The indicators are: a variant of the race route, the variation of the slopes of the route, the length of the route, the sum of the positive displacement, the total displacement, the altitude and the surface of the route. Their application to the specificity of each particular route creates an opportunity for the route to be assessed by its difficulty with determining its own unique complex coefficient. Through this innovative system, it is possible to categorize the individual courses for mountain running, which are of particular sport-pedagogical value for the planning, control and management of the training process in the preparation of the mountain running athletes.

The **aim** of the present study is to categorize the route for mountain running for "Hristo Botev Cup" by determining the degree of its difficulty.

Tasks of the survey are:

1. Estimating the indicators which characterise the current route.
2. Determining the zones of the indicators corresponding to the coefficients of difficulty.
3. Calculation of the coefficients of each indicator and the overall coefficient of difficulty.
4. Formulation of sports-pedagogical conclusions.

The object of the study is the race route of the mountain running for "Hristo Botev Cup" - Vratsa, Bulgaria, with start - village of Pavloche and final - peak Okolchitsa.

Subject matter of the survey is the main criteria which characterize the route.

The methodology of the study includes:

GPS-topography, to determine the variant of the route, the different slopes of the route, its length, displacement and altitude.

Description of the terrain.

Mathematical and statistical data analysis.

Results analysis

The indicators of the different criteria determined the following difficulty coefficients of the route: Criteria (A). Variant of the race route.

Four variants of race courses and their corresponding coefficients of difficulty have been determined in advance. In Fig. 1 it is obvious that the "Hristo Botev Cup" Mountain Run is a variant "Mostly ascent", which corresponds to the difficulty coefficient 8 (Table 1).

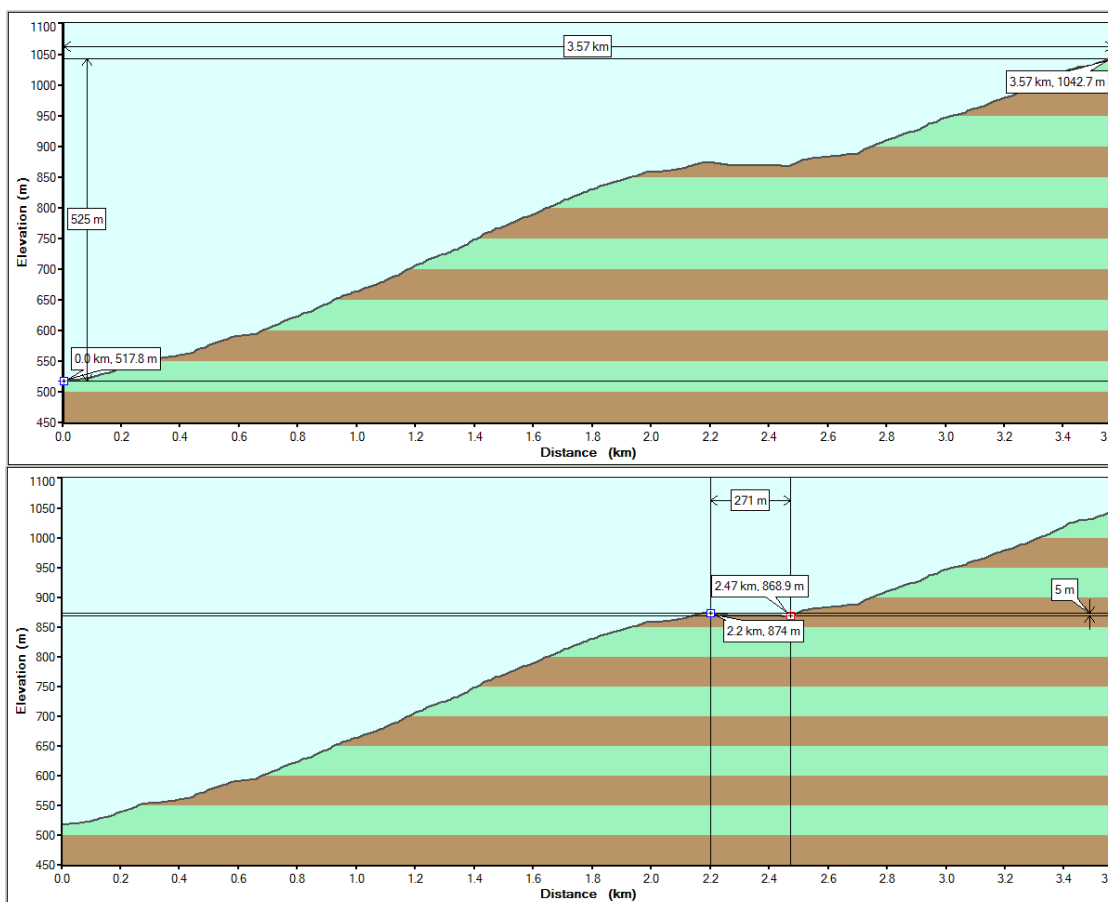


Figure 1 Displacement profile of the route

Table 1 Difficulty coefficients of the route according to the variant of the race route.

Variant of the route	Difficulty Coefficients
Lap with one ascent	5
Lap with two ascents	6
Only ascent.	8
Mostly ascent with significant descent	10

Criteria (B). Different slopes of the track

In the table. 2. an accurate description of the slopes of each section of the route is given, indicating the how many meters is each segment. Table 3 lists the different slopes, degrees and the percentages which correspond to them. Also the total length of each slope and the percentage of the route which it occupies. To the right, the relative difficulty coefficients are also presented. They are determined on the basis of the

speed of movement - as the speed of movement is lower, the higher the coefficient is. The difficulty of the route depending on the slopes is 7.81. It is impressive that a relatively high proportion of the route is large ascent (Figure 2).

Table 2 Description of route's slopes -section/slope measured in percent

Section of the route / slope	Section of the route / slope
0 - 260 m / 12%	2100 – 2170 m / 12%
260 - 440 m / 7%	2170 – 2250 m / -4%
440 - 570 m / 19%	2250 – 2480 m / 0%
570 – 650 m / 16%	2480 – 2700 m / 8%
650 – 1700 m / 21%	2700 – 3450 m / 19%
1700 – 2000 m / 17%	3450 – 3490 m / 0%
2000 – 2100 m / 4%	3490 – 3570 m / 14%

Table 3 Difficulty coefficients according to the slopes

Slope of the route	Degree of the slope	Percentage of the slope	Overall meters	Percentage of the route	Difficulty Coefficient
Small descent	-4°	-6.9%	80 m	2.2%	2
Flat	0°	0%	270 m	7.6%	3
Average descent	-8°	-14%	-	-	4
Big descent	-12°	-21.2%	-	-	5
Small ascent	4°	6.9%	500 m	14%	6
Extreme descent	-16°	-28.6%	-	-	7
Average ascent	8°	14%	720 m	20%	8
Big ascent	12°	21.2%	2000 m	56%	9
Extreme ascent	16°	28.6%	-	-	10
Difficulty coefficients according to the slopes					7.81

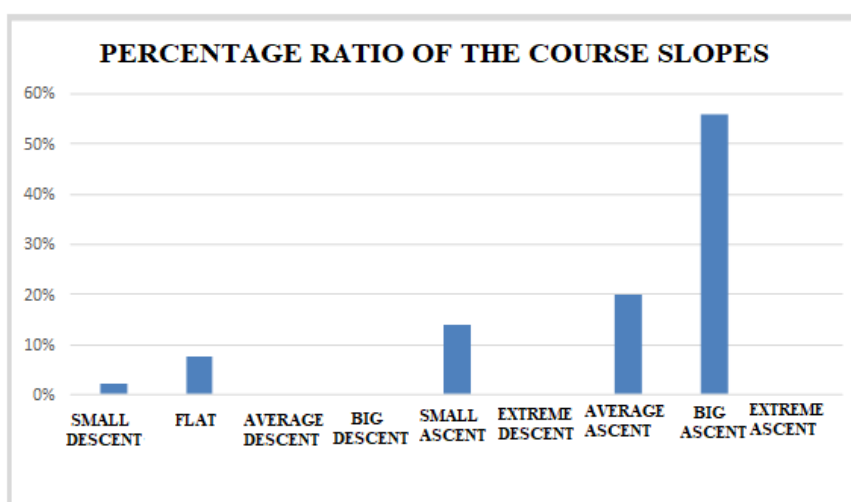


Figure 2 Percentage ratio of the course slopes

Criteria (C). Length of the route

The system for estimating the coefficients according to the length of the course is presented in Table 4. The smallest coefficient: 1 is for length of the route which is 20% under the recommended in the rules, and the highest: 10 is 20% above the recommendation.

The length of the track is 3570 m - fig. 1. It is obvious that according to this criterion, the course corresponds to a coefficient of 5 for junior boys and girls, and for senior is below the difficulty coefficient of zone 1 (Table 4).

Table 4 Difficulty coefficients according to the length of the course

Zones	Length of the course			Difficulty Coefficient
	Men and Women	Senior Boys and Girls	Junior Boys and Girls	
Zone 1	8000 m	4000 m	2400 m	1
Zone 2	8700 m	4350 m	2700 m	2
Zone 3	9400 m	4700 m	2900 m	3
Zone 4	10100 m	5050 m	3300 m	4
Zone 5	10800 m	5400 m	3500 m	5
Zone 6	11500 m	5750 m	3700 m	6
Zone 7	12200 m	6100 m	3900 m	7
Zone 8	12900 m	6450 m	4200 m	8
Zone 9	13600 m	6800 m	4500 m	9
Zone 10	14400 m	7200 m	4800 m	10

Criterion (D). Total Positive Displacement

The determination of the zones is again based on the 'twenty percent' principle. The positive displacement of the studied course is 530 m - fig. 1. This corresponds to a coefficient of 5 for senior boys and girls and it is significantly above coefficient 10 for the junior age (Table 5).

Table 5. Coefficients according to the overall positive displacement of the courses

Zone	Overall positive displacement						Difficulty Coefficient
	Variant "Mostly ascent"			Variant "Ascent and descent"			
	Men and Women	Senior Boys and Girls	Junior Boys and Girls	Men and Women	Senior Boys and Girls	Junior Boys and Girls	
Zone 1	800 m	400 m	240 m	400 m	200 m	120 m	1
Zone 2	870 m	435 m	270 m	435 m	220 m	135 m	2
Zone 3	940 m	470 m	290 m	470 m	235 m	145 m	3
Zone 4	1010 m	505 m	330 m	505 m	250 m	156 m	4
Zone 5	1080 m	540 m	350 m	540 m	270 m	175 m	5
Zone 6	1150 m	575 m	370 m	575 m	290 m	185 m	6
Zone 7	1220 m	610 m	390 m	610 m	305 m	195 m	7
Zone 8	1290 m	645 m	420 m	645 m	320 m	210 m	8
Zone 9	1360 m	680 m	450 m	680 m	340 m	225 m	9
Zone 10	1440 m	720 m	480 m	720 m	360 m	240 m	10

Criterion (E). Total displacement**Table 6.** Difficulty coefficient according to the overall displacement of the courses

Zones	Overall displacement (positive and negative) for all types of classical mountain running			Difficulty Coefficient
	Men and Women	Senior Boys and Girls	Junior Boys and Girls	
Zone 1	800 m	400 m	240 m	1
Zone 2	870 m	435 m	270 m	2
Zone 3	940 m	470 m	290 m	3
Zone 4	1010 m	505 m	330 m	4
Zone 5	1080 m	540 m	350 m	5
Zone 6	1150 m	575 m	370 m	6
Zone 7	1220 m	610 m	390 m	7
Zone 8	1290 m	645 m	420 m	8
Zone 9	1360 m	680 m	450 m	9
Zone 10	1440 m	720 m	480 m	10

The course of "Hristo Botev Cup" has a positive displacement of 530 meters and a negative displacement of 5 meters - fig.1. Thus, the total denivelation is 535 meters, and for junior boys and girls this is in the fifth

zone with a difficulty coefficient of 5, and for the junior age the value for the coefficient 10 and it is significantly higher (Table 6).

Criterion (E). Altitude of the finish

The altitude zones are distributed into 300 meters sections to the maximum allowed in the rules and regulations - 3000 meters above sea level. The finish line of the studied course is at an altitude of 1043 meters (fig.1), which falls in the sixth zone and has a coefficient of 6 (Table 7).

Table 7. Coefficients based on the altitude of the finish line

Zones	Altitude of the finish line	Difficulty Coefficient
Zone 1	From 0 to 300 m	1
Zone 2	From 300 to 600 m	2
Zone 3	From 600 to 900 m	3
Zone 4	From 900 to 1200 m	4
Zone 5	From 1200 to 1500 m	5
Zone 6	From 1500 to 1800 m	6
Zone 7	From 1800 to 2100 m	7
Zone 8	From 2100 to 2400 m	8
Zone 9	From 2400 to 2700 m	9
Zone 10	From 2700 to 3000 m	10

Criterion (G). Surface of the course

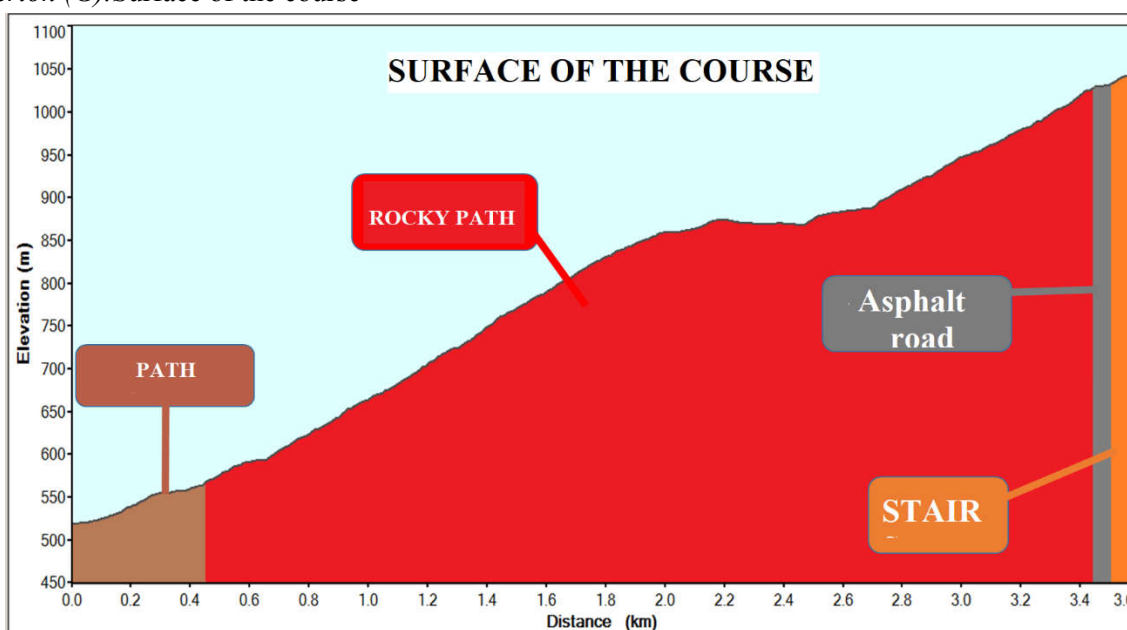


Figure 3 Distribution of types of different surface in the displacement profile of the course

Table 8 Description of sections which correspond to different surface

Section of the course	Surface of the course
From 0 to 450 m	Path
From 450 to 3450 m	Rocky path
From 3450 to 3490 m	Asphalt road
From 3490 to 3570 m	Stairs

Figure 3 represents the distribution of the types of the surface on the displacement profile. Table 8 provides information where each different surface covers a particular area. Table 9 shows the relative share of the surface of the course, calculated as a percentage. The data show that 84% of the track is rocky. The coefficient of difficulty according to the surface is 6.36 - Table 9.

Table 9 Difficulty coefficient according to the different surface of the course

Surface	Percentage of the course	Difficulty Coefficient
Path	12.6%	3
Rocky path	84.0%	7
Asphalt road	1.1%	1
Stairs	2.2%	4
Difficulty coefficient according to the surface of the course: 6.36		

Summary analysis

Figure 8. represents the criteria and coefficients which determine the complex characteristic of the course. In general, all criteria have a high difficulty ratio. The relatively low coefficient of the "slopes of the course" criterion is primarily due to the fact that the race takes place in the "ascent and descent" option and, as it is known, the downward slopes are easier to overcome. It is assumed that comparing it with other course of the same variant it will show that even on this criterion the route is rather difficult.

For the complex course difficulty coefficient value, the arithmetic mean of the established seven coefficients can be accepted.

CRITERIA AND DIFFICULTY COEFFICIENTS

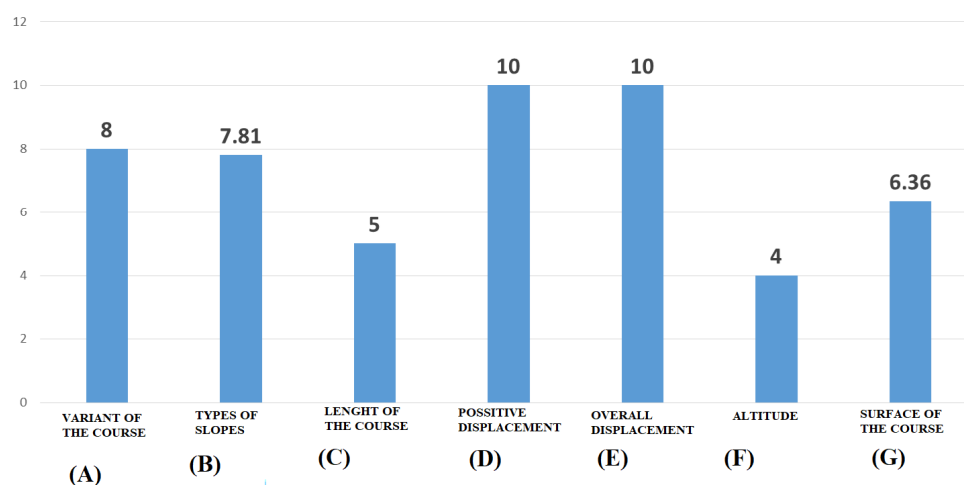


Figure 4 Criteria and difficulty coefficients determining the complex characteristic of the course for "Hristo Botev Cup"

Algorithm defining the complex coefficient = $(A + B + C + D + D + E + G)$: $7 = 7.31$

Conclusions

1. It can be assumed that the course of Mountain Run "Hristo Botev Cup" as a whole meets the requirements of the sport rules and regulations for junior and senior boys and girls, but with exceeding recommended values of the criteria for the displacement.
2. According to the displacement, the route corresponds to an average difficulty ratio for senior boys and girls (under 20 years).
3. The course requires athletes to be able to run on a large slope with rocky surface.
4. The course of "Hristo Botev Cup" is very suitable for conducting a specialized training for mountain runners of different qualifications.

5. The approach to participation in the competition does not need to be in line with the principles of altitude adaptation.
6. The established difficulty system makes it possible to acquire a more objective sport-technical characteristic of the course.
7. Clarifying the specific features of the particular course can help with the planning of more specialized training.

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SPORT AND DENTAL TRAUMA IN FRONTAL REGION - PROSTHODONTIC MANAGEMENT

UDC: 616.314:796.071.2

(Original scientific paper)

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Abstract

Healthy way of living requires physical and sport activities. Reasons to participate in sports and physical activity are many, such as pleasure and relaxation, competition, socialization, maintenance, and improvement of fitness and health. Sports participation also carries a risk of injuries. Falls, kicks and rough play are main reasons for orofacial and dental trauma. Dental trauma in sports is the major linking channel between the sports and dentistry. Sports trauma frequently involves insult to oral soft and hard tissues, resulting in loss of tooth structure and tooth loss. A large number of dental and orofacial injuries related to sports affect the maxilla, maxillary incisors, and the upper lip with 50%-90% of injuries involving the maxillary incisors. The main purpose of this study is to present the prosthodontic management of patients with present dental trauma as a result of injuries in sport and physical activities, treated at the Department of Prosthodontics at the University Dental Clinic – Skopje. The dental trauma at anterior teeth is resolved with fixed prosthodontic restoration. After the clinical examination and considering the current condition of the injured teeth and soft tissue in general, and after a consultation with the patient, several prosthodontic solutions were suggested. Using metal-ceramic and all-ceramic as possibility of choice, dental traumas are successfully solved, and thus good results in terms of good esthetic and function of the lost or damaged anterior teeth, full dental arch and satisfaction for the patients and dentist were gained. Dental trauma at sport activities causes functional, psychological and social problems for patients. The correct and on-time dealing of the dentist with these conditions removes the further problems, and education of the patients who take part in sport activities enables prevention and reduction of the dental traumas.

Key Words: *prosthodontic management, dental trauma, sport*

Introduction

Sports means "to carry away from work" and is one of the most common forms of recreation practiced by individuals in today's highly stressed life. There are a large number of people taking active part in training and competitions in professional sport too. Sports participation is a frequent cause of injury (muscle injuries, torn cartilage, fractured bones, tendinitis, soft-tissue lacerations, contusions and broken teeth), mostly among children, adolescents, however among adults too.

Dental injuries are the most common type of orofacial injury sustained during participation in sports. The common orofacial sports related injuries include soft tissue injury and hard tissue injury such as tooth intrusions, luxation, crown and/or root fractures, complete avulsions and dental-facial fractures.

Consequences of orofacial trauma for sport participants and their families are substantial because of potential for pain, psycho-logical effects and economic implications.

Sports dentistry had its origins in the 1980s (Ranalli D.N., 2002) and involves the prevention and treatment of orofacial athletic injuries and related oral diseases, as well as the collection and dissemination of information on dental athletic injuries and the encouragement of research in the prevention of such injuries.

Incidence of sport injuries in orofacial region

The face is the most vulnerable area of the body and is usually the least protected. Sports-related facial

injuries account for 8% of all facial soft tissue injuries. Approximately 11-40% of all sports injuries involve the face. These injuries are most often due to direct hits with a ball or player-to-player contacts.

The incidence of sports related orofacial injuries serve to depend upon the circumstances of the nation in terms of the number of people involved, the extent of the sports facilities and the sport, which is most popular.

The national youth sports foundation for the prevention of athletic injuries estimates that during the season of play, athletes have a 10% chance of sustaining an injury to the face or mouth.

Studies have shown that 13-39% of all dental injuries were sports related and of all sports accidents reporting, 11-18% were maxillofacial injuries (Camp J., 1996). The most common types of sports related facial trauma are the soft tissue injuries and the fractures of the "T-zone" bones (the nose, the zygoma and the mandible). These injuries often occur in combination. Males are traumatized twice as often as females. Among children, sports were found to be responsible for 13% of overall oral trauma. The majority of sport-related dental and orofacial injuries affect the upper lip, maxilla and maxillary incisors, with 50-90% of dental injuries involving the maxillary incisors.

Classification of traumatic dental injuries comprises trauma to the hard dental tissues and the pulp, to the periodontal tissues, to the supporting bone and to gingiva and oral mucosa (Table 1). It reflects the Application of international classification of diseases to dentistry and stomatology by World Health Organization (WHO).

It comprises seven types of tooth fractures, six types of luxation, eight types of damage to supporting bone and three types of injuries to oral mucosa or gingiva.

Classification used in clinical practice differs from classification used in epidemiological studies and comprises six categories: no traumatic dental injury, treated traumatic dental injury, enamel fracture, enamel-dentin fracture, pulp injury and missing tooth due to the traumatic dental injury.

Table 1. Classification of traumatic dental injuries

Type of injury (code according WHO)
Injuries to the hard dental tissues and the pulp
Enamel infraction (N 502.50)
Enamel fracture (N 502.50)
Enamel- dentin fracture (N 502.51)
Complicated crown fracture (N 502.52)
Uncomplicated crown- root fracture (N 502.54)
Complicated crown-root fracture (N 502.54)
Root fracture (N 502.53)
Injuries to the periodontal tissues
Concussion (N 503.20)
Subluxation (N 503.20)
Extrusive luxation (N 503.20)
Lateral luxation (N 503.20)
Intrusive luxation N 503.21
Avulsion (N 503.22)
Injuries to supporting bone
Comminution of the maxillary alveolar socket (N 502.40)
Comminution of the mandibular alveolar socket (N 502.60)
Fracture of the maxillary alveolar socket (N 502.40)
Fracture of the mandibular alveolar socket (N 502.60)
Fracture of the maxillary alveolar process (N 502.40)
Fracture of the mandibular alveolar process (N 502.60)
Fracture of the maxillae (N 502.42)
Fracture of the mandible (N 502.61)
Injuries to gingiva or oral mucosa
Laceration of gingiva or oral mucosa (S 01.50)
Contusion of gingiva or oral mucosa (S 00.50)
Abrasion of gingiva or oral mucosa (S 00.50)

Case Report 1

In the first case we had a 25 years old patient taking part in motorcycle racing. During a race he had a fall and got a fracture of central and lateral incisors. Both lateral incisors were fractured and we diagnosed a complicated crown fracture with pulp exposure. After the endodontic treatment we made a dental post and metal-ceramic crowns.

At the first maxillary incisors we diagnosed enamel fracture at currently vital teeth. After some time, the teeth defect was resolved with glass-ionomer filling. The second phase was the esthetic and functional reconstruction with metal-ceramic restorations. With the fabrication of the metal-ceramic fixed prosthodontic restorations the maxillary inter canine area was filled. (Figure 1, 2)

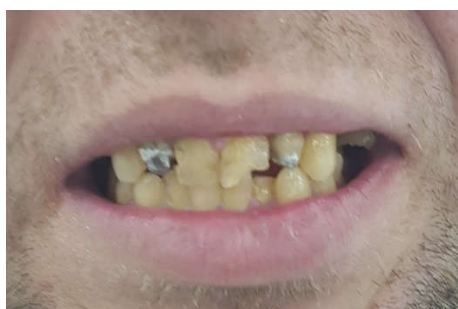


Fig 1. Pre-treatment view



Fig 2. Post-treatment view

Case report 2

The patient was a 20 years old active women basketball player. During a match and a duel with an opponent, she got a dental injury. After couple of hours after the accident, the patient came to the dental office and brought the broken part of the tooth with her. Enamel dentin fracture with no pulp exposure was diagnosed. The tooth was anesthetized and the fractured segment and the tooth were both then cleaned and disinfected. The fractured segment will be reattached with a highly filled bonding resin, according to manufacturer's recommendations. The enamel and dentin were etched for 15 seconds with 35% phosphoric acid. The tooth was rinsed and lightly dried, leaving the surface moist. The bonding resin was applied to the enamel and dentin, cured for 20 seconds. The fractured segment was etched in the same manner. Then bonding agent was applied to the fractured segment and tooth was cured for 20 seconds in each side of it. After 14 days we finished the work and we made an esthetic prosthodontic reconstruction of single central left incisor with all-ceramic crown. This procedure is one of the most challenging esthetic dental procedures. Both the patient and the doctor were extremely satisfied with solving of the sport dental trauma. (Figure 3,4,5)



Fig 3. Pre-treatment view



Fig 4. Reattaching of the broken tooth segment



Fig 5. Post-treatment view

Prevention of sports dental and orofacial traumas

Many sports-related traumatic dental injuries are preventable. The risk-to-benefit ratio can be improved by the use of appropriate, properly fitted, protective athletic equipment. Furthermore, as the predictive risk factors associated with such injuries are more clearly identified and defined, the design and development of new protective devices may contribute positively to future athletic injury prevention.

At present, helmets, facemasks, and mouth-guards are required in some sports to reduce both the likelihood and the severity of sports-related traumatic injuries to the head, face, and mouth of an athlete.

The imperative for future independent scientific research is emphasized to transform current clinical empiricism into statistically significant, evidence-based knowledge.

All preventive services offered by the private practitioner should be made available to athletes and others who are susceptible to sustain sports-related trauma. Specific counseling regarding the prevention of trauma, correction of malocclusion, removal of impacted teeth, use of mouth protectors, and treatment of any anomaly and prevention of pathology is important. Proper training of the school teachers, emergency management kits, and training are important (Dhillon et al. 2014).

A rapid proliferation of sports programs for children and adolescents has taken place over the past few years. The participation has grown dramatically at both the recreational and organized sports levels. The dentist has a professional responsibility to educate himself and the public regarding the issues related to sports dentistry, specifically to the prevention of sports-related orofacial and dental trauma. Dentists should also take the lead in educational, research, and public service activities. It is the duty of dentists to create awareness among the professional athletes, people, teachers as well as students, and children.

Proper education by the dentists can increase the knowledge of the sportsman for prevention, and protection of sport dental traumas. The role of the dentist-prosthodontist, although in the last phase of the care for the patients with dental traumas, is one of the most important for complete and esthetic solution of teeth after dental injury and a patient with “nice smile”.

Conclusion

Orofacial injuries that occur during sports activities are largely preventable. Mouth protection for athletes is one of dentistry's contributions to sports medicine. Therefore It is a responsibility of the dental profession to become more active in sports injury prevention programs. Mouth-guards provide protection against injuries to the orofacial and dental area, including the teeth, lips, cheeks and tongue, thereby reducing the incidence and severity of injuries that occur during athletic practice and competition. It has also been shown that they prevent head and neck injuries, concussions and jaw fractures. Many athletes are not aware of the health implications of a traumatic injury to the mouth or of the potential for incurring severe head and orofacial injuries while playing.

It is also our responsibility to identify, educate, and provide the athletes preventive measures like mouth-guards.

As stated above, dentistry has an important role in the athlete's health and consequently on sport performance. It provides the athletes optimal oral health conditions which in turn can contribute to achievement of optimal performance during competitions. The presence of Dentist in athlete support staff is of paramount importance. Surveys have shown that systemic diseases can often be caused by a dental problem.

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THE IMPACT OF MORPHOLOGICAL CHARACTERISTICS ON RESULT SUCCESS IN AGILITY TESTS WITH YOUNG FOOTBALL PLAYERS

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(Original scientific paper)

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Abstract

The research was conducted on a sample of 50 young football players, aged between 14 and 16, with the aim of determining the intensity and character of influence of the selected morphological characteristics on the effectiveness in agility tests results. The study used 12 variables to estimate morphological characteristics defined as a predictive (input) set of variables. The following criteria variables were used for the agility assessment tests: Agility test – forward-backward running (93639NN), hexagon, six-way sideways hops (MAGHEK), sideways shuffle (MAGKUS). In order to determine the possible influence of the selected morphological characteristics (measures) on the success rate in the agility assessment tests, three multiple regression analyses were applied to each test. The results of the regression analysis show that the morphological characteristics monitored in this study are, relatively, poorly related to the results in the applied agility assessment. A statistically significant relationship was obtained between the selected morphological characteristics and the sideways shuffle test (MAGKUS). No other statistically significant correlations were found with other agility evaluation and selected morphological characteristics tests. The obtained results can be useful to coaches and other experts who work in the football industry, as a guideline for more comprehensive planning and programming, as well as the selection of adequate training operators and methods.

Keywords: *agility, football players, morphological characteristics, regression analysis.*

Introduction

Morphological characteristics are responsible for the growth and development of the human body. Morphological characteristics include active components (muscles) and inertial components (body mass, body height, fat tissue, etc.). Measurement and diagnostics of the state of morphological characteristics give insight into the growth and development of the respondents, but it also enables the correct orientation of children in a particular sport branch and monitoring of their changes in the process of sports preparation. Morphological anthropometry is a method that involves measuring the human body, processing the obtained measures by applying appropriate statistical and mathematical procedures, and finally interpreting the obtained results (Mišigoj - Duraković, 1995). The exact data on the morphological characteristics of athletes are one of the important problems in contemporary sport for practical reasons.

Agility is a complex motor ability which occurs as a result of the complementary co-action of various motor skills. It can be said that success in complex motor activities is associated with the expression of agility, and that agility itself is a result of the conformity of different anthropological dimensions (morphological, motor, psychological). The complexity of the agility manifestation makes the understanding of its significance more important than emphasizing the subtlety of the results of the movement in which it is manifested. Its complexity is recognized in the necessity of a holistic understanding of the characteristics of the human, in respecting all potentials and limitations of the functions of the locomotor system, in the necessary correlation of interactions of current features, in the specific choice of means of preparation, in various protocols for its assessment, in the increased risk of injuries, etc. Based on previous research results of various authors, agility is defined as a complex manifestation of motor skills, of which depends fast and efficient connection of acceleration and deceleration itself, i.e. the change of direction and re-acceleration and re-deceleration with constant control of movement in vertical or horizontal direction (Drabik, J. 1996, Plisk, S. S. 2000, Verstegen, M., Marcello, B., 2001). Acceleration and

deceleration of movement in horizontal and vertical directions implies the manifestation of strength as a motor characteristic, so that success in movements requiring agility depends on characteristics of expressing strength and power - athletes who, in a shorter time, exhibit greater power or strength, have the expected prerequisites necessary for the manifestation of agility.

Football is a complex, variable, poly-structural game, characterized by the cyclic and acyclic structure of movement (Jerković, 1982; Bajrić, 2008; Mandić Jelaska, Katić, & Jelaska, 2013). From the standpoint of physiological processes, football is an aerobic-anaerobic sport that requires high intensity of different activities from players. However, there is a clear lack of research dealing with the impact of morphological characteristics on the results in agility tests with football players. Therefore, it is necessary that in this paper we identify and explain the manifestation of agility in terms of the impact of morphological characteristics of the body (longitudinal, transversal, circular dimensionality and body weight, and subcutaneous fat tissue).

Previous research studies have found that in the movements of the maximum possible intensity with the change of direction, morphological characteristics behave as an inertial factor, i.e. they make it difficult to change the direction of movement (Grbović, 2013; Šišić & Sekulić, 2013; Pehar, 2016).

Methods

Sample of respondents

The study was conducted on a sample of 50 respondents - young football players, aged 14 to 16. Respondents are all members of the following football schools: FC "BORAC" from Banja Luka, FC "BSK" from Banja Luka, and FC "KRUPA" from Krupa na Vrbasu.

Sample of variables

Variables for assessing morphological characteristics

12 variables were used to assess the morphological characteristics defined as a set of predictor variables. Measurement of morphological variables was carried out in accordance with the conditions laid down in the International Biological Program (IBP).

Variables for assessing longitudinal dimensionality

1. Body height (AVISTL)
2. Leg length (ADUŽNO)
3. Arm length (ADUŽRU)

Variables for assessing the transversal dimensionality of the skeleton

4. Biachromial range (ABIARA)
5. Knee diameter (ADIJKO)
6. Hock diameter (ADIJSZ)

Variables for assessing dimensionality and body mass

7. Body weight (ATEŽTJ)
8. Thigh circumference (AOPNAT)
9. Chest circumference (ASROGK)

Variables for assessing subcutaneous fat tissue

10. Abdominal skinfold (NABTRB)
11. Lower back skinfold (NABLEĐ)
12. Lower leg skinfold (NABPOT)

Variables for assessing agility (criterion variables)

The assessment of agility was carried out by running tests which are normally used to assess agility, but which differ according to the way, structure and duration of movement.

13. Forward-backward running 93639 (MAG9NN)
14. Hexagon – six-way sideways hops (MAGHEK)
15. Sideways (lateral) shuffle (MAGKUS)

All measurement procedures and all testing protocols were in accordance with standard methodological requirements related to this type of research. Respondents were explained the purpose of the research, as well as the protocols for measuring morphological characteristics and performing agility tests.

Data processing methods

Respondents were tested using the same protocols for the quantification of morphological characteristics and agility. All testing protocols for assessing agility were repeated twice. Measurement of morphological characteristics was organized separately, independently of agility testing and was carried out in the early morning hours. Measurement of predicted morphological characteristics and agility tests was organized and conducted in the sports hall of the Secondary School Center “Gemit” in Banja Luka.

For all applied variables, the basic descriptive parameters were calculated. Three regression analyzes were used to determine the size and significance of the influence of selected morphological characteristics on the results in agility tests.

Results and Discussion

Morphological characteristics were analyzed from the aspect of longitudinal, transversal, and circular dimensionality and body weight, as well as subcutaneous fat tissue indicators. The analysis of morphological characteristics was performed based on the basic descriptive parameters (Table 1) on the minimum and maximum characteristics of the observed characteristics, as well as based on the parameters of the central data tendency - arithmetic mean (Mean) and standard deviation (St. Dev.).

Table 1 Basic descriptive parameters of variables for assessing morphological characteristics

Variables	Min	Max	Rang	Mean	St. Dev.	Skewness	Kurtosis
AVISTL	1660.0	1950.0	290.0	1801.9	65.11	-.138	-.522
ADUŽNO	960.0	1230.0	270.0	1064.5	54.7	.698	.652
ADUŽRU	72.8	93.0	20.2	819.0	39.8	.144	.508
ABIARA	31.0	45.0	14.0	382.1	36.1	-.091	-.485
ADIJKO	7.9	9.9	2.0	88.94	4.67	-.176	-.635
ADIJSZ	5.2	8.0	2.8	68.15	6.27	-.269	-.188
ATEŽTJ	509.0	1003.0	494.0	691.03	9.42	.808	1.672
AOPNAT	460.0	690.0	230.0	543.5	47.93	1.011	1.802
ASROGK	744.0	1050.0	306.0	867.5	64.36	.679	.744
NABTRB	40.0	293.0	253.0	102.4	4.70	1.993	4.936
NABLEĐ	60.0	127.0	67.0	82.4	1.92	.455	-.732
NABPOT	60.0	147.0	87.0	81.3	2.06	.873	.589

Table 2 shows the values of the basic central and dispersion parameters of variables for assessing agility, as well as the coefficients of skewness and kurtosis. Based on the displayed values of arithmetic mean and median parameters (Table 2), it can be seen that the test results are within the range of normal distribution. Minor deviations are noticeable in the variable of six-way hops (MAGHEK) and the sideways shuffle (MAGKUS). The skewness coefficient in the asymmetry of all variables is closer to zero. A slightly higher value (above 1, more precisely 1.295) was achieved in the variable of six-way hops (MAGHEK). Based on the skewness value, we can conclude that the complete set of variables for assessing agility meets the assumption of normal distribution of results, i.e. the values of asymmetry and kurtosis in the applied variables are within the limits that satisfy the hypothesis of a normal distribution of results.

Table 2 Basic descriptive parameters of variables for assessing agility

Variables	Min.	Max.	Rang	Mean	St. Dev.	Skewness	Kurtosis
MAG9NN	8.04	10.17	2.12	9.16	0.49	-.046	-.470
MAGHEK	5.35	10.00	4.65	6.35	0.93	1.295	2.051
MAGKUS	7.61	9	2.35	8.87	0.56	-.127	-.544

Regression analysis

Three multiple regression analyzes were applied in order to determine the possible impact of selected morphological characteristics, marked as an input or explanatory or predictor system of variables, on the result effectiveness in agility tests with young football players, marked as a criterion. Based on the size of multiple regression (RO), the common variance (R Square) was explained only if it was statistically

significant. If the multiple correlation was statistically significant, we started the analysis of the impact of individual variables on the result effectiveness in the realization of agility tests with respondents.

Regression analysis of the MAG9NN criterion variable – forward-backward running 93639m (frontal agility)

The results of the regression analysis of the criterion variable (MAG9NN), which assesses the frontal agility - forward-backward running of given distances, are shown in Table 2. By looking at the given table, we can see that the predictor system of variables did not show a statistically significant correlation in the prediction of the MAG9NN criterion variable – forward-backward running 93639m. Therefore, no analysis of the relative impact of each individual predictor on the criterion will be made.

Table 2 Results of the multiple regression analysis of the MAG9NN criterion variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,371a	-,138	-,127	5.42159

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	183.955	12	15.330	,522	.888b
Residual	1146.353	39	29.394		
Total	1330.308	51			

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	B	Std. Error			
(Constant)	126.509	43.559		2.904	.006
AVISTL	.001	.003	.191	.596	.555
ADUŽNO	.000	.002	.012	.049	.961
ADUŽRU	-.003	.004	-.218	-.711	.482
ABIARA	-.002	.003	-.116	-.613	.543
ADIJKO	-.010	.023	-.095	-.462	.647
ADIJSZ	-.010	.018	-.119	-.546	.588
ATEŽTJ	.028	.031	.516	.913	.367
AOPNAT	-.002	.004	-.227	-.632	.531
ASROGK	-.004	.003	-.474	-1.496	.143
NABTRB	.031	.025	.286	1.257	.216
NABLEĐ	.038	.058	.145	.662	.512
NABPOT	.026	.049	.106	.529	.600

Regression analysis of the MAGHEK criterion variable – hexagon six-way hops (frontal agility)

The results of the regression analysis of the criterion variable (MAGHEK), which assesses the frontal agility – hexagon six-way hops, are shown in Table 3. By looking at the given table, we can see that the predictor system of selected morphological variables at the general level did not show a statistically significant correlation in predicting the MAGHEK criterion variable – hexagon six-way hops. However, what we can see in Table 1 is that the applied system of predictor variables explains 32% of the criteria variation by its partial impact. A statistically significant partial impact on the MAGHEK criterion variable was shown in the following variables: body weight (ATEŽTJ), thigh circumference (AOPNAT), and abdominal skinfold (NABTRB), which also show a relatively high partial correlation with the MAGHEK criteria test.

Table 3 Results of multiple regression analysis of the MAGHEK criterion variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.565a	.319	.110	8.79262

Model	Sum of Squares	df	Mean Square	f	Sig.
1 Regression	1415,20	12	117,934	1,525	.156
Residual	3015,098	39	77.310		
Total	4430,308	51			

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	B	Std. Error			
(Constant)	178.776	70.643		2.531	.016
AVISTL	.002	.004	.120	.422	.675
ADUŽNO	.000	.004	-.013	-.058	.954
ADUŽRU	-.002	.006	-.076	-.277	.783
ABIARA	-.008	.004	-.302	-1.801	.079
ADIJKO	-.029	.037	-.143	-.779	.441
ADIJSZ	-.016	.029	-.105	-.543	.590
ATEŽTJ	.110	.050	1.116	2.220	.032
AOPNAT	-.016	.006	-.827	-2.588	.013
ASROGK	-.007	.004	-.451	-1.604	.117
NABTRB	.098	.040	.493	2.442	.019
NABLEĐ	.059	.094	.121	.625	.536
NABPOT	-.094	.080	-.208	-1.172	.248

Legend: R – multi-correlation coefficient; R² - determination coefficient; Beta – standardized regression coefficient; t – t test; Sig. – statistical significance

Regression analysis of the MAGKUS criterion variable – sideways shuffle (lateral agility)

The results of the regression analysis of the MAGKUS criterion variable, which assesses the lateral agility, sideways shuffle, are shown in Table 4. By looking at the given table, we can see that the regression analysis of the MAGKUS criterion variable gives satisfactory information on the significance and magnitude of the impact of applied morphological variables on the speed of sideways shuffle. The predictor system of selected morphological characteristics explained 45% of the common variability of the criterion variable. The value of the multi-correlation coefficient is relatively high ($R = .67$), and in the high statistical significance of a strict criterion, it is .011. By inspecting the value of the individual effects of morphological variables on sideways shuffle (MAGKUS), the following interesting information can be noticed: statistically partially significant influence of predictor variables on the criterion variable was achieved by the following variables:

- AVISTL variable – body height. The value of the BETA partial coefficient is .734, which is significant at the level $p = .007$.
- AOPNAT variable – thigh circumference. The value of the BETA partial coefficient is -.750, which is significant at the level $p = .013$.
- NABTRB variable – abdominal skinfold. The value of the BETA partial coefficient is .585, which is significant at the level $p = .003$.

Other variables for the assessment of morphological characteristics did not show a statistically significant impact on a successful realization of the MAGKUS test - which assesses lateral agility through sideways shuffle.

Table 4 Results of multiple regression analysis of the MAGKUS criterion variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.670a	.449	.280	4.79613

Model	Sum of Squares	df	Mean Square	f	Sig.
1 Regression	731,658	12	60,972	2,651	.011
Residual	897,111	39	23,003		
Total	1628,769	51			

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	B	Std. Error			
(Constant)	69.987	38.534		1.816	.077
AVISTL	.006	.002	.734	2.867	.007
ADUŽNO	-.003	.002	-.272	-1.405	.168
ADUŽRU	.000	.003	.008	.032	.975
ABIARA	-.002	.002	-.117	-.774	.443
ADIJKO	.002	.020	.017	.100	.921
ADIJSZ	-.012	.016	-.132	-.759	.453
ATEŽTJ	.010	.027	.171	.384	.703
AOPNAT	-.009	.003	-.750	-2.607	.013
ASROGK	-.002	.002	-.206	-.815	.420
NABTRB	.070	.022	.585	3.219	.003
NABLEĐ	-.038	.051	-.128	-.734	.468
NABPOT	-.014	.044	-.052	-.328	.745

From the aspect of research aim, it is important to determine and explain the magnitude and significance of the impact of selected morphological characteristics on result success in agility tests as a motor performance. On the basis of obtained results of regression analysis, a relatively poor correlation between the morphological characteristics applied in this study and the results in the treated agility tests can be noted. A statistically significant impact of applied morphological characteristics on the result in the agility test (MAG9NN), forward-backward running 93639m, which assesses frontal agility without turning, has not been identified.

Also, at the global level, the impact of applied morphological characteristics on the agility test (MAGHEK-hexagon), six-way hops for assessing the frontal agility, has not shown a statistically significant impact, but a partial impact of the following variables is evident: body weight (ATEŽTJ), thigh circumference (AOPNAT), and abdominal skinfold (NABTRB).

As far as lateral agility is concerned, there is a statistically significant impact of applied morphological variables on the results in the MAGKUS test, sideways shuffle, at the global level (Sig. = .011) and at the partial level. A statistically significant impact of the results in the agility test, sideways shuffle (MAGKUS), has been achieved by the following variables: body height (AVISTL), thigh circumference (AOPNAT), and abdominal skinfold (NABTRB). So, it is the same variables as for the result in the MAGHEK test. It can be noted that the influence of these morphological characteristics is manifested through aggravation of performance in agility tests in conditions of jumping, acceleration, deceleration, as well as in conditions of change of movement direction. It is reasonable to expect that the inertial forces in movement with direction change are bigger if the dimensions of the body are bigger.

The obtained results can be explained from the aspect of the specificity of the tested sample of respondents, their age categories, i.e. by knowing the principles of growth and development in relation to the age period - the heterogeneity of development (Šišić & Sekulić, 2013). The age of the respondents ranges from 14 to 16, which may be one of the reasons for this kind of results. On the whole, the results of this study clearly show that the impact of morphological characteristics on the agility test results is different, i.e. that the informational content obtained in terms of measured properties in various agility tests is not the same.

The correlation between selected indicators for the assessment of morphological characteristics and applied agility tests is similar to those obtained by other researchers (Pearson, 2001; Grbović, 2013; Spasić, 2013, Pehar, 2016).

The obtained results are significant from the aspect of correct planning of football trainings, because they point to a desirable profile of football players, who can successfully respond to the requirements of modern game.

However, given the wide spectrum and the high level of complexity of different structures of movement in football (in relation to intensity, duration, complexity, as well as in relation to openness and closeness of movement conditions), the impact of morphological characteristics cannot be fully explained without considering other anthropological characteristics of football players (motor, functional, cognitive, conative), i.e. without taking into account their interactions. In addition, the explanation of agility as a complex motor characteristic implies the consideration of both morphological and psychological characteristics and motor skills (Lačić & Bajrić, 2003; Marković, & Bradić, 2008).

Although the results of the research indicate a relatively low impact of the selected morphological characteristics on agility, it cannot be ignored.

The authors of this paper are aware that this research is one of the few studies that deals with the problem of researching the impact of morphological characteristics (predictors) on the agility (criterion) of football players of this age (cadets), at least in our area. Therefore, the obtained results should be interpreted with appropriate caution, but they can be used in some future research.

Conclusion

The obtained results of the research contribute to solving the set goal and are in the function of obtaining significant information on the magnitude and significance of the impact of morphological characteristics on the results in agility tests. The obtained results indicate that the morphological characteristics are not a significant predictor in treated agility tests, but that their impact cannot be ignored. The results indicate that selected morphological characteristics mostly aggravate the manifestation of agility. The aggravation of agility manifestation is a consequence of the inertial forces that are present during running with direction change and which are bigger if the body dimensions are bigger (body height and weight, skinfolds and circumference). Based on the results of the research it can be concluded that, nevertheless, there is a significant impact of some morphological characteristics on certain agility tests, depending on the presence and duration of the acceleration and deceleration phases, as well as of direction changes. In some future research studies, authors should examine the impact of morphological characteristics that are not included in this study on some other agility tests with other content and movement structures. Also, they should examine how different lengths of movement before direction change affect the magnitude and significance of the impact of morphological characteristics on agility.

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IMPACT OF CORRECTIVE EXERCISES SETS DURING PHYSICAL EDUCATION AND SPORTS CLASSES ON THE SPINE STABILITY OF 11-12 YEAR OLD PUPILS

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(Original scientific paper)

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Abstract

Problem statement: The spinal column is an important link in the kinematic chain of the human body. It allows stability in maintaining the standing position of the body, as well as mobility, to move the body into the environment. Very often children worsen their body posture in school age and some get vertebral deformities. Spinal deformities lead first to back pain, poor self-esteem, and in advanced stage to many complications for internal organs. The counteraction of spinal deformities and the poor posture of the body is a serious challenge for the teacher of Physical education and sport. Purpose: To follow the impact of sets of corrective exercises in Physical education and sports classes on the spine of 11-12 year old pupils. Methods: Within the period of nine months corrective gymnastics were applied to the pupils in classes of Physical education and sport at school. The pupils were examined at the beginning and at the end of school year (September 2017– May 2018). During that period of time the functional condition of 16 pupils was monitored. Data of anthropometric indicators, static and dynamic strength of abdominal and dorsal muscles and degree of mobility of the spine was collected. Results: After the end of experiment it was found out that the implementation of sets of corrective exercises in Physical education and sports classes improves the static and dynamic muscular strength of abdominal and dorsal muscles and does not increase the flexibility of the spine, which is of particular importance for maintaining the spine in standing position and works against spinal deformities. Discussion: The obtained results confirmed the effectiveness of the sets of corrective exercises. Conclusions: It is important to include corrective exercises in Physical education and sports classes at school for better spine stability and for prevention of spinal deformities.

Key words: spine, spinal deformities, poor body posture, muscle function, dynamic and static muscle strength, flexibility, anthropometry

Introduction

Standing posture is inherent only to human beings. The construction and function of the spine are essential for the proper body posture. It is the base and it supports both the shoulder girdle and the head, as well as the pelvic girdle and the lower limbs, and allows the body to move.

The physiological curves of the spine allow it to act as a springing column. The elasticity of the curves contributes to greater resistance to vertical load compared to the straight column. The physiological curves of the spine are relatively unstable. They permanent shaping begins at the age of seven and ends at 14-15 years of age. Therefore, it is essential to prevent spinal deformities, especially at this age, by creating habits for a proper body posture, as well as through appropriate physical exercises and sports [1, 6].

A proper body posture allows an optimal load on both the spine (joints, intervertebral discs, ligaments and muscles) and other musculoskeletal structures, including the pelvis. A poor posture is a major prerequisite for the development of spinal deformities, and vice versa, spinal deformities lead to deterioration of the body posture [2, 3]. This applies mostly to children, but the adult individual could as well be affected by such problems. Thus, clarifying the underlying causes that may interfere with the proper posture and their elimination is of utmost importance for the prevention and treatment of vertebral distortions [4].

The preconditions for vertebral distortions intensify at school age, when the pupils are forced to remain for a longer time in a static posture. As a result of the fatigue of the dorsal muscles by the end of the class, the child starts looking for a pose to ease the static posture of the musculature. This posture repeats every time the child feels tired until it becomes a vicious motor habit, which is a vicious posture of the spine. Prerequisites for spinal deformities can be found in children using a desk or a chair inappropriate for their height, often physical unilateral load, an early labour process in awkward postures [7, 8].

Spinal deformities in the anterior-posterior direction are characterised by increased or decreased physiological curves of the spine. Compared to the poor postures, with the aforementioned distortions there is always a compensation that occurs both in the spine itself and beyond, including the pelvis. As far as the lateral direction is concerned, the spinal deformation is called scoliosis. It is a complex deformity with torsion and distortion of the spine in three planes: frontal, sagittal and horizontal. This is not just a spine deformity, it is a disease with a characteristic clinical picture [9, 10]. Severe stages of spinal deformities alter the position of chest organs, impair the function of the cardiovascular, musculoskeletal, and respiratory system, as well as digestive organs, which adversely affects the general condition and functioning of the individual, and therefore spinal deformities are a serious medical-social problem [1, 8]. Mixed forms of spinal curvature such as scoliosis, combined with a kyphotic spine deformity are common.

In the initial stages of spinal deformities, when there is still only a functional disorder, the process is reversible, and the means of corrective gymnastics can restore the balance of the muscles that support a proper posture.

The development of a healthy and strong young generation is an objective necessity for a modern society. In this connection, physical education and sport are essential for proper motor development. Physical education aims to minimize the harmful effects of sedentary lifestyles on students at all school levels. Various medical studies strongly confirm that vertebral deformities are most prevalent in children in primary school age [1]. Contemporary science of human nature clearly demonstrates that one of the most powerful means of preventing a disease, increasing the resistance of the child's organism, and enhancing physical and mental capacity, is active motor activity [5].

Purpose of the Study:

By applying sets of corrective exercises in Physical education and sports classes to 11-12-year-old pupils in order to improve the strength and endurance of the body muscles as well as the body posture.

Materials and Methods

The study was applied to 16 pupils in one class at a school in Ruse, Bulgaria. The parents of the pupils gave their consent to the pupils' participation in the experiment with duration of one school year (September 2016 - May 2017). The children were aged between 11-12 years, with 9 girls and 7 boys examined. No one of them had practiced corrective gymnastics until the beginning of the experiment and to all pupils the sets of exercises was new.

The following tests were applied in the study:

Investigation of anthropometric indicators:

Height - Measured in the morning (typically, the height measured in the morning is greater than the one measured in the afternoon or in the evening). A pre-lined wall was used for the measurement. The unit of measurement was **centimetres**.

Weight - measured in the morning on an empty stomach - unit of measurement: **kilograms**.

Body Mass Index - used to determine normal weight values and, respectively, the degree of obesity / malnutrition in different individuals. The index is calculated by dividing the weight in kilograms by the height in meters per square.

Specialized tests:

Depth of the bend forward - from a main posture on a stool / bench, the student leans forward, in which case the knee joints are extended. The aim is that the student, with both hands (moving parallel downwards), touches with their fingers as low as possible. This is executed slowly without springing. The bend forward is measured with accuracy to 1 cm. If the student's achievement is above the surface (on which the student is standing), it is denoted by a minus sign, and below the surface - by the plus sign. If the hand reaches the surface of the tread, the mark is zero. A higher result is obtained with a higher score denoted by a plus sign.

Depth of the bend to the side - to the left and to the right. From a standing position, the student leans to the left and to the right without bending their body forward or folding their knees. The unit of measurement is centimetres. The measurement is from the tip of the middle finger to the ground on the left and on the right side.

Static strength endurance of the abdominal muscles - Here we measure the maximum amount of time, in which the body remains in a half-standing posture. The starting position is a supine position, the student starts moving to a half-standing posture up to 45 degrees lifting of the body, the hands are placed behind the neck, and the student remains in this position as long as possible.

Static strength endurance of the dorsal muscles - Here we measure the maximum amount of time, in which the body remains lifted. The starting position is a prone position, the arms are clenched in the elbows and the hands are placed under the chin.

Dynamic strength endurance of the abdominal muscles - clarification - a number of repetitions from a starting supine position, hands behind the neck, the student lifts the body.

Dynamic strength endurance of the dorsal muscles - a number of repetitions from a starting prone position, hands behind the neck, the student lifts their body.

Methodology of corrective gymnastics for prevention and control of spinal deformities in physical education and sports classes for children in 5th grade

There were two variants of a set of corrective exercises in the preparatory, main and final part of the physical education lesson, including line-up exercises, rearranging exercises, walking exercises with different positions of the feet and the upper limbs, exercises with a gymnastic stick, on a gym mat from a horizontal position of the spine, on a gymnastic wall and games of a corrective character. The use of corrective exercises of this type did not prevent the implementation of the basic tasks of each lesson of physical education and sports, and they were conducted in due course. The overall ratio between corrective exercises and other physical activity in physical education and sports classes was approximately 25% to 75%.

Results and Discussion

Analysis of the results of the anthropometric tests

The anthropometric indicators height, weight, and Body Mass Index were examined at the beginning and at the end of the experiment. The variation analysis of the anthropometric indicators at the beginning (Table 1) and at the end of the experiment (Table 2) shows that the dispersion of the indicators did not show any significant differences with the exception of the Body Mass Index, which demonstrated a more pronounced dispersion of the indicator in the initial study compared to the final one.

Table 1. Variation analysis of the results of the study of anthropometric indicators (September 2016)

№	Test	min	max	R	\bar{X}	S	V%
1.	Height	140	164	24	152,3	6,30	4,14
2.	Weight	31.80	61.10	17.89	43.21	8.44	8.39
3.	Body Mass Index	13.84	23.22	9.38	18.6	2.89	15.57

Table 2. Variation analysis of the results of the study of anthropometric indicators (May 2017)

№	Test	min	max	R	\bar{X}	S	V%
1.	Height	145	167	22	155.6	5.89	3.78
2.	Weight	33	64	31	45.16	8.39	8.57
3.	Body Mass Index	13.72	22.95	9.23	18.7	2.81	7.6

The average values of the indicator *height* at the beginning and at the end of the experiment are respectively $X_1 = 152.3$ cm and $X_2 = 155.6$ cm (Figure 1). The calculated difference between these two averages is $d = 3.3$ cm. During the experiment from September to May it is normal for the pupils to grow up, especially considering that the age of 11-12 years is characterized by pronounced growth of the locomotor system.

The average values of the indicator *weight* shown on Figure 1 are $X_1 = 43.21$ kg and $X_2 = 45.16$ kg respectively, and the difference is $d = 1.95$ kg, indicating that the pupils did not significantly increase their body weight during the experiment period. The average values of the Body Mass Index measured at the beginning and at the end of the experiment are respectively $X_1 = 18.6$ and $X_2 = 18.7$, with a slight difference $d = 0.1$, which is statistically insignificant. The average levels of the indicator Body Mass Index at the beginning and at the end of the experiment indicate that the pupils generally have normal body weight for their age.

The results of the study of anthropometric indicators show that the changes in the child's organism are due to normal physiological processes of growth and development of the musculoskeletal system and are not the result of a deliberate impact.

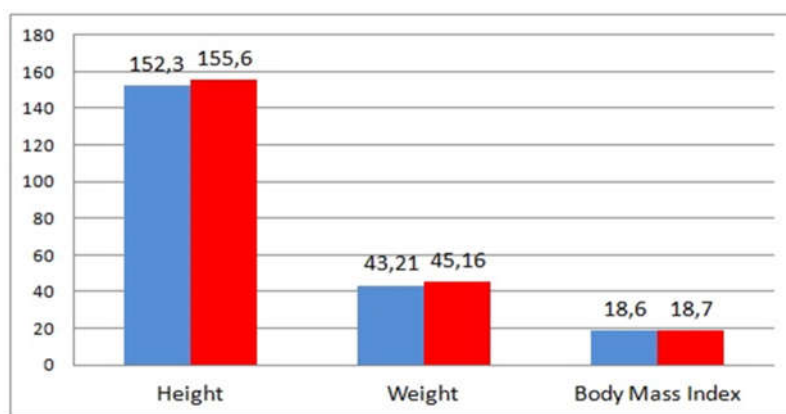


Figure 1. Comparative analysis of the results of the anthropometric indicators

Analysis of the results of the specialized tests

The variation analysis of the specialized tests at the beginning and at the end of the experiment is shown on Table 3 and Table 4. Looking at the two tables, we can draw the conclusion that the magnitude values, the standard deviation, and the coefficient of variation show greater heterogeneity of results in the initial examinations, while at the end of the experiment, the dispersion of the indicators decreases. Exceptions are the results of the static strength tests for abdominal and dorsal muscles, where the values of dispersion of the indicator remain high in the second examination. Perhaps this is due to the poor physical fitness of the children at the beginning of the experiment, as well as to the difficulty of the tests and the different baseline.

Table 3. Variation analysis of the results of the specialized tests (September 2016)

№	Test	min	max	R	\bar{X}	S	V%
1.	Depth of the bend	-20	7	27	-6,69	9.74	94.93
2.	Depth of the bend to the right	31	47	16	37.73	4.37	11.57
3.	Depth of the bend to the left	32	49	17	38	4.96	13.04
4.	Static strength endurance of the dorsal muscles	8	90	82	44.88	20.4	45.46
5.	Static strength endurance of the abdominal muscles	14	102	98	52.87	31.21	59.03
6.	Dynamic strength endurance of the dorsal muscles	16	22	6	18.4	1.92	10.43
7.	Dynamic strength endurance of the abdominal muscles	15	40	25	27.5	6.96	25.27

The average values of the depth of the bend at the beginning and at the end of the experiment are, respectively, $\bar{X}_1 = -6.69$ cm and $X_2 = -1.69$ cm (Figure 2). The difference between these two averages is $d = 4.47$ cm, which is statistically insignificant at Student's *t* - criterion for dependent values of 1.83 and a guarantee probability of less than 95% at a degree of freedom $k = 15$ and $\alpha = 0.05$ suggests that the applied sets of corrective exercises does not contribute to the flexibility of the spine. This is understandable considering the aim of the exercises, i.e. primarily to strengthen the torso muscles and less to contribute to the flexibility of the spine, which is contraindicated in the corrective gymnastics.

Table 4. Variation analysis of the results of the specialized tests (May 2017)

№	Test	min	max	R	\bar{X}	S	V%
1.	Depth of the bend	-16	12	28	-1.69	8.62	74.36
2.	Depth of the bend to the right	29	48	19	38.67	4.55	11.76
3.	Depth of the bend to the left	29	48	19	38.33	4.91	12.81
4.	Static strength endurance of the dorsal muscles	25	118	93	73.67	38.32	38.44
5.	Static strength endurance of the abdominal muscles	38	154	116	75.13	34.81	46.33
6.	Dynamic strength endurance of the dorsal muscles	22	36	14	28.13	3.8	13.49
7.	Dynamic strength endurance of the abdominal muscles	29	52	23	40.13	5.73	14.28

The average test values of the depths of the bend to the left and to the right at the beginning of the experiment and at the end of the experiment were respectively $X_1 = 37.73$ cm and $X_2 = 38.67$ cm and $X_1 = 38$ cm and $X_2 = 38.33$ cm, where the differences are respectively $d = 0.93$ and $d = 0.33$, which are statistically insignificant and the guarantee probability is less than 95%. This indicates that the applied methodology does not improve the flexibility of the spine of the pupils in the lateral direction.

The average values obtained from the static strength endurance tests of the dorsal and abdominal muscles at the beginning and at the end of the experiment are respectively $X_1 = 44.88$ sec and $X_2 = 73.67$ sec and $X_1 = 52.87$ sec and $X_2 = 75.13$ sec, with the differences being respectively $d = 31.47$ sec and $d = 20.8$ sec, which is statistically insignificant at Student's t-criterion of 2.56 and 2.89 and the guarantee probability $P_t > 95\%$. This shows that the applied set of corrective exercises in physical education and sports classes leads to an improvement in the static muscular strength of the abdominal and dorsal muscles, which is essential for maintaining the spine upright and preventing spinal deformities.

The average values obtained from the dynamic strength of the dorsal and abdominal muscles tests at the beginning and at the end of the experiment were respectively $X_1 = 18.4$ sec and $X_2 = 28.13$ sec and $X_1 = 27.53$ sec and $X_2 = 40.13$ sec, the differences being respectively $d = 9.73$ sec and $d = 12.6$ sec, which is statistically significant at Student's t-criterion of 2.86 and 3.12 respectively and the guarantee probability $P_t > 95\%$. This confirms the hypothesis that the applied set of corrective exercises will result in positive changes in the musculature supporting the spine.

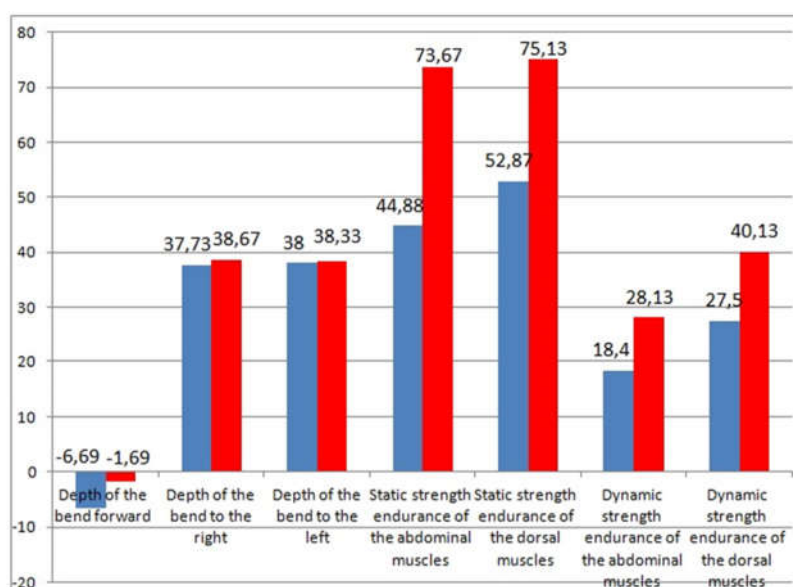


Figure 2. Comparative analysis of the results of the specialized tests

The results obtained from the specialized tests indicate the good effectiveness of the sets of corrective exercises in terms of strengthening the torso muscles and opposing the tendencies for spinal deformities and improving the body posture.

Conclusions

1. Through the literary review we were able to prepare a set of corrective exercises intended for physical education and sports classes with 11-12 year old pupils.
2. The proper selection of corrective gymnastics means helps increase the static and dynamic muscular strength of the abdominal and dorsal muscles, which improves the spine stability as well as the body posture.
3. The efficacy of the applied set is evidenced by the significantly better results and significant differences achieved in the second study in terms of muscle strength and spine stability.
4. Corrective exercises are recommended to be included in each lesson in Physical Education and Sports as part of the lesson to prevent spinal deformities.

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ISOKINETIC PEAK TORQUE VS 1RM TESTS AS RELIABLE METHOD TO FOLLOW UP POWER DEVELOPMENT

UDC: 796.015.52
(Original scientific paper)

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Abstract

The objective of this research was to compare the isokinetic test for maximum peak torque and one-repetition maximum test, as methods for assessment of the maximum strength of the subjects arm flexors. On 14 subjects, non-athletes, at age of 19 +/- 0.5 years, 6 weeks of experimental programme was conducted to stimulate the elbow flexors with maximum muscle load. Exercises (flexion) were performed by lifting external weight with one-arm weight on Scott bench. The isokinetic maximum peak torque and one-repetition maximum were tested in three time sequences (1. beginning, 2. after the 3th week and 3. after the 6th week. Results shows that there is no statistically significant difference in the maximum torque in the subjects tested after first three weeks of exercises ($p=0.43$, $d=0.24\pm0.40$), after the next three weeks, 3rd to 6th week ($p=0.68$, $d=0.27\pm0.23$) as well as in total of 6 weeks of the experimental procedure ($p=0.78$, $d=0.51\pm0.53$). The results for one-repetition maximum test, shows significant positive changes in the values for the arithmetic mean for maximum strength after the 3rd week, by 20.9% [± 7.9] for $p=0.00$ ($d=0.45\pm0.15$) between 3rd to 6th week by 19.9% [± 5.0] ($p=0.00$; $d=0.43\pm0.10$) and in total following the 6 weeks of training, significant change by 45.0% [± 10.6] at level $p=0.00$ ($d=0.88\pm0.17$). Those differences in test probably appear because of the [1] manner in which maximum torque test is performed (biomechanical differences between to tests), [2] simultaneous testing of flexion + extension as a part of biodex testing protocol, as well as the [3] phenomena of "learned movement" during exercises, which is slightly different compared to the movements executed when testing the Biodex devices.

Keyword: maximum peak torque, 1RM, isokinetic, training, flexors, experimental program, muscle power

Introduction

Contemporary lifestyle requires efficient time utilization. Practitioners, during recreation and sports, prefer to conduct activities that are efficient for them, and for which least time will be consumed for the realisation of their objective, which is the transformation of specific motor capacity. On the other hand, the research community, in the field of kinesiology, is under increasing pressure to go into details when setting fitness programmes and the control thereof. The objective is to make them functional, so as to present them at the fitness market.

When creating fitness programmes, the initial step is to set an experimental programme the functionality of which is to be proven. In order to present the programme effects, it is necessary to select real measuring mechanisms-tests, which will be used for the purposes of making an actual assessment of the achievements from experimental procedures.

For the experimental procedures in which maximum muscle strength is transformed, the one-repetition maximum 1-RM test is most often used (Milenkovski J., Jovanovski J., Strezovski G.,). However, the need for more precise evaluation of the muscle strength capacity has launched the isokinetic machines on the market, as a laboratory variant for power capacity assessment, with vast (and quality) number of information, collected within a short period, in only few movements in particular joint of the human body (Brown, L. E., 2000).

Isokinetic tests are not entirely new; they have been used long time ago as muscle strength test method. In 1967, Perrine introduced a new speed-controlled device which was described as 'cybernetic exercise'

(Wimpenny P., 2016). In 2017, the technology has developed the current three-dimensional isokinetic machines, which are increasingly becoming part of each sport laboratory.

As an easy and precise method for muscle potential assessment, isokinetic machines are used particularly for medical purposes, as post-operative arthroscopy for muscle strength testing (Ericsson YB, 2006; Koutras G, 2012; Woods GW, 2006; Miura K, 2004), as well as for restoring of the muscle function (Fabiś J, 2007; Asagumo H, 2007; Moisala AS 2007). In their meta-analysis Ellenbecker et al (2000), concluded that: "Isokinetic training and testing is an important part of the comprehensive evaluation and rehabilitation of the patient with a shoulder injury. Research has demonstrated its efficacy in training and in providing clinically relevant information regarding muscular performance"

According to different joints of human body, isokinetic find good practice in testing/ rehabilitation in knee Harilainen, 2006), shoulder Bellumore Y, Mansat M, Assoun J. (1994), elbow (Peeters T et al., 2009), wrist (Croisier JL et al, 2007), hip (Boling MC, Padua DA, Alexander-Creighton R, 2009) or ankle (Gribble PA, Robinson RH., 2009).

In kinesiology research, isokinetics assumes a high position as a method for assessment of the strength capacities of the subjects, Brown, L. P., et al, 1988, (max. peak torque); Bennell, K., et al, 1998; Ellenbecker, T. S., et al, 2006), and especially the maximum torque test, Perrin, D. H. (1993). This is particularly due to the fact that metric specifics are with high coefficients, which is of particular importance for the scientific research procedures (Bohannon, R. W., 1986; Feiring, D. C., et al, 1990; Sole, G., et al., 2007; Saenz, A., et al. 2010).

The objective of this research was to compare the isokinetic test for maximum peak torque and the one-repetition maximum test, as methods for assessment of the maximum strength potential of the subjects.

Both test (1RM and max. peak torque) are recommended as muscle strength assessment methods (Brown, L., Weir, J.P., 2001). Nevertheless, there are claims that the results obtained by maximal peak torque and 1RM are not equivalent when evaluating individual responsiveness and/or the efficacy of an intervention on muscle strength, as the results obtained show large variations and can be even conflicting, Gentil, P., et al, (2017), but they did not include elbow flexor's in their research.

In this research, the method for comparison of the two tests was through implementation of an isolated experimental procedure, and whether it shall demonstrate that maximum torque and the 1RM test are identical tests which assess the maximum power of the subjects.

Materials & Methods

The research was conducted on 14 subjects, non-athletes, at age of 19 +/- 0.5 years.

The objective of the experimental programme was to stimulate the elbow flexors with maximum muscle load (1 to 3 repetitions). Exercises (flexion) were performed by lifting external weight with one-arm weight on Scott bench (for elbow flexor muscles- m.biceps brachii, m.brachialis, m.brachioradialis). Before launching the experimental programme, subjects were tested for one-repetition maximum (1RM) on Scott bench as well as for maximum peak torque (BIPTRQ), on isokinetic machine. All subjects have executed the programme within a six-week period, and have worked with maximum external load, three times a week. Dosage of external load in the experimental programme was the same for all subjects, and was defined from the one-repetition maximum test, amounting 90% of 1RM of the achieved results. The number of repetitions was limited to one, and up to mostly 3 repetitions. The number of sets was limited to 3 sets per training. Break between series was limited to 3-5 minutes. Changes of muscle strength in the subjects (for both groups) was individually monitored, at each training, so as to intervene in the external load, thus maintaining the load level of 90% of 1RM throughout the programme. This means that weight was chosen for each subject, at each training, which limited the number of repetitions in each series from one to three repetitions. In this manner, it was ensured that muscle loads during exercises were maintained within the zone of muscle strength stimulations, with no more than 3 repetitions. Personal records were kept for each subject throughout the experimental procedure (42 days, 18 exercise units) so as to record potential personal changes of muscle strength. Following the three-week treatment (21 days), control test was conducted for 1RM and the maximum torque. Following the realisation of the six-week experimental programme, at the final testing (42nd day), the envisaged tests were implemented, as on the control testing.

The isokinetic maximum peak torque test -BIPTRQ [Nm] was tested on Biodex Multi-Joint System (#900-550), machine. Subjects were tested fixed on the machine in a seating position. The non-dominant arm was supported by the upper arm at height of 45° against the torso. Subjects performed 5 maximum

repetitions (flexion/extension) on the biodex machine, at speed of 60 degrees/second. Results are presented in kilograms [kg];

The one-repetition maximum test (1RMBI) was tested on Scott bench (under angle of 45° against the floor vertical), with one-arm weights from 1-20 kg, at elbow flexion, on the non-dominant arm. Subject is in standing position, upper arm on the non-dominant arm, with its rear side (with all its surface) supported by the front bench side. Results are presented in kilograms [kg];

Differences in groups, for applied tests, from initial, to control, and up to the final measuring, were tested with Wilcoxon post hoc test. The Cohen's d effect size with 90 % CL were evaluated as trivial (0–0.19), small (0.20–0.49), medium (0.50–0.79) and large (0.80 and greater) (Cohen, 1992).

Results

Post hoc (Wilcoxon) test, Table No 2, has shown that there is no statistically significant difference in the maximum torque (BIPTRQ) in the subjects tested after three weeks of exercises (p=0.43, d=0.24±0.40), as well as in the next three weeks (3rd to 6th week) of the experimental procedure (p=0.68, d=0.27±0.23). The Wilcoxon test, realised on the data from the initial and final testing (after 6 weeks of the experimental procedure), also showed no statistically significant changes in the values for the maximum torque (p=0.78, d=0.51±0.53).

Table No 1. presents the basic statistical indicators for the tests for one-repetition maximum and the maximum torque.

Table 1. Basic statistics

test	Initial			control			final		
	mean±Sd	Min	Max	mean±Sd	Min	Max	mean±Sd	Min	Max
1RMBI	13.32±1.20	12.00	15.00	16.42±2.19	12.50	20.00	19.41±2.38	15.00	23.50
BIPTRQ	49.25±7.44	36.50	64.80	47.91±6.52	29.60	55.00	48.18±6.11	37.30	57.30

1RMBI-one repetition maximum; BIPTRQ-max pick torque (isokinetics);

Table 2. In the groups differences, change in mean % and effect size at initial, control, and final tests, for flexor muscles (BIPTRQ-test).

Test: BIPTRQ	Wilcoxon p-level	Change in mean %	Chances for value: smaller/similar/greater	Uncertainty in the true differences	Cohen's d ± 90% CL
initial/control	0.43	6.6 ±11.4	59/37/4	possibly +ive	0.24 ± 0.40
control /final	0.68	7.4 ± 6.4	73/27/0	possibly +ive	0.27 ± 0.23
initial/final	0.78	14.5 ±16.3	85/13/2	likely +ive	0.51 ± 0.53

initial/control - first 3 weeks; control /final-second 3 week (3th to 6th week); initial/final- total 6 weeks of experimental program

Unlike the statistical analysis of the BIPTRQ test, for the one-repetition maximum test (1RMBI), the test results have shown significant positive changes in the values for the arithmetic mean for maximum strength after the 3rd week, by 20.9% [±7.9] for p=0.00 (d=0.45±0.15). In the second part of the programme (3rd to 6th week), the maximum strength of the subjects was statistically significantly improved by 19.9% [±5.0] (p=0.00; d=0.43±0.10). When testing the changes of the total effect following the 6 weeks of training, significant change is observed by 45.0% [±10.6] at level p=0.00 (d=0.88±0.17) between the initial and final test. This interpretation is supplemented by the information from Table No 1 on the mean value for the minimal [min] and maximal [max] result of the lifted weight in the three tests.

Table 3. In the groups differences, change in mean % and effect size at initial, control, and final tests, for extensor muscles (1RMBI-test).

Test: 1RMBI	Wilcoxon p-level	Change in mean %	Chances for value: smaller/similar/greater	Uncertainty in the true differences	Cohen's d ± 90% CL
initial/control	0.00	20.9 ±7.9	99/1/0	very likely +ive	0.45 ± 0.15
control /final	0.00	19.9 ±5.0	100/0/0	most likely +ive	0.43 ± 0.10
initial/final	0.00	45.0 ±10.6	100/0/0	most likely +ive	0.88 ± 0.17

initial/control - first 3 weeks; control /final-second 3 week (3th to 6th week); initial/final- total 6 weeks of experimental program

Discussion

The objective of the research was to answer whether the isokinetic tested maximum torque is a good example for the progress of maximum strength in subjects following the six-weeks training, of the elbow flexors, with free weight training.

A unique finding in this research is that maximum torque does not really present the progress of maximum strength in elbow flexor muscles (non-dominant arm), following the 6-week training with free weights. Unlike the maximum torque, the one-repetition maximum test, executed with free weights, has displayed significant changes in the three testing points. The conclusions of this research are similar to the conclusions of Gentil, P., et al., 2017, de Souza et al., 2010; Feiereisen et al., 2010; Gentil et al., 2010.

Similar method, yet reverse training manner (in reference with this research), was performed by Ratamess, et al. (2016). They performed 6-week training on isokinetic machine, and muscle strength assessment with free weight test. Authors have presented that the free weight test presents the existence of positive changes following the training on isokinetic machine.

Conclusion

Having in mind the research results, perhaps the answer should be sought in:

1. The manner in which maximum torque test is performed.

Although, to a significant extent, movements on the Biodex machine that were performed so as to test the flexor muscles, simulate movements which were also executed during training, the results have, however, shown that most probably these are not identical movements (Biodex vs 1RM). In biomechanics terms, training with free weights required involvement of muscles that help the movement, such as muscle fixators and similar (Vuksanovic, V., Handjiski, Z., & Handjiska, E. (2014). In addition, the 1RM test procedure is identical method with the training. However, with the biodex testing, although generally, the same large musculature in the elbow joint is included, it still does not refer to lifting of free weights, but opposition to force generated by the branch of the machine whose lever has precisely defined trajectory of movement. Similar interpretations can be found at Gentil, P., et al., 2017; Chmelo et al., 2015; Churchward-Venne et al., 2015; Gentil et al., 2015a.

2. This procedure uses the method for simultaneous testing of flexion + extension, which could potentially have an impact on the maximum torque results. In general terms, biodex procedures are executed in this manner so as to perceive whether there is an imbalance between the two opposite muscle groups in the elbow joint (agonists/antagonists).

3. Potentially, the increase in lifted weight (tested through one-repetition maximum) is based on "learned movement" during exercises, which is slightly different compared to the movements executed when testing the Biodex devices.

Recommendation for future research: perhaps it is necessary to also choose another type of angle speed in case of isokinetic testing. This research used angle speed of 60 degrees/second.

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TRUNK ROTATIONAL VELOCITY IN YOUNG AND OLDER ADULTS: A ROLE OF TRUNK ANGULAR DISPLACEMENT

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(Original scientific paper)

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Abstract

This study investigates the relationship between peak and mean velocity during trunk rotations and respective angular displacement in young and older adults. Altogether 91 young and older subjects of both genders performed 5 rotations of the trunk to each side, in a seated position, with a barbell of 1 kg and 20 kg placed on their shoulders behind the neck. Basic parameters throughout the trunk rotational movement were monitored using the FiTRO Torso Dynamometer. Two-way ANOVA indicated a significant interaction between age and trunk angular displacement in determining velocity of trunk rotations ($P < 0.01$). Peak velocity was significantly higher in young than older adults with both 1 kg ($699.1 \pm 90.5^\circ/s$ and $564.3 \pm 71.5^\circ/s$, $p = 0.021$) and 20 kg ($267.7 \pm 41.1^\circ/s$ and $206.1 \pm 35.0^\circ/s$, $p = 0.014$). Similarly, mean velocity in the acceleration phase of trunk rotations was significantly higher in young than older adults with both 1 kg ($420.2 \pm 62.7^\circ/s$ and $342.4 \pm 56.6^\circ/s$, $p = 0.023$) and 20 kg ($150.8 \pm 33.8^\circ/s$ and $117.6 \pm 29.0^\circ/s$, $p = 0.017$). Trunk angular displacement was also significantly higher in young compared to older subjects with both 1 kg (peak values: $188.3 \pm 36.5^\circ$ and $156.5 \pm 31.7^\circ$, $p = 0.036$; mean values: $104.5 \pm 25.4^\circ$ and $88.5 \pm 21.9^\circ$, $p = 0.043$) and 20 kg (peak values: $166.2 \pm 27.2^\circ$ and $132.6 \pm 24.6^\circ$, $p = 0.027$; mean values: $83.9 \pm 19.3^\circ$ and $69.7 \pm 18.1^\circ$, $p = 0.038$). Furthermore, peak and mean values of velocity correlated significantly with a range of trunk rotational motion at both weights used in young (r ranged from 0.650 to 0.790, $p < 0.05$) as well as older adults (r ranged from 0.772 to 0.927, $p < 0.01$). These findings indicate that slower velocity of trunk rotations is most likely due to a limited range of trunk rotational motion, which is more evident in older adults. This fact has to be taken into account for practitioners of sports, such as canoeing, golf, table tennis and tennis that require rotational movements of the trunk under unloading or loading conditions.

Key Words: *peak and mean velocity, range of trunk rotational motion, trunk rotations*

Introduction

The core musculature is the base for efficient movement and maximum power production during trunk rotations. Previous research indicates that trunk muscle strength, trunk coordination and trunk range of motion (ROM) determine a) the trunk position which impacts on force application on the hand rims, b) the trunk stability which decreases paradoxical movements, making arm movements and force application more effective, and c) the trunk movement which determines the range of the push rim that can be used in each push stroke (Altmann et al., 2015).

Lack of flexibility has been related to a decrease in performance (Shellock & Prentice, 1985). Reduced ROM of the hips and the thoracic spine, which allows the greatest rotation because of the orientation of the joints (Sahrmann, 2002), could contribute to lower velocity of the trunk rotational movement and consequently decrease throwing or striking speed. Sports that involve throwing motions require the production of an explosive movement in either the transverse or oblique planes (Earp & Kraemer, 2010). The force is transferred sequentially from the proximal segments, such as hips, toward the more distal segments, such as the shoulders and arms. Because of the kinetic linkage of the proximal to distal sequence

in throwing (Putnam, 1993), the rotational mobility might play an important role in the production of trunk rotational power. This power transference of the proximal segments, such as the hips and upper trunk, may be crucial to throwing speed.

Therefore, adequate ROM of the hips and the thoracic spinae is necessary for the production of trunk rotational velocity and consequently also for throwing speed. Rivilla-García et al. (2011) reported a high correlation ($r = 0.90$) between a light overhead medicine ball throw (0.8 kg) and handball-throwing velocity. Conversely, Kohmura et al. (2008) reported that the scoop medicine ball throw has very little shared variance with baseball fielding (throwing distance, standing long jump, and agility T-test) (~7%) compared with batting (~14%). Recently, Talukdar et al. (2015) examined the role of rotational power and mobility on cricket ball throwing speed using a linear position transducer attached to the weight stack of a cable pulley system, to measure chop and lift power. According to the authors, greater ROM at proximal segments, such as hips and thoracic, may not increase throwing speed in cricket players as reduced ROM at proximal segments can be useful in transferring the momentum from the lower extremity in an explosive task such as throwing.

This issue is not related to only professional athletes but also physically active young and older adults practicing sports such as tennis, golf or canoeing that involve rotational movements of the trunk. However, aging is associated with increased skeletal muscle stiffness. In particular, older adults experience different dynamic spinal stiffness and loading compared to younger adults during a functional lifting task (Quirk et al., 2014). An increase in muscle stiffness is possibly associated with the decrease in ROM of joints with advancing age. Flexibility systematically decreases with aging, with female participants being more flexible across all ages and having a more gradual, 0.6 %/year vs. 0.8 %/year, age reduction. This age-related loss of mobility is joint-specific (Medeiros et al., 2013). In general, proportionally, shoulder and trunk became less flexible, while elbow and knee mobility was preserved to a greater extent. The authors speculate that extreme ROM positions in the movements of these two most affected joints—shoulder and trunk—are rarely performed in daily living conditions, which may predispose to a more accelerated reduction in the maximal ROM for their various movements.

Moreover, thoracic ROM during trunk extension decreases significantly with age for males (Hashimoto & Kuno-Mizumura, 2010). For females, a significant increase of kyphosis and a significant decrease of thoracic ROM during trunk extension with age is apparent. On the other hand, the authors observed no significant effects of aging in kyphosis for males and in thoracic ROM during trunk extension for females. In addition, a significant decrease of lumbar lordosis and ROM were confirmed for both males and females. From the results of this study, it is suggested that the effects of aging differ in the thoracic and lumbar spine, and could differentially contribute to joint mobility in these spine regions. Whilst young and older adults have similar ROM in the thorax and in the pelvis, older adults demonstrate a reduced ROM of the lumbar spine (Sung, 2016).

Such lower spine mobility in older adults may have functional consequences on the trunk rotational movement. However, it is still unknown what role trunk flexibility plays in velocity and power production during trunk rotations and whether it depends on age and gender. We assume that low trunk rotational velocity in older adults could be related to low levels of trunk flexibility. Verification of this assumption was accomplished by investigation of the relationship between peak and mean velocity during trunk rotations and respective angular displacement under unloading and loading conditions in young and older adults.

Material & methods

Participants

A group of physically active young and older adults volunteered to participate in the study (Table 1). The participants were included in the study only if they subjectively did not report back pain. Individuals who had previously undergone surgery or other medically invasive procedures for the lower back were excluded from participation in the study. They were all informed of the procedures and the main purpose of the study. The study was performed in accordance with the ethical standards on human experimentation outlined in the Declaration of Helsinki.

Table 1. Descriptive characteristics of young and older adults of both genders.

	Male young adults	Male older adults	Female young adults	Female young adults
N	25	17	22	27
Age (years)	22.1 ± 3.5	60.9 ± 3.3	21.4 ± 2.8	63.4 ± 4.2
Height (cm)	180.2 ± 8.1	175.1 ± 8.8	170.4 ± 7.7	160.7 ± 6.7
Body mass (kg)	85.6 ± 11.4	92.8 ± 13.8	59.3 ± 5.4	69.8 ± 10.0

Experimental design

Before testing, participants were given a visual demonstration of the proper exercise technique and were kept informed of the instructions during testing. Following the warm-up, they were exposed to a familiarization trial during which they performed seated trunk rotations in a slow and controlled manner, while keeping the back straight. They were then required to complete five repetitions of trunk rotations to each side, in the seated position, with a barbell of 1 kg and 20 kg placed on their shoulders behind the neck. They were instructed to perform trunk rotations with maximal effort in the acceleration phase. Emphasis was placed on the proper position of the body while seated on a chair and holding the barbell on the shoulders with the hands. Their legs were strapped to the chair and their feet were inserted into board bindings. They began with trunk rotations to the right (or left) side, then rotated their torso forcefully from the right (or the left) towards the opposite side until the body reached the end position, and finally they slowly returned to the starting position. The test was then repeated for the opposite side of the body. They had to engage their core muscles to stiffen the torso and stabilize the spine. A laboratory assistant ensured that participants remained upright throughout the movement and that the head, chest and torso were aligned over their hips. The same experienced researchers conducted the measurements during testing sessions.

Basic parameters throughout the trunk rotational movement were monitored using the FiTRO Torso Dynamometer (FiTRONiC, Slovakia). This system allows the seat height to be individually adjusted whilst the lower limbs are fixed in place. The system monitors rotational movement of the barbell by means of the mechanically coupled precise angular velocity sensor. Angular acceleration was obtained by derivation of angular velocity. Angular displacement was calculated as an integral of angular velocity over time. Peak and mean values of angular velocity from the acceleration phase of trunk rotation as well as angular displacement were analysed.

Statistical analysis

Data analyses were performed using the statistical program SPSS for Windows, version 18.0 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics, including mean and standard deviations were calculated for all variables.

Data was analyzed by two-way ANOVA (age x trunk rotational velocity) and analysis of covariance (ANCOVA) that included sex as a covariate. In the case of a significant F value, a post hoc test with Scheffe's method identified significant differences among mean values. The criterion level for significance was set at $p \leq 0.05$.

Previous studies have not identified significant differences in peak torque in strength testing, or in total work in the rotational endurance testing between the dominant and non-dominant side in healthy golfers, the control group and golfers with low back pain (Lindsay & Horton, 2006). Likewise, there were no significant differences in the mean power produced during the standing cable wood chop exercise on the left and the right side with all weights used in a group of fit healthy men (Zemková et al., 2017a). Taking these findings into account, we assumed no side-to-side differences in trunk rotational velocity in healthy physically fit adults.

Correlations between peak and mean values of trunk rotational velocity and respective angular displacement in young and older adults were assessed by calculating Pearson's product moment correlation coefficient. Total variance is reported by the coefficient of determination. The level of significance was set at $\alpha = 5\%$.

Results

Two-way ANOVA indicated a significant interaction between age and trunk angular displacement in determining velocity of trunk rotations ($P < 0.01$).

Peak velocity was significantly higher in young than in older adults with 1 kg ($699.1 \pm 90.5^\circ/\text{s}$ and 564.3

$\pm 71.5^\circ/\text{s}$, $p = 0.021$) as well as with 20 kg ($267.7 \pm 41.1^\circ/\text{s}$ and $206.1 \pm 35.0^\circ/\text{s}$, $p = 0.014$). Similarly, mean velocity in the acceleration phase of trunk rotation was significantly higher in young than older subjects with both 1 kg ($420.2 \pm 62.7^\circ/\text{s}$ and $342.4 \pm 56.6^\circ/\text{s}$, $p = 0.023$) and 20 kg ($150.8 \pm 33.8^\circ/\text{s}$ and $117.6 \pm 29.0^\circ/\text{s}$, $p = 0.017$). The differences remained significant after normalizing peak and mean values of velocity for sex when analyzed by ANCOVA.

Trunk angular displacement was also significantly higher in young than older subjects with both 1 kg (peak values: $188.3 \pm 36.5^\circ$ and $156.5 \pm 31.7^\circ$, $p = 0.036$; mean values: $104.5 \pm 25.4^\circ$ and $88.5 \pm 21.9^\circ$, $p = 0.043$) and 20 kg (peak values: $166.2 \pm 27.2^\circ$ and $132.6 \pm 24.6^\circ$, $p = 0.027$; mean values: $83.9 \pm 19.3^\circ$ and $69.7 \pm 18.1^\circ$, $p = 0.038$). The differences remained significant after normalizing trunk angular displacement for sex when analyzed by ANCOVA.

Furthermore, trunk angular displacement highly correlated with peak and mean velocity in the acceleration phase of trunk rotation with both 1 and 20 kg in older adults (Table 2). The R^2 values in range from 0.596 to 0.859 indicate that a high proportion of variance could be explained (60–86%). Moderate correlations were also found between trunk angular displacement and peak and mean velocity in the acceleration phase of trunk rotation with both 1 and 20 kg in young adults. The R^2 values ranged from 0.423 to 0.624, explaining 42–62% of total variance.

Table 2. Correlations between peak and mean values of velocity during trunk rotations and respective angular displacement in young and older adults (r values [95% CI]).

Variables	Trunk angular displacement	
	Young adults	Older adults
Peak velocity during trunk rotations with 1 kg	0.673* [0.607, 0.750]	0.803** [0.737, 0.866]
Peak velocity during trunk rotations with 20 kg	0.650* [0.598, 0.706]	0.772* [0.718, 0.824]
Mean velocity in the acceleration phase of trunk rotations with 1 kg	0.790* [0.727, 0.856]	0.927** [0.883, 0.975]
Mean velocity in the acceleration phase of trunk rotations with 20 kg	0.766* [0.711, 0.829]	0.896** [0.832, 0.956]

* $p \leq 0.05$, ** $p \leq 0.01$

Discussion

As expected, peak and mean velocity in the acceleration phase of trunk rotations as well as trunk angular displacement were significantly higher in younger than in older adults with both 1 kg and 20 kg. These values of trunk rotational velocity correlated significantly with the trunk angular displacement at both weights used in young and older adults. These findings indicate that slower velocity of trunk rotations is most likely due to a limited range of trunk rotational motion, which is more evident in older adults. These results are in agreement with our preliminary findings that showed significantly higher mean velocity during trunk rotations and trunk angular displacement in young than in older male subjects, and a significant relationship between these two variables (r ranged from 0.83 to 0.93) (Zemková et al., 2015).

It is most likely that reduced ROM with aging (Araújo 2008; Barnes et al. 2001; Beighten et al. 1973; Doriot & Wang 2006; Intolo et al. 2009; Roach & Miles 1991), as a result of increased trunk stiffness in older adults, compromised velocity of trunk rotational movement. Because some degree of ROM in the major body joints is needed for performing most of the sporting activities, lower trunk flexibility in older adults may have functional consequences. We speculate that due to the limited range of trunk motion, distal parts of the body could contribute more to the velocity of movement (e.g., stroke, kick). This phenomenon was also observed in people with a lack of trunk muscle strength, who compensated for this by the recruitment of shoulder and arm muscles (Seelen et al., 1998; Potten et al., 1999; Schantz et al., 1999).

A recent study of Castillo et al. (2017) suggests that exercises to strengthen the abdominal or back muscles are more likely to be effective at modifying spinal posture in individuals with naturally flexible lumbar spines, or when muscle strengthening is accompanied by stretching to increase lumbar ROM. Strengthening the trunk muscles to modulate lumbar posture is unlikely to be effective in individuals with naturally low lumbar flexibility and in people with immobile lumbar spines. Interestingly, a 10-week course of strength training led to a significant increase of only shoulder horizontal adduction, hip flexion and

extension and trunk flexion/extension in sedentary middle-aged women but not elbow and knee flexion (Monteiro et al. 2008). This could be due to the fact that these later joints were already positioned in daily living near their maximal ROM when compared to the shoulder and trunk joints.

These findings lead us to recommend flexibility training for older adults taking part in sporting activities involving trunk motions. Although for the majority of the aging population, the goal of an exercise program may be to improve functionality in activities of daily living, today's expectation of an increased active life for older people requires more attention be paid to flexibility-specific training interventions for this population. The systematic review by Stathokostas et al. (2012) revealed that flexibility-specific interventions may have effects on ROM outcomes; however there is conflicting information regarding both the relationship between flexibility interventions and the functional outcomes or daily functioning of older adults.

The limitation of the study was that subjects performed seated trunk rotations that reduce the involvement of legs and the contribution of thoracic/hip mobility to the upper-body rotational velocity and power. It is therefore obvious that velocity and power production would be greater during standing than seated trunk rotations and these differences would be more pronounced at higher weights, as shown in our previous study (Zemková et al., 2017b). This may be attributed to a greater trunk rotational mobility while standing as compared to sitting, which allows individuals to accelerate the movement more forcefully at the beginning of rotation. This results in higher trunk rotational velocity and consequently also overall power outputs. Such a comparison of trunk rotational velocity and respective angular displacement during standing trunk rotations at lower and higher weights in subjects of various ages could be a subject of further study.

Conclusions

Peak and mean velocity in the acceleration phase of trunk rotation and respective angular displacement were significantly higher in younger as compared to older adults. These values of velocity of trunk rotations significantly correlated with trunk angular displacement in both groups. These findings indicate that slower velocity of trunk rotations is most likely due to a limited range of trunk rotational motion, which is more evident in older adults. This fact has to be taken into account for practitioners of sports (such as canoeing, golf, table tennis or tennis) that require rotational movements of the trunk under unloading or loading conditions.

Acknowledgements

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Conflicts of interest

The authors declare no conflict of interest.

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TANDEM TEACHING IN PHYSICAL AND HEALTH EDUCATION CLASSES FROM TEACHER'S PERSPECTIVE

UDC: 37.091.312.011.3-051:796

(Original scientific paper)

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Abstract

Physical education is an integrated part of the educational system in Macedonia. Its effectiveness and realization are determined by many factors and teachers are one of those factors. This paper analyses the possibility to influence the effectiveness of PE teaching process by implementing tandem teaching of generalist teachers and physical education specialist at PE classes. In this process, the opinions of the main involved actors are the most relevant for the effectiveness of suggested model. Therefore, the aim of this study was to investigate the opinions of generalist teachers and PE specialist for implementation of tandem teaching. The research was realized on a sample of 118 teachers, 83 generalist teachers and 35 PE specialist from 15 primary schools in the Republic of Macedonia. Specially designed questioner was applied. The results suggest that both group of teachers supports the idea of tandem teaching but also that additional workshop, seminars and other forms of education are required. The paper emphasizes the benefits from implementation of tandem teaching and also suggest the future steps in the implementation process.

KeyWords: *physical education, teachers, tandem.*

Introduction

Education is one of the most important segments in human lives providing knowledge and experiences that determine the future of each human and each country worldwide. As one of the segments of everyday life, education is closely related and influenced by changes in other segments in everyday life and existence – economical, social and political. These changes result with many educational reforms in different segments of education that should make it more reliable to needs and requirements of the society and everyday living. As integrated part of the educational system, physical education is not exception from this process of reforms and constant changes.

The values and importance of quality physical education are recognized by many international institutions such as UNESCO, United Nations, European Commission. UNESCO recognize physical education as “the most effective means of providing all children and youth with skills, attitude, values, knowledge and understanding for lifelong participation in society” (Quality PE report, 2013: pp 6). Values of physical education that are not only related with physical and motor development but also referring to good health, personal development and social inclusion are recognized and emphasized by the European commission (Euridyce report, 2013). In the White paper of sport (European Commission, 2007a) it is underlined that “time spent in sport, whether in school physical education lessons or extracurricular activities, could result in substantial education and health benefits”. These values of physical education are recognized on the national level as well. As underlined in national conception for education of the Republic of Macedonia (2007), physical and health education curriculum is realized with different physical education contents and fundamental motor activities that activates the locomotor system and have a positive impact and influence on symmetric growth and proper holistic development of the children, improving their physical and motor abilities, promoting health and active lifestyle. Other specific goals of PHE are determined as: acquisition of system of motor knowledge and skills, efficient and creative functioning, development of

social conscience, national and cultural identity, development of conscience for care and protection of health and importance of maintaining healthy environment. These specific aims of PHE are in accordance with the main educational goal: holistic and harmonious development of children according to their individual abilities and development characteristics (Conception for nine-year compulsory education, 2007). More important than only theoretical determinations of the goals of PHE education curriculum is its realization, implementation in practice and effects that this implementation has on children. Regarding these issues, teachers' particularly their education, competences and motivation are the key factors for successful implementation of PHE curriculum and realization of PHE process. As emphasized in the report of the Expert Group on Health-Enhancing Physical Activity, (2015) "physical education teachers are key agents for putting physical and sport policies into practice". Putting teachers' work in the spotlight as agents for effectiveness of PHE teaching process, indicates the importance of their work and effects from that work. In this regard, and related to previously indicated processes of constant reforms in the educational system aiming to make it more reliable to the needs of contemporary society, are the last reforms in the educational system in Macedonia.

Namely, the current situation in Macedonia related to PHE teaching process and its effectiveness indicates a decrease in the quality of its realization. Although there is an evident lack of research data that will justify this decrease in the quality of PHE realization, it is notable and evident in everyday work and practice. Apart from common problems and obstacles that exist in everyday work related to PHE process such as lack of equipment and material facilities, improperly designed certain unions in the current curriculum (Popeska, Klincarov, Mitevski & Nikovski, 2017) some of the noted problems are also related to teachers' education, competences and possibility for constant learning and improvement. In this regard, teachers reported a lack of instructions for work for specific thematic unions within the regular curriculum, problems with practical realization and demonstration of certain contents as well as a lack of opportunities for professional development (Popeska et al., 2017). These results indicate that certain changes are needed in the segment of teachers' work and delivery of physical education. In this regard, using the positive experience from some European countries in the first line the experience from Slovenia, one of the suggested reforms in education in Macedonia is implementation of Tandem of generalist teacher and PHE specialist in PHE teaching process in primary education.

Currently, in the primary school education system in the Republic of Macedonia, general primary school teachers (classroom teachers) up to 5th grade and specialized PE teachers that teach only PE at 6th, 7th, 8th and 9th grade deliver the subject physical and health education. Considering the educational work that they should deliver as well as the different age groups that they are working with, the university education of these two groups of teachers is quite different. Generalist teachers are educated at Teaching Faculties and Faculty of Philosophy, particularly Institute for Pedagogy. PE specialists are educated at Faculty of Physical Education, Sport and Health. The education of both groups of teachers as well as within the group of generalist teachers is different regarding the knowledge for bases of physical education, methodical and didactical aspects of realization of PHE teaching process, knowledge for development characteristics of children in different age periods, PHE contents and level of practical preparation (Malcev & Popeska, 2017). The suggested reforms for implementation of tandems should integrate the qualifications of both groups of teachers and consequently is expected to improve the effectiveness of realization of PHE teaching process and effects on children.

The tandem by itself means common work of generalist teachers and PHE subject teachers as partners in the teaching process. This means equal participation in planning and preparation of PHE classes, equal participation in practical realization, equal obligations and responsibilities as well.

Tandem teaching is not unknown form of work in primary education, also is not very common practice in Europe and worldwide. Based on results presented in UNESCO worldwide study for physical education, primary education PE is delivered 79% by generalist teachers and 31% by specialized PE teachers. For example, in Malta, each class has both types of teachers. Specialist teacher in charge for one lesson and generalist teachers in charge for the remaining lessons. Based on analyses in Eurydice report from 2013, in some European countries such as Germany, France and Ireland, classroom teachers are supported by sport coaches or advisers for some PE lessons. The tandem teaching as suggested in reforms in the Republic of Macedonia already exists as a positive practice in Slovenia. In this country, both generalist teachers and PE specialist work together at PE classes at elementary primary education. This concept is evaluated very positively from both groups of teachers.

Considering that the reform for implementation of tandem teaching in PHE is oriented toward teachers

that deliver PHE in primary education, we were interested in their opinions for this issue. In this regard, we designed this study with aim to identify the opinions of generalist teachers and PHE subject teachers related with implementation of tandem teaching at PHE classes in elementary stage of primary education.

Material & methods

The study was realized on total sample of 118 teachers, from 15 primary schools in four different cities in the Republic of Macedonia. From the total sample of participants, 70% or 83 participants were generalist teachers, while 30% or 35 teachers were specialized PE teachers. The study was realized in May, 2017. Descriptive analytical and descriptive explicative analyses were used as method of research. Teachers opinions for their competences, initial educational preparation for delivering PE in primary education as well as the possibility for implementation of tandem teaching, were identified using specially designed questioner. The validity and reliability of the questioner were previously determined an published in separate study. The questioner was composed from four different questions with four suggested answers. The obtained data were analyzed using frequencies (f) and percents (%). Results are also presented graphically.

Results

The first question refers to teachers opinions for possibility for tandem or co-operational teaching in physical education from first to fifth grade. Following options were suggested: it is possible working together with generalist teachers as tandem; possible as cooperators and professional advisers to generalist teachers; possible as cooperators and tandem teachers to classroom teachers for certain specific units and it`s not possible, there is no need for such organization. The obtained results from both groups of teachers are presented on Figure 1.

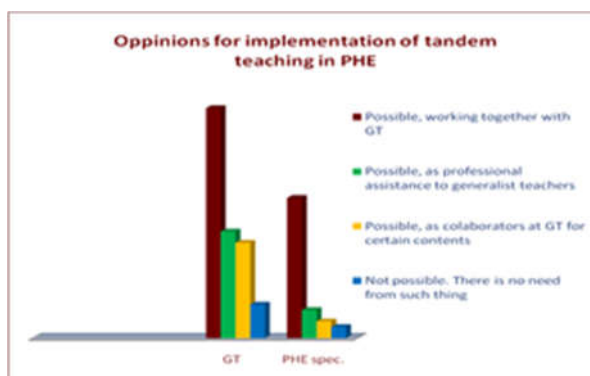


Figure 1: Tandem teaching

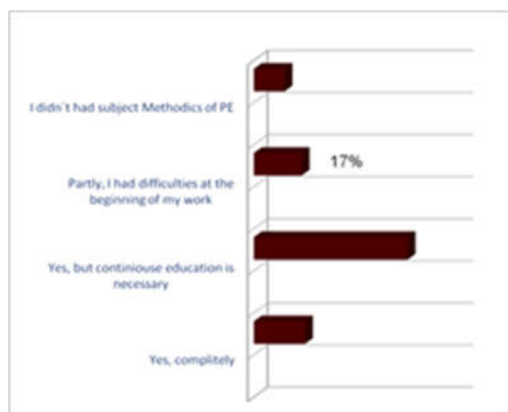


Figure 2: Satisfaction from acquired knowledge for PE didactics during university studies – Generalist teachers

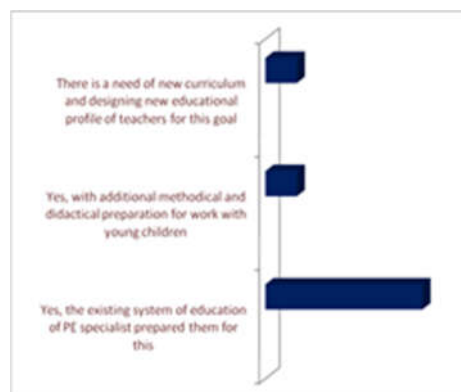


Figure 3: Satisfaction from acquired knowledge for PE didactics during university studies – PE specialists

Realization of physical education process requires teachers to have certain knowledge from kinesiology

related with motor development of children, children motor abilities and skills, basic principles of physical exercises, theoretical and practical knowledge for fundamental movements, elements from certain sport disciplines etc. Teachers should also have specific pedagogical and psychological knowledge for work with children in different age periods as well as specific knowledge from methodic and didactics of physical education. All these aspects integrated together are one of the important factors for successful realization of PE teaching process. Therefore, the following two questions are related with satisfaction from the level of acquired knowledge during initial studies at faculty for both, generalist teachers (Figure 2) and PE specialists (Figure 3) and need of additional education and continuous development in this segment (Figure 4).

The realization of curriculum should be related with children needs and possibilities in certain age period, but the success of its implementation is mainly related with teachers' knowledge and abilities to deliver the curriculum contents in the best possible way and most efficient manner. Therefore, the issue of curriculum delivery is closely related with teachers' education, which was previously mentioned. The responsibility that teachers have on effectiveness of curriculum realization, as well as their everyday work and experiences, suggest on great competences that teachers have in evaluation of current PE curriculum. This also puts teachers in position to suggest changes and improvements in this segment. Considering this, the last question refers to teachers' opinions for current PHE curriculum for primary education and possible needs for changes. The obtained results are presented in Figure 5.

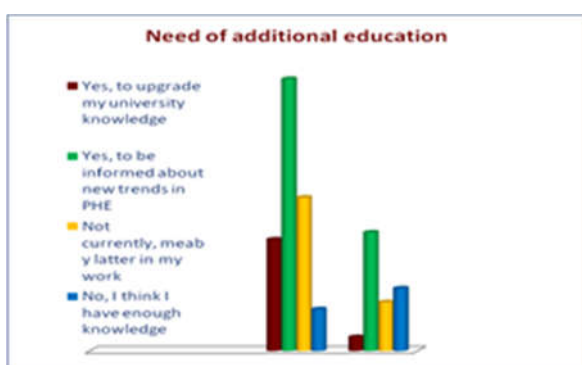


Figure 4: Additional education and continuous development in PE teaching

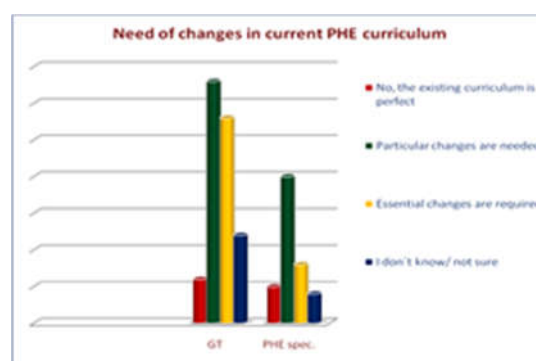


Figure 5: Possible changes and improvements in current PHE curriculum

Discussion

According to the results for the first questions that investigate teachers' opinions for possibility for tandem or co-operational teaching in physical education from first to fifth grade, the highest percent of interviewed teachers in both groups, particularly 49% of generalist teachers and 71% of PE specialists agree to work together as tandem teachers. The next highest percent of choices or 23% of generalist teachers and 14% of PE specialist consider that PE specialists can be professional advisers to generalist teachers. These form means that responsibilities and realization are mainly to generalist teachers but PE specialists can be included as support, help and advice in process of planning, selection of content and if needed demonstration in certain part. For 20% of generalist teachers and 9% of PE specialists, this role of PE specialist is needed only for some specific thematic unions. The smallest percent of interviewed teachers, particularly 7% of generalist and 6% of PE specialist consider that operational and tandem work between both groups of teachers is not needed, it's impossible to be implemented, suggesting that current organization is acceptable and should not be changed. Based on obtained results on this question, it's notable that both, generalist teachers and PE specialist recognized the need of co-operational and tandem work at PE teaching process in elementary level of primary education. This means a green light for latest suggested educational reforms. Considering that both group of teachers are aware of benefits from this process, next steps should be oriented toward precise determination of the tandem model, clear distinction of tasks, requirements of both group of teachers and professional training for how this process should be implemented and realized most effectively.

Following two questions are closely related to implementation of tandem teaching. They are investigating the level of knowledge of teachers for didactics of PE and their need for continuous future professional development, considering that the university education of both group of teachers is realized in

different institutions and different study programs. From the sample of generalist teachers 54% are satisfied from the level of knowledge that they had during university education related to PE, but also emphasize the thing that is essential for teachers – continuous learning following the changes in educational requirements. From all interviewed generalist teachers, 15% are very confident and completely satisfied with current level of education, while 14% reported that they had difficulties at the beginning of their work. These answers could be a result of several factors. Some of them could be different personal level of activity of teachers during their initial education, manner of education or whether they were fulltime or part time students, or suggest on different quality of delivery of didactics of PE at different universities that is also, in some points, closely related with different maintains of hours for practical work (Jovanova – Mitkovska, Popska & Smilkov, 2014). One group, particularly 11% of generalist teachers reported that they never had subject Methodic of PE. This is not surprising, considering the fact that in the Macedonian educational system, generalist teachers could be teachers educated at Teaching faculties having diploma “graduated generalist teachers” and teachers that had diploma qualification “graduated pedagogues” and were educated at Faculties of Philosophy, studies for pedagogy (Conception for primary education, 2007). The structure of study programs of both groups of studies is completely different, especially in terms of methodic of certain subject, mainly physical education, music education and art education. This difference, and possible consequences from it, are also emphasized in other studies (Popska, Klincarov, Mitevski & Nikovski, 2017; Malcev & Popska, 2017) alerting that all generalist teachers at state level should have proper and equal education for PE. Related with the sample of PE specialist, the level, their satisfaction for acquired knowledge from methodic of PE and competences to deliver it in elementary phase of primary education, 72% are satisfied with the existing system of education required for effective delivery of PE teaching process in primary education. From total sample of PE specialists, 14% consider that additional methodic and didactic preparation is needed, while 14% consider that essential changes in this process are needed in order to be fully competent to deliver PE at all levels of primary education. The explanation of this result could be given with analyses of study program at Faculty of physical education, sport and health where 97% of interviewed participants were educated. Namely, this study program offers a variety of subjects from different sports, sport disciplines, methodical, psychological, social aspects of work, but particular subjects related with educational work with small children are missing. These answers indicate the future actions that should be oriented to the need of continuous education of both groups of teachers and development of specific qualification required in the work with children in early and middle childhood.

Preparedness for continuous learning, improvement of competences and knowledge is investigated in the third question in the interview. Based on the results, the highest percent of teachers, particularly 47% of generalist teachers and 49% of PE specialist have a need of additional education, workshop and seminars in order to be informed for new trends in PE education and manners how to improve their work. The need of additional education in order to upgrade university knowledge is reported by 19% of generalists and only 6% of PE specialist which is in line with the results from the previous questioner. Nearly half of PE specialists (45%) and 34% from generalist teachers are not so interested for improvement of personal knowledge, reporting that currently they don't need any form of additional education or improvement (26% GT and 20% PE specialist). Surprisingly, almost 25% of PE specialists and 8% of generalist teachers are very confident in their knowledge and don't need additional professional improvement at all. The explanation in the results for the final two groups can be found in several reasons such as age of the participants and years of working experience, motivation for personal development, satisfaction from work, working conditions, lack of offers possibilities for development (lack of professional seminars, workshops) etc. All suggested aspects should be specifically investigated in future studies.

This question was also followed with an open question: What are the topics that you are most interested to be included in future possible seminars and workshops? Based on qualitative analyses on obtained results, we did the ranking of mentioned answers. From most to less mentioned, they are as follows: creative approaches in teaching work that not require use of standard sport equipment and alternative forms of realization of PE teaching process; new trends in PE; use of technology in PE teaching process; work with children with special educational needs; creating an effective network for practice exchange between generalist teachers and PE specialists etc. Similar results for suggested topics for additional improvement via workshop and seminars are obtained in study of Popska, Jovanova & Sivevska (2017) referring to implementation of technology in PE teaching process. The study of Popska, Klincarov, Mitevski & Nikovski (2017), referring to common obstacles in realization of PE teaching process, where teachers included in realization of PE teaching process reported lack of seminars and workshops for their topic of

interests.

Considering teachers working experience and the impact of their work upon effectiveness of PE teaching process, the last question refers to their opinion for current PE curriculum in primary education at the level that they teach and possibilities for improvement or change. According to the results, 42% from generalist teachers and 54% from PE specialist consider that particular changes are needed. Essential changes are required by 35% of generalist teachers and 22% of PE specialist, while completely satisfied with the existing one are 8% of generalists and 13% of PE specialist. When asked about segments that should be changed or improved, different aspects were emphasized. For generalist teachers, changes are needed in certain thematic unions; more hours for corrective gymnastics, compatibility between suggested contents, age and development characteristics of the children. PE specialists suggested the following issues for improvement or change: contents in the curriculum with emphasis on selection of sport in 8th and 9th grade, implementation of new interesting sports, greater compatibility between theoretical contents suggested in books for each grade from 6th –to 9th and curriculum for respective grades; greater compatibility of the contents and requirements in the curriculum with material facilities and available equipment as well as suggestion of alternative forms of realization of PE teaching process.

Conclusions

Summarizing the results from all previous analyzed questions, the same vision could be noted. Changes are needed in several segments of realization of PE teaching process in elementary education. Uniting the knowledge and working forces of both group of teachers, generalist teachers and PE specialist many of challenges and noted problems could be overcome and will lead to greater effectiveness of PE teaching process and greater benefits for the children. In this regard, implementation of tandem teaching between generalist teachers and PE specialist could be one of the possible effective manners.

What could the possible benefits be from implementing the tandem teaching in PE in elementary primary education? Further on we present some of which we consider the most important:

- Increased level of physical activity of children at PHE classes
- Equal and successful realization of all suggested contents
- Better holistic learning through PHE
- More effective realization of PHE classes
- Possibility to follow and assess children motor development at regular bases
- Increased level of PA during school day
- More time for educational component
- Possibility for better realization of health component
- Better support between generalist teachers and physical education specialists

The concept of tandem teaching should be beneficial and successful only if it is created with joint actions of all relevant and included parties. In this regard, the following future actions should be taken:

- Creating an expert group that will work on concept and implementation of tandem teaching. This expert group should be consisted of university professors from Faculty of physical education, sport and health and Teaching faculties from all state universities that work in the field of methodic of PE; representatives of generalist teachers and PE specialists, a representative from Bureau of Education, a representative from Ministry of Education, experts from countries that already implemented such concept. This group should work on all aspects of implementation of tandem teaching.
- Implementation of positive experiences of other countries considering and adapting the national context.
- Organization of meetings, seminars, workshops for promotion of the concept.
- Organization of workshops, seminars, lectures for preparation of generalist teachers and PE specialist for tandem teaching.
- Designing text books and guidelines for tandem teaching for the teachers.
- Development of network of teachers included in TT
- Designing a common study programs for educating tandems.

All suggested actions require teamwork from generalist teachers, PE specialists, university professors from Faculty of PE, sport and health and Teaching faculties and governmental institutions. Each one of them should contribute in their field of expertise. Each one of them is equally important and the implementation could be successful only if teamwork and benefits for the children are focused as priority. At the and the focus and main goal are the children and their wellbeing and only common actions could

lead to this common goals.

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STUDENTS' FEAR AND BEHAVIOR IN THE BEGINNING OF SKI TRAINING

UDC: 796.9.015.2-057.874

(Original scientific paper)

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Abstract

Learning the skiing technique can happen quickly or it can take longer, and the set of mind of a beginner skier may very much affect the learning speeds. In this article, we will observe the behavior of beginner skiers and their fears through: the reasons that lead to fear while learning to ski; creating a model for bringing the beginner skier back to an effective learning state. In the analysis of the results, using the "Discussion in Focus Group - Poll Discussion" method, three types of fear of initial ski education were identified. Exploring the fear of falling, we conclude that this fear is provoked by the sense of collision with the earth, not the actual activity itself. The second one is the fear of the unknown. We often waste time worrying about what can happen to us, and this fear has a lasting impact on how we act and what our behavior is on the ski track. Fear of failure is an attitude that leads to stiff and tense movements and a low probability of dealing with the element studied. This fear also causes great mental tension - thoughts are changing in uncertainty in well familiar movements and doubts in one's abilities. Summing up, we can note that with a sense of security on the ground, with confidence built by the ski teacher, with emotional comfort in interpersonal relationships that exists in the lesson, each fear can be overcome and the beginner skier returns to an effective state of learning skiing techniques.

Key words: *ski, fear, student*

Introduction

People who enjoy the advantage of being in nature and clean air and who like to keep their top physical condition by skiing, enjoy an abundance of emotions and health. It is a well-known fact that participating in sports means being healthy!

One may ask "Is it easy to learn skiing?" Mastering skiing techniques can be either quick or it may take a longer time, and the set of mind of a beginner skier may greatly influence the rate of learning and mastering such skiing techniques.

Hypothesis: Someone who has been living by the same stereotype "home-school/work-home" for years, may be afraid of starting a new activity, because in general, such a person is fully aware of the danger and risk involved (picturing the steep ski slopes with skiers and snowboard riders shuttling on it or the dreary images of falling and resulting traumas), and that poses quite a serious obstacle to that person's ability to learn skiing.

What is fear? Fear is a natural reaction caused by environmental factors. It tampers with the pursuit of a dream and the striving for success, holds back one's actions and suppresses one's determination. In this context, the ability to overcome arising fear is a very important life ability. How to master this skill while learning to ski?

We suppose that the application of a model, consisting of the creation of a mental picture of skiing-related skills and movements, shall chase away the fearful thoughts of the unknown, the unfamiliar or failure, and shall make skiing a favorite outdoor activity in natural environment.

Purpose and objectives:

This article studies the behavior of beginner skiers and their fear notions in terms of:

- the reasons that arouse fear while they are learning to ski;
- designing a model intended to bring back the beginner skier to a condition which is effective for learning.

Study methods: The study is conducted on 125 first year students (the contingent) (105 men and 20 women) (62 full-time students and 63 part-time students) attending the specialty of Pedagogy in Physical Education Teaching (PPET) of St. Cyril and St. Methodius University of Veliko Tarnovo in Bulgaria. All of them are required by the academic program to train in the winter sports course in the town of Bansko.

The subject of this study is the students' attitude toward fear and how they overcome such fear in the beginning of their training in alpine skiing. This requires the use of the following methods:

1. Theoretical and logical analysis of literary sources.

In order to gather knowledge about the current state of the problem, in particular to get an idea of the extent to which the different aspects of that problem have been studied by Bulgarian and foreign authors, we made a review of existing literature.

2. Structural observation

Targeted observations were made during the training course along the ski slopes near the town of Bansko and the town of Dobrinishte.

3. Polling method – discussion in the focus group.

We investigated the problems subject to this study by conducting discussions with the students of the specialty of Pedagogy in Physical Education Teaching (48) – part-time attendance.

4. Method of inquiry

We made inquiries with the purpose to outline the main problem underlying the mastering of skiing techniques, which is fear and the emanations of fear. We obtained the opinion of all 125 students who participated in our study. The questionnaire used to investigate the fear and the behavior of students in the beginning of their ski training (Appendix 1) is attached hereto.

5. Mathematical and statistical analysis by benchmarking.

6. Simulation

This method was used to create a model enabling them to attain effective condition for learning the movements that are typical of alpine skiing techniques.

Results

The analysis of the results obtained from the questionnaire used to investigate the fear and behavior showed that men defined themselves most of all as athletes and said to have self-confidence – “I know what my strengths are” (68.7%). “I have my own concerns” and “I am aware of my shortcomings” was expressed by almost 19.5%, and 11.8% had no opinion. That is how students answered to questions 1. “Who am I?” and 4. “Do I have self-confidence?” (fig. 1).

In the group of women-students prevailed average self-confidence based on the answers of “I am aware of my shortcomings” and the self-definition as “a young person with his/her own concerns” (about 57%) – almost three times more than men. Those who demonstrated high self-confidence were 36.2% of the women-students whereas 7.8% of the women-students had no opinion.

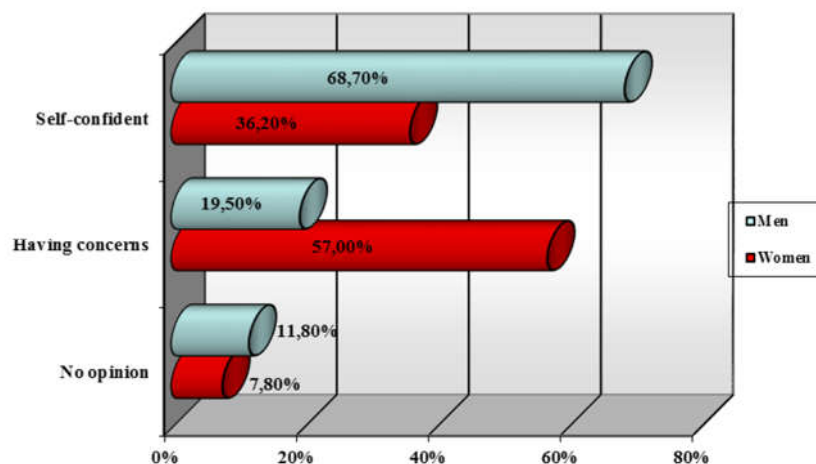


Fig.1. Students' opinion on the questions: “Who am I?” and “Do I have self-confidence?”

To our opinion the awareness of the inner need to do well, as well as the believing in one's self, can be achieved by identifying the students' desires and needs for targets achievable within one lesson. Needless to say, the role of the coach for creating an environment that promotes self-confidence is paramount. The self-confidence to keep going, to make a step further, or to attain a target can enable students to evaluate and manage his/her needs, which results in a productive and exciting training. Students who perform on such level are often on active communications while being in learning environment.

Grouping the questions about the feeling of fear (questions 6, 7 and 11) all participants (100%) answered that they were afraid because skiing is "a very different type of sport and something quite new". 45.8% - men and women together both part-time and full-time students showed high level of personal anxiety fearing falling, 36.6% of them feared failure, and the remaining 22 students (17.6%) – feared the unknown (fig.2).

Most diverse are the shapes that young people give to fear. Here are some of them: a monster, ice, frost, myself, something that looks like me, a bird of prey, etc.

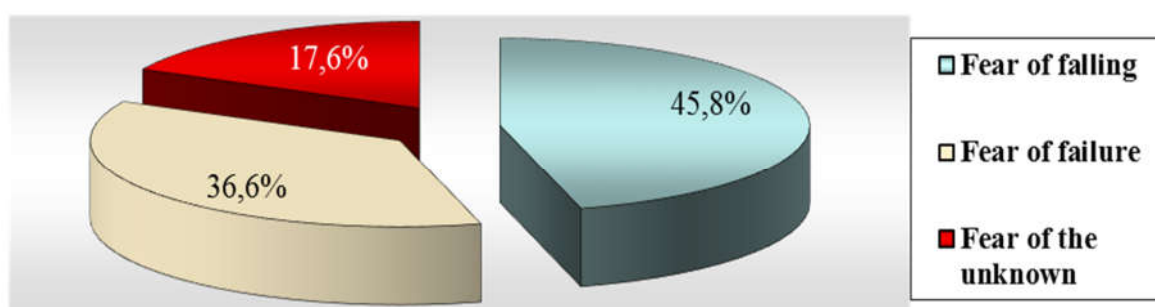


Fig.2. What fears do we face in the beginning of our ski training?

To our opinion the established fear notions determine students' behavior during their skiing training. It is perfectly normal for a beginner skier to fear falling. It is also normal to feel fear while sloping down for the first time or making his/her first parallel turn on skis. Fear starts to subside with each next exposure to the fearful situation. The same principle applies to the fear of falling. As soon as a student begins to fall he/she gains experience and gets used to the process, which in its turn results in attenuation of the feeling of fear and the building of fear-resistance.

To eliminate the imaginary fear of falling the right thing to do from a methodical point of view is to train falling – a series of controlled falls. The idea is to train several falls in the course of a lesson in order to develop a stable mental state that would not yield to any unreasonable fears. For instance, let us imagine that you want to learn to ski. The first time you stand up on your skis you would almost inevitably fall, but your body gets a bit more accustomed. The second time you are able to stand up in starting position and you move a little, you fall again. You fall a third time, but before that you have been able to move a little further. The hundredth time you slope down from the top of the slope and the thousandth time ... well, you easily slope down from the steepest slope "without batting an eyelid".

Let us analyze the second most common type of fear for skiers – the fear of failure. Ironically, the fear of failure sets the pattern for failure because one is distracted from the thoughts on possible outcomes and loses focus, which renders skiing ineffective.

The fear of failure is a mental attitude that manifest itself in stiff and tense movements and offers little chances of mastering the trained element of skiing technique. This fear causes enormous mental tension – thoughts are diverted into being insecure in already mastered movements and into doubting one's capabilities.

The fear of failure springs from a result-oriented attitude where the effects in case of success are constantly judged against the effects in case of failure. Therefore, this fear can be overcome by directing the focus at 100% on the process of skiing (the stance, the inclination, the eyes, etc.) and one's awareness should not fluctuate to and from possible results. When attention is focused like this the worrying skier will have no opportunity to think of any failure or success.

The fear of “what will others think of me” can be trained by creating a situation where students would feel uncomfortable. The things to do in such cases are as follows:

- listening to the critics of others – to train the fear of being criticized;
- making the movement (the element) in a way that others would not expect to see – to train the fear of inconformity with the opinion of others;

By every instance of overcoming the fear of failure, fear-resistance increases. It is said: “This fear is not real, it is nothing but an illusion, and it exists only in my mind”. When dozens of such fears are overcome, fear disappears. Our body and mind have the congenial capacity to adapt! Adaptation forms the basis of survival.

It is important to note that unlike the fear of falling, which may sometimes be even useful, the fear of failure has no other purpose but to safeguard one's ego. The fear of failure is entirely based on auto-suggestion, which means that the elimination of this fear is entirely in the hands of oneself.

What will happen on the ski slope or in the cableway? This is the fear of the unknown. It exists only in one's mind and in the exuberant imagination. Since this fear is groundless, unreal, it often arouses for no reason or occasion and drives one to do things that are often ridiculous. The fear of the unknown has one more peculiarity worth mentioning – it may win a victory in case one delays the making of a decision or the taking of an action under its influence. This fear has the tendency to grow bigger when dealing with it is postponed. And one more thing that is typical of the fear of the unknown – it will immediately disappear when action starts. Needless to say, this is much easier said than done.

Ignoring the fear of the unknown may be achieved by making a conscientious differentiation between one's personal observation and the imaginary image. The first time you fear death and it seems to you that if you dare do it your life will end. But yet, you dare do it and your life does not end and you understand that it is not that frightful. The second time it is something like half-fear and once again it seems like it is way beyond your powers to do it. But still you keep doing it and it's not that frightful after all. Each next time you try, you understand that your action is not that frightful as your mind may be depicting it.

Many risks originate from the inexperienced skier's imagination. The fear that either something of the outfit may be defective or the cableway may stop and leave you hanging in the air or the ski slope is very steep, are very common imaginary fears that worry many beginner skiers. In such situations negative thoughts should be put to questioning and one should try to overcome them by reasoning. Naturally, the outfit has been tested and guaranteed as strong, furthermore you can trust your skiing coach counting on his/her knowledge and experience. Thoughts should be directed towards the movements performed on the ski slope by repeating in one's mind phrases like “relax“, “you are doing great, “don't stop“.

Once provoked, the negative emotions may lead to the occurrence of stronger doubts, the level of self-confidence drops, and self-esteem inevitably falls down. Stop! Your determination is your guarantee that you will overcome every fear. What is the main difference between fear and determination? Fear activates negative emotions and directs them to thought of failure. Determination, on the contrary, provokes positive emotions and directs them to favorable concurrence of circumstance. The fear-instigated negative thought begins to “multiply” in an increased rate but this is nothing for people who are used to saying: „eyes fear but hands are doing it“.

One of the most important steps in fighting fear is the preparation to fight. So far we defined what types of fear prevail in students and that is a great advantage for our study.

The average values for men when asked about the methods they use to manage their fears (question 8, 9, 10 and 12) are within the “tenths” range in the upper percentage scale (89.4%, 89.2%, 88.9% and 89.8%), which is directly related to the better and more successful coping with tasks, namely: „I forget about fear” by playing a game; by using the trick of „I can do it” which motivates them; they are convinced that by stepping on the skis „everything will be fine”, and the answers to question 12 “Let me make one more step” – “I'm doing it on my own” show their approach to reality by saying “this is a great opportunity for me” (fig. 3).

We also asked the twenty female students the same questions in an informal conversation (discussion). Here are the results: 92.2% of them would not think about their fears when the elements of skiing technique are mastered “by playing a game”, for 38.4% of them fear was still there even after they were repeating “I can do it” but the encouraging thing was that the remaining 61.6% of them were “ready to win”. The most preferred answer to the question “What will happen when you step on your skis?” (question 10) was “I am entirely focused on the skiing I am about to do but I am still worried” – 74.7% whereas 25.3% of them answered “I am very concerned about the skiing I am about to do”. Unanimously all women (100% of

them) answered that they were willing to make “one more step” in order to be successful and to overcome their fears.

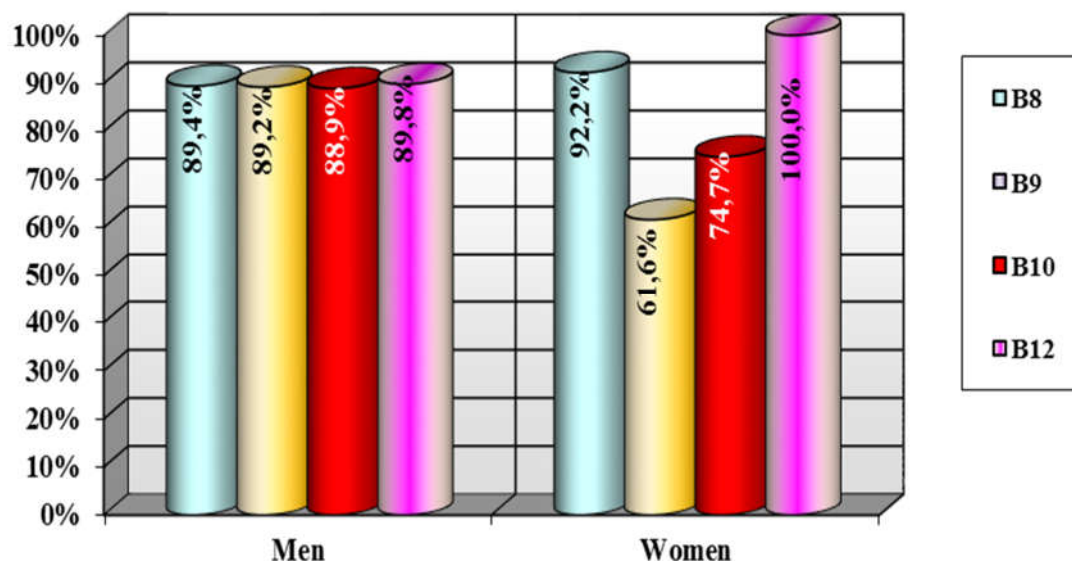


Fig. 3. Average values of the methods to manage fear

Ski schools have been integrated into the service provision section of winter tourism. Whether or not a guest to the resort is going to return and become a regular visitor of the resort, greatly depends on the effective performance of the skiing coach (instructor) because the time spent on the ski slope is the most time-consuming part of the guest’s stay in the resort. This is important for our students – the future sport specialists should have the passion to sport and mountains as good skiing coaches.

Comparison of the opinions of students from the two forms of attendance – full-time and part-time – regarding any “noticed concerns/worries of the skiing coach“ showed that 12.2% and 17.6% of them (part-time and full-time accordingly) thought that the coach had some concerns/worries with respect to the “environmental and weather conditions”, “he/she was afraid of failure” was the preferred answer for 5.1% of the full-time and 2.9% of the part-time students. The students of both forms of attendance who answered that “everybody is afraid sometimes, it is only normal” were about 10%. The other 44.9% of the part-time and 67.3% of the full-time students were convinced that the skiing coach showed no signs of being afraid of anything.

We are convinced that the skiing coach has accepted the responsibility to influence the student’s behavior. The mastering of mobile skills and movements such as the ones associated with skiing bears a clear and structural information about the direction and time of practicing but also some concerns about the safety and discipline of students. The skiing coach should be able to play different roles in order to ensure a successful lesson.

The preferred “strategies used by the students in order to be able to overcome their worries and fears when learning to ski” were almost equally proportioned in percentage rating – about 25% each. Four groups of 25 students chose to manage their fear: by paying games, by training, by the feeling that “I am not alone” (the skiing coach, my friends are next to me), by “having the others understand my problem“ and the remaining 25% of them had their own management strategy – by sharing, by saying that things can always get worse, by dividing the problem into pieces, etc.

Based on the result analysis we created a model of the strategies for managing the fear of falling, the fear of failure and the fear of the unknown during the ski training (fig. 4). Although it is not always possible to do a lot in order to change the way people see things that could be changed, still an attempt can be made to build a better mental frame.

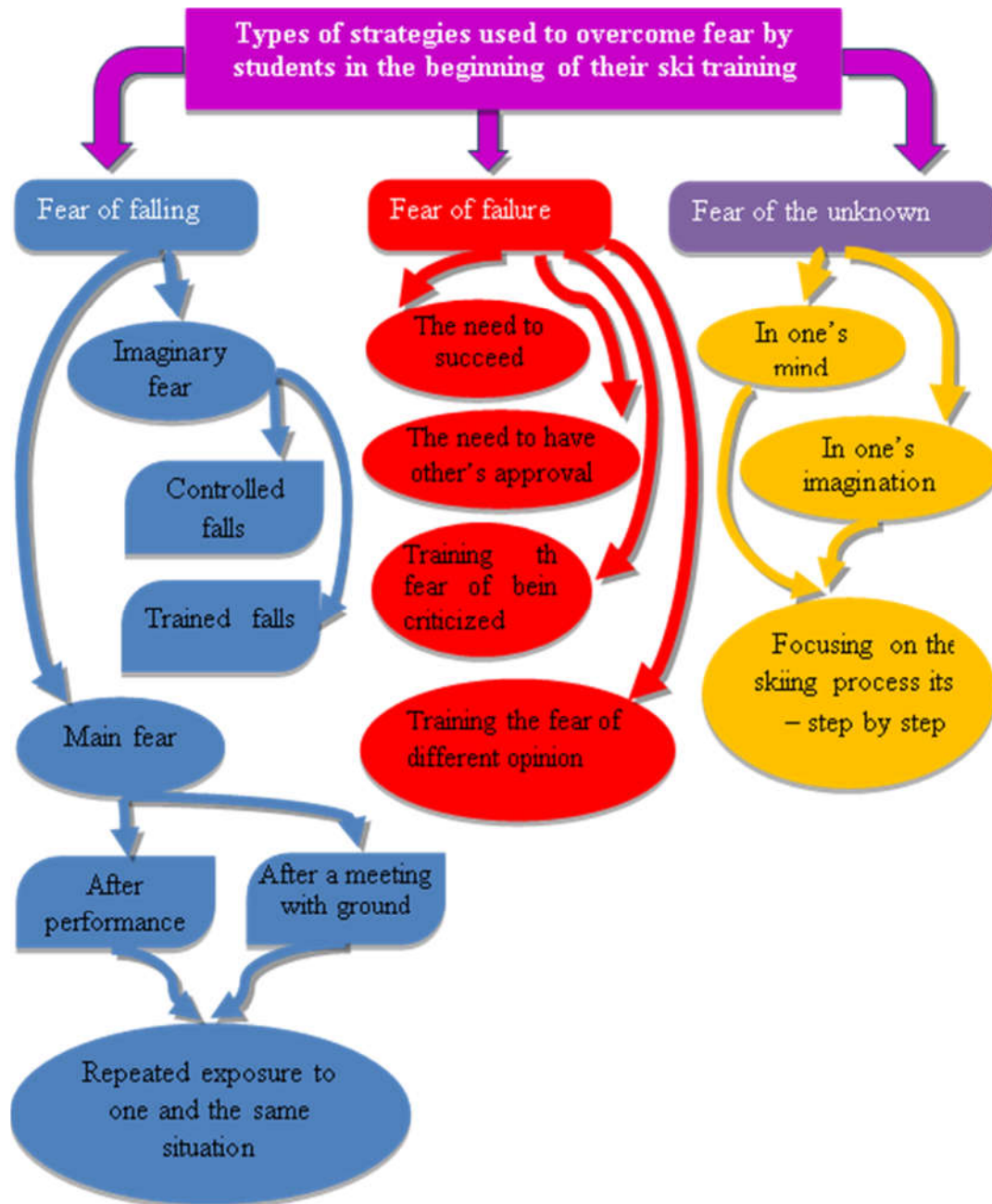


Fig. 4 Model of fear management strategies

Inferences

1. The feeling of touching the ground is what causes the fear of falling and not the particular movement or action taken alone.
2. The safe practicing of trained falls contributes to the gaining confidence in one's mobility skills.
3. The fear of failure is a mental attitude that manifest itself in stiff and tense movements and offers little chances of mastering the trained element of skiing technique.
4. Coping with the fear of the unknown starts by identifying the problem and by taking appropriate action to reduce the risk in a given situation.

To summarize, let us mention that every fear can be overcome by feeling secure on the slope thanks to the trust built by the skiing coach and the emotional comfort of one's relationships with others that prevail in the lesson so that the beginner skier could restore his/her effective condition for learning to ski.

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Appendix

QUESTIONNAIRE THE FEAR AND BEHAVIOR WE EXPERIENCE IN THE BEGINNING OF OUR SKI TRAINING

1. "Who am I?"

- a) I am a young person ready to face challenges.
- b) I am an athlete and I always strive to win.
- c) I have my own concerns.

2. "How well do I know myself?"

- a) rather Yes;
- b) rather No;
- c) I can't tell.

3. "Am I able to adjust, to adapt?"

- a) Yes;
- b) rather Yes;
- c) rather No;
- d) No;
- e) I can't tell.

4. "Do I have self-confidence?"

- a) I love myself;
- b) I know what my strengths are;
- c) I am aware of my shortcomings;
- d) I am sleeping through my life;
- e) I don't know.

5. "What is my attitude to real life?"

- a) It is a great opportunity for me;
- b) A fear that I will not be successful;
- c) It is a challenge/jump into the unknown;
- d)

6. "Why am I afraid in the beginning of my skiing training?"

- a) because it is only human;
- b) the unusual outfit bothers me;
- c) because it is done outdoors;
- d) because it is a quite different sport for me;
- e)

7. "What are my fears?"

- a) falling;
- b) trauma;
- c) failure;
- d) the unknown
- e)

8. "How can I forget about fear?"

- a) When I take a deep breath, time after time, I feel my body truly relaxed.
- b) While playing I can't think about fear.
- c) I feel do difference – fear is still there.
- d)

9. Repeating "I can do it!"

- a) If I repeat it 10 times using increasing voice strength, I forget about fear.
- b) This trick is used in other sports too and this motivates me to win.
- c) I feel do difference – fear is still there;

10. "What will happen when you step on your skis?"

- a) I am very concerned about the skiing I am about to do.
- b) I am entirely focused on the skiing I am about to do but I am still worried.
- c) I redirect the focus of my thoughts because I know that everything will be fine.

11. "If you were able to give your fear a specific shape or face, for instance a despicable person, a monster, etc., what would it look like?" The better you describe it the easier you will overcome it.

12. "Let me make one more step!"

- a) If you are afraid, for instance, to climb a Christmas tree up to a marked level, would you make one more step to overcome your fears.
b) I'm not afraid to try and I will go to the end because the ski coach is right next to me.
c) I'm doing it on my own.

13. "The ski coach is also afraid/worried sometimes. Have you noticed?"

- a) Everybody is afraid sometimes, it is only normal. b) He/she is afraid of failure.
c) He/she is afraid of the environmental and weather conditions.
d) He/she shows no signs of being afraid.

14. "How would you describe your problem if it had not been yours?"

- a) I would try to judge how serious the problem is by imagining that it was mine.
b) I would show my friend that it is only normal to feel fear sometimes.
c) Looking at it from a distance I would judge if it is worth worrying about or not.

15. "Which strategy of fear management would you like to use at this time?"

- a) by playing a game; b) by sharing;
c) by the feeling that I am not alone (the coach, my friends are next to me);
d) by having the others understand my problem;
e)

Sex: a) M b) F

Age: a) younger than 25 years b) younger than 30 years c) older than 30 years

THANK YOU FOR YOUR TIME!

THE CONCEPT OF INTERACTIVE MODELS IN UNIVERSITY TEACHING

UDC: 378.026(497.7)
(Original scientific paper)

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Abstract

The issue of improving the quality of the teaching in higher education presents an open and contemporary problem, which can and should be studied from several scientific aspects. With the introduction of the credit transfer system in higher education in the Republic of Macedonia, which entails a higher level of students' participation in the realization of the teaching, constant monitoring and a contemporary means of evaluation, the efficiency and quality of the teaching have significantly improved, but it seems that the process of realization still comes second, at least from the aspect of its interest to be improved. The subject of this research is designing interactive models for learning in the academic teaching as well as developing didactic competences for future teachers. Studying the problem is done by action research of a participative, interpretative and descriptive character. The essence of such a way of research is that it consists of a sequence of action steps, with the help of which action is immediately put into practice, and simultaneous monitoring of the action itself (participation), the activities of the subjects included in the process, as well as revision in stages after each action, ending in the final reconstruction, is being done. The relevant data in the research are received through formative and summative examination of the views and opinions of the students regarding the interactive models of realization of the teaching, and through examining the abilities and skills of the students regarding the application of interactive models in practical teaching. The conclusions point to the need for increased participation of the separate didactics in the study programs, as the most applicable subject programs that are mostly connected to the students' practical work. From the received results of the research, it can be stated that the students' views regarding the interactive work are visibly positive, since the teaching is dynamic and interesting, while the acquired knowledge and developed skills complement the development of their competences for practical work. Due to the universality of the basic didactic concept, which is applied in this research, one of its main aims is for them to become generators, i.e. original examples (samples) for support of the interaction in higher education when developing a variety of profiles. It firstly refers to the category of students who in the future will choose to work as teachers in different levels of education.

Key words: *interactive models, higher education, didactics of higher education, students*

Introduction

Interaction as a modern educational strategy

“... The industrial revolution, neoliberal economic reforms and the movement of behavioral objectivism, in their mutual time and theoretical interweaving, form an education aimed at the development of competences, which in contemporary theory and practice have more general meaning ...” (Despotović, 2008: 35-49). The genesis of the development of the goals and tasks of university teaching and learning is always in the context of the educational tradition of specific educational systems. They can be placed between two different conceptual solutions: traditional teaching or progressive teaching. Thus goals and tasks are oriented either towards content and knowledge or towards the student. The first option directs the teaching towards learning the content, which leads to the creation of a general profile of an expert, the second option puts the emphasis on the individual, on individual qualities and social behavior. This creates an expert who is able to do research, i.e. he/she knows how to think methodologically, he/she has developed communication skills and is capable of teamwork. These are the capabilities that are necessary for life in a

civil society. The second model of learning is generally accepted today. In the broadest sense, education focused on the development of competences can be defined as an educational theory or concept, which explains the interdependence of education and economic development, or, more precisely, the promotion of economic development through education. According to this, “competency-based education is an instrument of economic reform or micro-technology of human capital theory” (Anderson, 2008: 24).

Regardless of which model is applied, different definitions and categories can be found in the theoretical and research learning studies to determine the diversity of the learning process. What this refers to, above all, is the learning styles, the approach to learning and the different types of intelligence. For example, Howard Gardner develops the theory of multiple intelligence and, accordingly, on the different bases of the learning process. According to Gardner, “there are seven types of intelligence: verbal (linguistic), logical-mathematical, visual (spatial), music, interpersonal (social), intrapersonal (personal), and bodily-kinesthetic” (Gardner, 1991: 28). The way of thinking, priorities and needs are different for different types of intelligence. Kolb starts from the “differences in approach to the learning process: practical experience, reflective observation, active experimentation, abstract conceptualization” (Kolb, 1985: 95).

Therefore, the use of the interactive concept in higher education should correspond to the different needs and predispositions of the students. The implications of this approach of interactive teaching are: use of different interactive models that correspond to different learning styles, development of the same topic through the use of different methods, and individualization of the learning process which takes into account the learning capacities.

For adults, the process of learning involves multiple activities, and an integral, conceptual and phased process. The multiplicity of learning means that learning is a process that integrates the emotional, social, cognitive and affective dimensions. The phased process of learning involves procedurality and passing through certain stages that do not have to be successive, which are: motivation, acquiring information and knowledge, perceiving their meaning, practicing and applying the learned, and its planning and implementation.

The process of integrated learning is based on and it complements the past, the current and the future experience. Contextuality of the learning process involves learning through interaction in a certain physical and social context and through exchange and collaboration. The benefits of the understanding of this learning are activities with different functions that: motivate, stimulate, relax, let the students get to know each other, create an atmosphere of trust, and so on. They are integral parts of the interaction, the procedurality in the development of sub-topics, the content and methods that provide a phased formation and application of knowledge; technical and organizational support of the process of interactive teaching with which contextual variables, such as physical space and social context, are specified according to the initial basics of interactive teaching; enabling and encouraging various forms of group work, exchange between stakeholders and cooperative activities, as well as development of monitoring and support strategies.

When presenting the basic characteristics of these two opposing models, we begin from the analysis of the indicators: the placement of the two models, the types of activities used in them, and the articulation components of the teaching. The traditional model is based on the understanding of the learning as a transmission i.e. one - way transfer of knowledge in the direction of teacher - student, without obtaining feedback on the level of acquired knowledge and developed skills. Within this model, the learning is same for all students. It is a uniform process that does not respect individual differences and does not meet the different needs of the one who is being taught. At the same time, the learning process is understood as a “pure and isolated” cognitive process and as an individual activity – “everyone learns for themselves” and “is responsible” for the results of their own learning.

Discussions

The basics of interactive teaching, according to Kolb, are grounded in the notions that “learning is an active construction of knowledge, which is constantly being upgraded through an active two-way mode” (Kolb, 1985: 25). Yet, the different styles of learning and individual differences and learning abilities are appreciated, and learning is a “multiple activity” (Gardner, 1991: 34), an integral and contextual process. Cooperative forms of learning are used and partnership relations are developed.

And the different types of activities used in both models are diametrically different in nature. Thus, while the traditional model uses uniform types of activities according to their function and a limited number of methods, interactive classes develop activities that differ in their function and with a number of different

methods. And the articulation sections of the teaching - preparation, realization and monitoring - are different in both models.

In the traditional model of teaching in the preparatory part, the attention is directed towards the teacher, the teaching programs set goals that are primarily related to the teaching contents, and efforts are not made to develop a learning environment. In interactive teaching, the attention is focused on the students, the context of the content, the procedures and the teacher. Objectives are set to be achieved by the students, the teaching process and the teaching content. The existence of material and technical logistics is obvious. During the realization of the traditional model, the attention is focused on the results, and in the interactive model the attention is focused on the process, the relations between the subjects and the results. In the first model, linear interaction is used, and in the second multiple interaction.

The role of the teacher is visibly different, instead of a mediator he is a facilitator in the traditional model. In the interactive teaching, there is a diagnostic, formative and summative evaluation. Evaluation in the traditional model is usually not planned and does not come down to examination of the acquired knowledge. The analysis of the last articulation element shows the absence of *monitoring* in the traditional model, while in the second model there are developed monitoring strategies as a support process.

The initial teacher education is a basic requirement for practical introduction in the teaching profession. For K. Kamberski, initial education of teachers is “a system of knowledge, abilities and expertise (skills) that future teachers acquire during their studies, which enable the professional execution of the teaching activity. These are basic (initial) competences, abilities and skills without which the teaching profession cannot be imagined, and with which it is further upgraded through the system of continuous education (professional development)” (Kamberski, 2000: 114). According to the same author, “initial teacher education is an initial certified education for acquiring the right to work in a particular subsystem” (Kamberski, 2000: 115). Initial education as an initial professional preparation of teachers in primary and secondary education in the Republic of Macedonia is conducted with a different approach, depending on whether it comes down to a class or subject teacher in general, arts or vocational subjects or practical classes.

So, the teacher needs to perform very specific tasks. In addition to the common functions and roles that define the term - teacher, the teaching work in the first three cycles of primary education has specificities that arise, primarily, from the developmental characteristics of the students. They are manifested through the professional obligations, requirements and tasks that are placed before the teacher. The first three cycles of primary education are the basic level i.e. a kind of entry into education. Teaching in the early grades is the first contact with an organized educational activity.

“Their characteristics can be identified in the documents of the Bologna Declaration and other documents relating to the Bologna Process, which are the basis of the reforms in higher education in Europe” (Miovska-Spaseva, Achkovska-Leshkovska, 2010: 10-15). On the other hand, when speaking more specifically about the initial education of teachers, the analyzes made in many European countries of the OECD distinguish two basic models that form the teaching (and any other) profession. All this puts forward the issue of the effectiveness of the academic production of teachers and the involvement in the contemporary requirements of the “Bologna Process”, in regards to the issue of the quality of the initiation in the education of teachers, as well as the quality of the realization itself, which is partially selective, especially in our case.

In this way the issue which is only one part of the theoretical elaboration will be absolved, as far as possible, at the level of a paper of this kind, and will briefly draw on the analysis of the policy of educational reforms and their reflection on education, primarily on the initial education of teachers in the first and second education cycle in the nine-year primary education.

Speaking about the educational policy in higher education in general, the full acceptance of a more comprehensive European model is evident. Our country is one of the signatories of the Bologna Declaration, and is in the process of developing the realization of the goals arising from the Bologna Process.

The transition from the traditional to the contemporary is a feature of the time of work of the higher education institutions in our country, including the faculties that educate future teachers. The recommendations of the Bologna Declaration, which are the initiators of most of the changes in higher education, are incorporated as basic components for the development of education in the Republic of Macedonia by 2015. The full results of the integration of the Bologna requirements into our education, which can be defined in the most general way as a process, changing and opening up education towards

European practices, can be measured at the end of this educational transition, i.e. within the time limit provided for it (2015).

From the modernization of teaching and traditional learning models, in which a large number of students studied in one group, the lack of informational-communication technology and its poor application in the teaching process, the weak didactic competencies of some teachers, the failure to apply the concept of learning outcomes and to make the students competent for independent work, arose the need for a system of new measures. This system consists of the following elements: implementation of the concept of educational output, introduction of informational-communication technologies and training of the teaching staff.

Results

The weak didactical competencies of some teachers impose the need to improve the teaching staff, from which, in the context of the research, the following would be emphasized: introduction of interactive models in teaching and use of educational modern technology in teaching, which, as present weaknesses, can be overcome in many ways, but above all as an examination of the educational needs of the staff in higher education, who according to previous personal experiences, will point out the need for finding a form for developing high-academy didactic competences.

“The change of the principles and recommendations of the Bologna Process, besides among the teaching, collaborative and administrative staff, caused changes and stirred up the students too” (National Program for the Development of Education in the Republic of Macedonia 2005-2015: 290).

Current issues and problems associated with initial teacher education relate to the need for higher education institutions to promote standards that will apply not only to studies in basic subjects, but also to pedagogical, psychological and methodical skills of teachers for more efficient work in schools. Among other things, there is a need for conceptualization and application of modern programs for permanent professional and pedagogical improvement of the teaching staff in the elementary education. The need for the development of study programs at the faculties of teachers and their revision supported by empirical indicators should also integrate the representation of subjects in the education studies and teaching methodology. The analyzes indicate that with the European standards in the initial teacher education for pedagogical and methodical preparation of future teachers, 25 to 35% of the total number of hours are allocated.

According to the above, in the next revisions of the study programs, as one of the solutions for overcoming the situation, the number of hours within the specific didactic (methodic) has to increase, also subject programs for integrated pedagogical practices need to be introduced. Regarding the permanent training of teachers, the relevant institutions show different level of initiative for improvement. Different forms of professional development are offered by the various relevant institutions.

Conclusions: Determinants of interaction in higher education

The most significant conclusions are the ones regarding the importance of the general educational didactics for possible successful realization of the special didactics, as well as the fact that during the development of the study program with general pedagogical subjects, modern contemporary tendencies of higher education had been taken into consideration. Following the modern trends in higher education indicate the need for a high percentage of representation of practical instruction.

The use of modern teaching methods, in which students are included as equal partners, requires a high level of activity from their side, that positively reflects on the quality of knowledge, regular attendance, and at the same time it may also be a way to overcome some of the problems which occur when studying under the European Credit Transfer System – which is visualized as a very effective way of studying.

These statements point to the conclusion that interactive teaching significantly influences the quality of the learning process and the obtained results.

The highly active working methods in their fragmented use or in their continuous and complete didactically meaningful use, in the form of ready-made interactive models, which is the case with this research, positively influence the quality of knowledge, especially in a multiplied form, as in this case.

The second reasoning suggests that the proactive way of working, through the use of appropriate interactive models, positively influences the durability of knowledge, the possibility for its application and the development of strong didactic competences.

If one starts from these two considerations as premisses, the conclusion that proactivity in teaching appears as a significant factor in improving the quality of knowledge and the development of skills is inevitably imposed, all the more so that this whole “educational scenario” largely takes place in the sphere of the immediate practical activity. So, contemporary academic teaching should increasingly be developed in the direction of using proactivity in conditions of immediate practice (everywhere and always).

The question of how much and what kind of knowledge will the future pedagogues and teachers need, and where is the boundary between what is considered a productive need and what is really needed to those who “tomorrow” will compete in the market of labor, remains open.

This prompts another question as to how the interactive way of work actually represents a kind of burden for teachers and how much they avoid additional (i.e. only seemingly additional because they are essential) burdens that occur during the interactive teaching. Namely, it is quite clear that teaching *ex catedra* is the easiest for every teacher (but also least productive for every teacher).

The development of interactive models, which ultimately do not have to be programmed at the level of those used in this research, the production of additional materials, continuous monitoring and the creation of conditions for a positive transfer of the theory in the form of its applicability, require greater engagement from the teachers, more time, more energy and effort, and material logistics. This is certainly not due to pedagogical indolence of the teachers, nor to their ignorance of the modes of interaction, but to several actual factors, such as working with large groups of students, performing teaching on many subjects, certain personnel problems, and above all lack of new educational and scientific cadres.

However, the issue on the level of pedagogical competence of teachers in higher education and the development of their didactic abilities, without which, no matter how highly educated they are, effective teaching at this level of education is not possible, still remains open at the university-level. Therefore, one of the outcomes of this research is the establishment of a new concept for the development of high school didactics, which can be developed on two levels, both formally and informally. On the first level, as a systemic solution, a program for didactic training for future teachers in higher education should be made. On the second level, a systematic and programmatic solution should be offered for the professional development of teachers in higher education, which will improve and strengthen their pedagogical and didactic competences.

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SOCIAL MEDIA - COLLECTIVE OF ONLINE COMMUNICATIONS CHANNELS

UDC: 316.774:004.738.5

(Original scientific paper)

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Abstract

Websites and applications dedicated to forums, microblogging, social networking, social bookmarking, social curation, and wikis are among the different types of social media. Facebook is a popular free social networking website that allows registered users to create profiles, upload photos and video, send messages and keep in touch with friends, family and colleagues. Twitter is a free microblogging service that allows registered members to broadcast short posts called tweets. Twitter members can broadcast tweets and follow other users' tweets by using multiple platforms and devices. LinkedIn is a social networking site designed specifically for the business community. The goal of the site is to allow registered members to establish and document networks of people they know and trust professionally, etc. Traditional channels did not fare nearly as well. Print, radio, and television were expected to see a net decrease in total marketing investments. How marketing funds are ultimately allocated is driven by the nature of the business, the competitive marketplace, and how target customers behave through the buying funnel.

Key words: Social media, Facebook, Twitter, LinkedIn, online communications

Introduction

Social media is the collective of online communications channels dedicated to community-based input, interaction, content-sharing and collaboration. Websites and applications dedicated to forums, microblogging, social networking, social bookmarking, social curation, and wikis are among the different types of social media. Some prominent examples of social media are: (Techartget.com, 2017)

Facebook is a popular free social networking website that allows registered users to create profiles, upload photos and video, send messages and keep in touch with friends, family and colleagues. According to statistics from the Nielsen Group, Internet users within the United States spend more time on Facebook than any other website. In 2010, Facebook bought FB.com domain from the American Farm Bureau Federation and paid a king's ransom for it – \$8.5 million dollars, which is 42 times more than the company originally paid for facebook.com! One feature of the new Facebook Messages is that it assigns you a personalized Facebook.com e-mail address. If a friend sends a message to your Facebook e-mail, you will receive it in your Facebook Inbox. (Domain.me, 2017). Unfortunately, Facebook's employees were using the Facebook.com domain for their e-mails already, so they had to switch to another domain. That's why Facebook needed to buy FB.com in the first place. With the launch of FB.ME in 2010, Facebook's new URL shortener. ME domain is helping the world's largest social network save its more than 350 million users valuable digits in a world where every character counts. Used as the Facebook shortener on their mobile interface, it automatically shortens a mobile link (for example a m.facebook.com link) to FB.ME link. This is clearly another confirmation of the intrinsic value of our extension's personalized branding and ability to instantly create a 'call to action' using minimal characters and maximum impact. Another feature of the shortener is the ability to take you straight to the Facebook username. (Domain.me, 2017)

After the launching of m.facebook.com and officially announcing mobile support in 2007, Facebook Messenger was launched for Android and IOS in 2011. Facebook did a whole lotta work to make mobile app users feel comfortable. Their Creative Labs department introduced services like Sling.me (early Snapchat clone, used for creating/sharing pictures/videos with one or more of your friends that will eventually be erased from the cyberspace) and Rooms.me (mix of a forum and news group, with a pinch of

Reddit and a dash of Instagram that lets you create “rooms” for the things you’re into, and invite others who are into them too). (Domain.me, 2017) Unfortunately, both the department and services mentioned were shut down in 2015. It is not a secret that back in 2012 Facebook acquired Instagram and in 2014 both Oculus VR, Inc and WhatsApp. That way, Facebook made clear that they will be using acquisitions as an expansion tool like many other internet giants. Then, in 2016, Facebook acquired MSQRD.me (or Masquerade), an app that uses sophisticated facial recognition technology, combined with just the right dose of magic, to bring you video selfies like you’ve never seen before. (Domain.me, 2017)

Twitter is a free microblogging service that allows registered members to broadcast short posts called tweets. Twitter members can broadcast tweets and follow other users' tweets by using multiple platforms and devices. (Techtarget.com, 2017) In February 2017, Twitter announced it had 319 million monthly active users worldwide, or just slightly under the number of every person in the United States. But of those 319 million, as many as 48 million aren’t actually real, according to a study conducted by researchers from the University of Southern California: They’re just software programs, designed to do everything a normal person on Twitter would do, including following other accounts and liking and retweeting certain messages. Those accounts, called “bots,” can range from accounts dedicated to alerting their followers about emergencies to political advocates intended to boost the numbers of a programmer’s preferred candidate. (Miamiherald.com, 2017)

LinkedIn is a social networking site designed specifically for the business community. The goal of the site is to allow registered members to establish and document networks of people they know and trust professionally. Microsoft has a set of goals for its LinkedIn integration plan, including some specific areas where the company will leverage the social network. Nadella reveals a list of what’s planned (Theverge.com):

- LinkedIn identity and network in Microsoft Outlook and the Office suite
- LinkedIn notifications within the Windows action center
- Enabling members drafting résumés in Word to update their profiles, and discover and apply to jobs on LinkedIn
- Extending the reach of Sponsored Content across Microsoft properties
- Enterprise LinkedIn Lookup powered by Active Directory and Office 365
- LinkedIn Learning available across the Office 365 and Windows ecosystem
- Developing a business news desk across our content ecosystem and [MSN.com](#)
- Redefining social selling through the combination of Sales Navigator and Dynamics 365

Most of the initial integrations are what you’d expect, but Windows 10 users will be surprised to see the addition of LinkedIn notifications in the Windows notification center. LinkedIn is well known for its bombarding emails and notifications, and Microsoft will have to manage these very carefully if it plans to highlight them directly within Windows 10. (Theverge.com)

Pinterest is a social curation website for sharing and categorizing images found online. Pinterest requires brief descriptions but the main focus of the site is visual. Clicking on an image will take you to the original source, so, for example, if you click on a picture of a pair of shoes, you might be taken to a site where you can purchase them. An image of blueberry pancakes might take you to the recipe; a picture of a whimsical birdhouse might take you to the instructions.

Google+ (pronounced *Google plus*) is Google's social networking project, designed to replicate the way people interact offline more closely than is the case in other social networking services. The project’s slogan is “Real-life sharing rethought for the web.”

Wikipedia is a free, open content online encyclopedia created through the collaborative effort of a community of users known as Wikipedians. Anyone registered on the site can create an article for publication; registration is not required to edit articles. Wikipedia was founded in January of 2001.

Reddit is a social news website and forum where stories are socially curated and promoted by site members. The site is composed of hundreds of sub-communities, known as "subreddits." Each subreddit has a specific topic such as technology, politics or music. Reddit site members, also known as, "redditors," submit content which is then voted upon by other members. The goal is to send well-regarded stories to the top of the site's main thread page.

Sent by computer engineer Ray Tomlinson in 1971, the email was simply a test message to himself. The email was sent from one computer to another computer sitting right beside it in Cambridge, Massachusetts,

but it traveled via ARPANET, a network of computers that was the precursor to the Internet. (Computinghistory.org, 2017) Facebook, Twitter, LinkedIn, YouTube, Google+, Instagram, and Pinterest were the top seven platforms used by marketers, with Facebook leading the pack by a long shot. All of the other platforms paled in comparison to these top seven.

Chart no.1 Seven platforms used by marketers

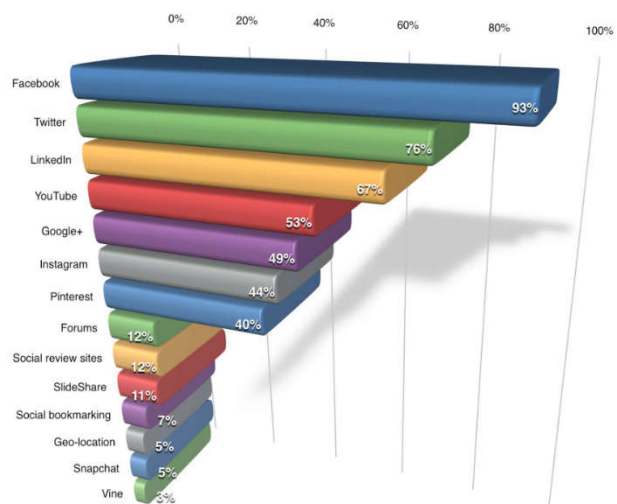
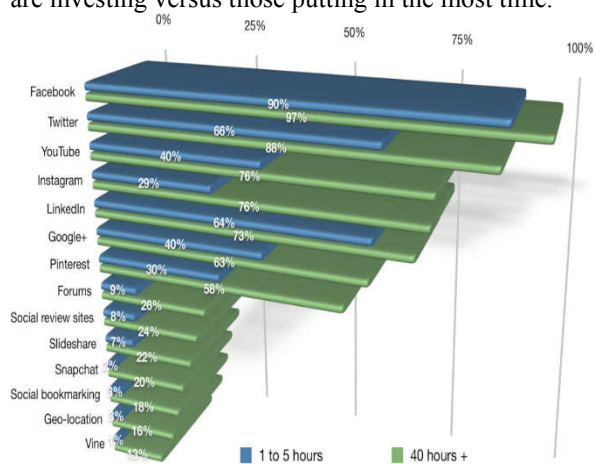


Chart no.2 Where marketers putting in the least time are investing versus those putting in the most time.



Source: Michael Stelzner (2016), "Industry Report", Social Media Examiner,

<https://www.socialmediaexaminer.com/wp-content/uploads/2016/05/SocialMediaMarketingIndustryReport2016.pdf>,
 Chat 1 p.23 and p.27

Chart no 2 shows where marketers putting in the least time are investing versus those putting in the most time. There are some interesting findings here. Marketers investing 40+ hours per week are much more focused on Instagram (47% more), YouTube (36% more), and Pinterest (28% more) than those investing 6 or fewer hours a week with social media

Here's a quick summary of Socialmediaexaminer primary findings (Stelzner, 2016):

- Video has become essential: A significant 60% of marketers use video in their marketing and 73% plan on increasing their use of video.
- Live video is hot: A significant 50% of marketers plan on using live video services such as Facebook Live and Periscope, and 50% want to learn more about live video.
- Facebook and YouTube hold the top spots for future plans: At least 63% of marketers plan on increasing their use of these social networks.
- Snapchat is on a growth trajectory: Only 5% of marketers are using Snapchat, yet 16% plan on increasing their Snapchat activities and 28% of marketers want to learn more about Snapchat.
- Facebook is the most important social network for marketers by a long shot! When asked to select their most important platform, 55% of marketers chose Facebook, followed by LinkedIn at 18%. Plus, 67% of marketers plan on increasing their Facebook marketing activities.
- Many marketers are unsure about their Facebook marketing: A significant 40% of marketers don't know if Facebook traffic has declined in the last 12 months and 35% aren't sure if their Facebook marketing is effective.
- Facebook ads dominate: A surprising 86% of social marketers regularly use Facebook ads, while only 18% use Twitter ads.
- Tactics and engagement are top areas marketers want to master: At least 90% of marketers want to know the most effective social tactics and the best ways to engage their audience with social media.

The above summary is just a taste of what's in this report.

The top social media questions marketers want answered can be summarized with the following keywords: tactics, engagement, measurement, audience, and tools—in that order. These questions and their order have remained the same since 2014. Below are the top issues marketers are facing today with social media marketing. At least 86% of marketers surveyed felt they're struggling to answer all of the following questions (Stelzner, 2016, p.6):

1: **TACTICS:** What social tactics are most effective? The number-one question marketers want answered (92%) is which tactics work best. This isn't a surprise, given the constant changes taking place across many social networks.

2: **ENGAGEMENT:** What are the best ways to engage my audience with social media? Figuring out how to best connect with people remains high on the list of questions marketers want answered (90%). Engaging with customers is becoming a unique competitive advantage.

3: **MEASUREMENT:** How do I measure the return on my social media marketing? A significant 86% of marketers want to know how to measure their return on investment for social media activities.

4: **AUDIENCE:** How do I find my target audience with social media? Locating ideal customers and prospects is a big concern for marketers (86%). Marketers are looking for guidance on sifting through enormous social networks and connecting with the right people.

5: **TOOLS:** What are the best social management tools? Marketers want better tools to simplify their social media tasks. A surprising 86% don't know which tools are best.

Social media is important for my business A significant 90% of marketers said that social media is important to their businesses. This is slightly down from 2015 findings, where 58% strongly agreed and 34% agreed. Years using social media marketing they asked participants how long they've been using social media marketing. Fifty-nine percent of marketers surveyed have at least two years of social media marketing experience. On the following pages, they asked marketers to rate their agreement with a few broad statements related to social media. (Stelzner, 2016)

A report from Forrester Research shows the estimated allocation of marketing funds offline vs. online and across the digital channels. Here are some conclusions from that report (Webstrategiesinc.com. 2017):

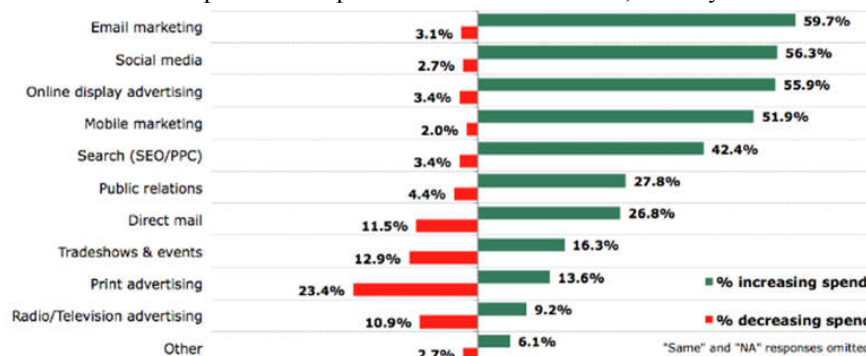
- In 2016, the average firm was expected to allocate 30% of their marketing budget to online, this rate is expected to grow to 35% by 2019
- Search engine marketing will capture the largest share of online spend with online display (banner ads, online video, etc.) taking the second largest share
- Social media investments will continue to grow as an overall share of online spend, but will only represent about 15% of the total online spend
- Mobile marketing has grown to a point that it's no longer tracked in the forecast and it's presumed to be considered across all channels

Conclusions from the 2014 report for comparison (Webstrategiesinc.com. 2017):

- 29% of a marketing budget was allocated to online/digital channels
- Search engine marketing (SEO & SEM) captured the largest share of online spend at 47% or about 14% of the firm's total marketing budget
- Online display advertising (banner ads, remarketing & retargeting) captured the next biggest share of the online spend at about 34% of total online spend and about 10% of the total marketing budget
- Social media investments were estimated at 6% of total online spend and a bit less than 2% of the total marketing budget
- Mobile garnered about 10% of the total digital marketing budget and slightly less than 3% of the total marketing budget.

investment.

Chart 3 Marketing Spending Plans for 2016 by program based on survey of 295 global leaders, 72% of whom are with companies headquartered in North America, January 2016



Source: Webstrategiesinc.com.(2017)<https://www.webstrategiesinc.com/blog/how-much-budget-for-online-marketing-in-2014>, 26.11.2017

The chart below shows strong increases in digital channel investment. Of the five digital tactics represented in the report, each expected to see at least a 42% increase in

Traditional channels did not fare nearly as well. Print, radio, and television were expected to see a net decrease in total marketing investments. Once again, these are averages. How marketing funds are ultimately allocated is driven by the nature of the business, the competitive marketplace, and how target customers behave through the buying funnel.

Which Social Media Channels Should you invest in? An August 2016 report from eMarketer attempts to project social media penetration by social platform through 2020. While there are no direct investment assessments associated with this particular study, it does show noteworthy trends among the major social channels.

Chart 4 US Social Network Users and Penetration by platform, 2015-2020, millions and % of total social network users

	2015	2016	2017	2018	2019	2020
Facebook users	162.1	166.8	171.4	175.6	179.1	182.0
% of total social network users	90.0%	89.8%	89.7%	89.4%	89.3%	89.2%
Instagram users	57.4	67.2	76.2	83.6	89.5	95.1
% of total social network users	31.9%	36.2%	39.9%	42.6%	44.6%	46.6%
Twitter users	51.2	52.2	53.2	54.2	55.3	55.8
% of total social network users	28.4%	28.1%	27.9%	27.6%	27.6%	27.3%
Pinterest users	49.9	54.3	58.1	61.4	64.2	66.3
% of total social network users	27.7%	29.2%	30.4%	31.3%	32.0%	32.5%
Tumblr users	21.0	23.2	25.2	26.8	28.2	29.4
% of total social network users	11.7%	12.5%	13.2%	13.7%	14.1%	14.4%
Total social network users	180.1	185.7	191.1	196.3	200.6	204.1

Source: eMarketer, 2016 Aug., 28.01.2018

Chart 5 US Total media Ad Spending Share, by Media, 2014-2020 % of total

	2014	2015	2016	2017	2018	2019	2020
TV	39.1%	37.7%	36.8%	35.8%	34.8%	33.7%	32.9%
Digital	28.3%	32.6%	35.8%	38.4%	40.8%	43.1%	44.9%
Mobile	10.9%	17.3%	22.7%	26.2%	28.8%	31.0%	32.9%
Print	17.4%	15.4%	13.9%	12.9%	12.2%	11.6%	11.1%
Newspapers	9.1%	8.0%	7.2%	6.6%	6.1%	5.7%	5.5%
Magazines	8.3%	7.4%	6.8%	6.4%	6.1%	5.8%	5.6%
Radio	8.4%	7.8%	7.4%	7.0%	6.7%	6.4%	6.1%
Out of home	4.0%	4.0%	3.9%	3.8%	3.7%	3.5%	3.4%
Directories	2.8%	2.5%	2.2%	2.0%	1.9%	1.7%	1.6%

Source: www.eMarketer.com, 12.01.2018

Facebook is expected to remain king, with 90% of social media users utilizing in the platform. Instagram is expected to grow, from 32% penetration to 47% by 2020. Other social channels with baked in advertising features, such as Pinterest and Twitter, will continue to have relatively low penetration, peaking around 33% of users by 2020. This data suggests an emphasis should be made on Facebook and Instagram channels for social advertising.

The chart 5 from eMarketer projects the following: “in 2017, TV ad spending will total \$72.01 billion, or 35.8% of total media ad spending in the US. Meanwhile, total digital ad spending in 2017 will equal \$77.37 billion, or 38.4% of total ad spending.” This marks the first time in history digital spend surpassed TV ad spend in the US. And the gap will only widen - by 2020, digital spend will surpass television by

36%. Digital spend is only a portion of total marketing spend for most businesses. For 50% of businesses surveyed, digital represents less than 40% of total marketing spend (Webstrategiesinc.com, 2017).

Chart 6 Structure of the surveyed enterprises according to the number of employees

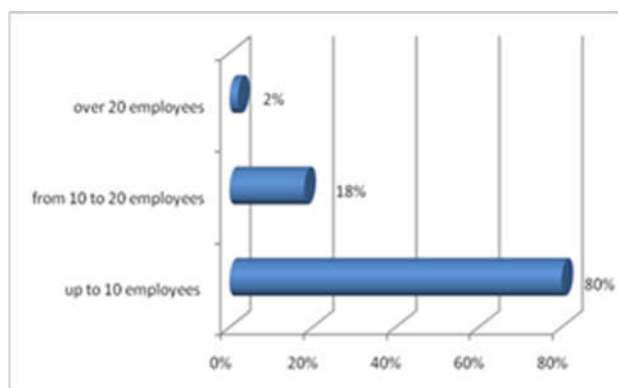
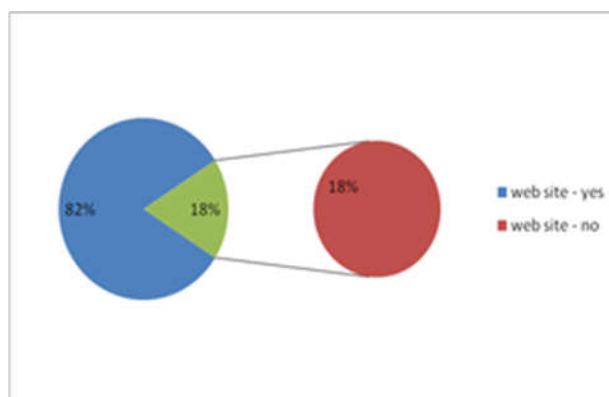


Chart 7 Structure of the surveyed enterprises according to whether they have their own website



The aim of the research in this paper is to indicate the structure and number of enterprises on RMacedonia according to whether they use social media. Description of the results obtained from the survey prepared for this paper: The total number of surveyed enterprises is 30, and the companies are located in Skopje. According to the number of employees, 80% of enterprises have up to 10 employees, 18% from 10 to 20 employees, while only 2% of enterprises have over 20 employees.

When asked if the company had its own website, 82% of enterprises received positive response, and 18% of enterprises gave a negative response. Although at first glance it is assumed that a large percentage of the surveyed enterprises have their own website, however, in today's conditions of the role of the Internet in the creation of a business, this can not be accepted as a positive indicator. The site is the easiest, cheapest and easiest way for a business to get closer to consumers, potential business partners, etc.

An identical number of positive responses are also given to the question of whether the company has its own Facebook or Instagram profile, but that does not mean that there is a full match between those who have their own website and those who have their own Facebook or Instagram page (profile). 2% of enterprises that do not have their own website have their own Facebook or Instagram account, which means that a very small number of surveyed companies do not have a web site, neither a Facebook nor an Instagram account. This greatly improves the notion of using the Internet as a means of self-representation by enterprises.

All those companies that have given a positive response to the question of having their own Facebook or Instagram page are asked if they are advertising, or whether they use paid advertising on one of these two platforms. 60% said they advertise on one of these platforms (paid advertising). Consequently, the number of companies that advertise on social networks (Facebook or Instagram) is still small.

Enterprises who responded that they advertise through paid advertising on Facebook or Instagram, only 27% spend a budget over 100 euros a month to advertise on one of the Facebook or Instagram platforms, the remaining number of companies allocate less than 50 euros per month. 90% of companies as a result of paid advertising on social networks Facebook or Instagram has positive effects. Regarding the question whether they plan to continue advertising on social networks in the future if they plan to increase their advertising budgets, 100% of the interviewed companies have answered positively both in relation to one and in relation to the other question that confirms the thesis that the future the promotion is largely linked to the Internet and social networks as the most used ways of communication.

Summary

An August 2016 report from eMarketer attempts to project social media penetration by social platform through 2020. While there are no direct investment assessments associated with this particular study, it does show noteworthy trends among the major social channels. Facebook is expected to remain king, with 90% of social media users utilizing in the platform. Instagram is expected to grow, from 32% penetration to 47% by 2020. Other social channels with baked in advertising features, such as Pinterest and Twitter, will continue to have relatively low penetration, peaking around 33% of users by 2020. This data suggests an

emphasis should be made on Facebook and Instagram channels for social advertising. The use of the Internet in Macedonia by the business sector is already an important tool for promotion, although the opportunities offered by it are still insufficiently used.

Confirmation of this conclusion is the fact that not all surveyed enterprises use the advantages of such media, as well as the small funds allocated for this purpose in those companies that use the services and advantages of the Internet.

The reasons for such situations are mostly: insufficient knowledge of the opportunities offered by social media, lack of financial resources, lack of appropriate staff, lack of information about the existence of specialized agencies that deal with the provision of this type of marketing services, uncalculation as an expense of own engagement for using Facebook or Instagram advertising platforms, etc.

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DIFFERENCES BETWEEN VARIABLES FOR ASSESSMENT OF THE EXPLOSIVE POWER, THE AGILITY AND THE BIOMECHANICAL INDICATORS IN THE PERFORMANCE OF JUMP-SHOOT

UDC: 796.015:796.431
(Original scientific paper)

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Abstract

Basketball is one of the most dynamic sports games. It requires from the players the ability to overplay the opponent, possession of: speed, spin, versatility, explosive force, flawless movement with, successful realization of technical and tactical tasks and above all possession of good perception and intelligence. Has been conducted a survey with a sample of 54 young basketball players aged 14 to 16, of which 18 at 14 years of age, 18 at 15 years of age and 18 at 16 years of age in order to determine whether there are differences in structural basketball elements with a ball (ball-leading and jump-shot), the explosive force, the running speed and agility in young basketball players representing Macedonia. A total of 10 variables were applied to accomplish the research goals, 4 for estimating the explosive force, 1 variable speed rate estimation and 1 variable for agility assessment and 3 biomechanical variables. It can be concluded that in the variables for evaluating the explosive force, the basketball players at the age of 14 show weaker results in the variation of the double-edged jump in height with hands on hips compared to basketball players 15 and 16 years of age. Also, 14-year-old basketball players achieve weaker results in the variation of a double-edged jump in height from a high-pitch compared to basketball players aged 16 years. The arsenic jump in height did not determine statistically significant differences between players 14, 15 and 16 years of age. Basketball players at the age of 16 are showing better results in throwing the ball from the chest in a sitting position than the basketball players aged 14 and 15. It can be concluded that in the speed estimation variable (running at 20 m. high start), the basketball players at the age of 16 show better results than basketball players aged 14 and 15. Basketball players of 15 years of age show better results in the variable 20 m run from a high start aside from basketball players aged 14. There weren't statistically significant differences in the variable agility (t-test) estimation between basketball players 14, 15 and 16 years of age.

Keywords: *basketball, motor skills, technique, variables, ability, age.*

Introduction

Motor skills are important factors that determine the success of basketball. Every situation during the game should be adequately accomplished with motor skills. It can be accomplished through the locomotor system which includes the strength, the accuracy, the speed, the coordination, the balance and the agility of the players. Basketball is characterized by a large number of jumps in defense and attack. Along with frequent fast movements, with change of direction with and without the ball, fast passes and short sprints, i.e structure of movements for which the explosive force is present. The high frequencies of these structures in the game indicate that the explosive force significantly contributes to the success of each individual player. Other forms, such as, repetitive and static force, contribute significantly less to success, because the structure of movements in which these two forms of force are present, static and repetitive, in basketball are very rare. Almost every action in the game ends with a shooting at the basket, which implies that in basketball it is most important to hit the basketball hoop of the opponents. The motoring capability that is responsible for achieving a point is the precision. Precision must be present in

the passing and the leading of the ball, if these elements of the technique are desired to be successfully performed. The speed in the basketball game structure is most often present as the speed of a motor reaction, which is the capability of the player to react quickly to important information from the environment during the match and on the basis of the received information to create a response in the form of an adequate motor reaction by assessing the situation on the court. The position of the ball and the opponent and anticipating the possibility of the continuation of the action, all this requires a high level of this ability. The speed of movement during the action in the match - counterattack, return to defense - is significantly affected by the explosive strength, because the structure of the game is such that the distance that needs to be overcome is short, and the speed of overcoming them depends to a large extent on the fast explosive start.

The frequency of the movement as a form of speed is the ability of the players which is present during the entire game. This motor skill will help the defensive players in a position of defensive basketball attitude to disable the player who is attacking. Coordination is the ability to effectively solve complex motor tasks. Keeping in mind that basketball is a complex game, whose complexity is conditioned by the small court and the specifics of the morphological construction of the basketball players and the presence of the ball, one should not specifically point out the influence of the coordination capacity of the final success in the game.

Agility is responsible for the rapid change in the direction of movement, at different angles, in the structure of the movement without and with a ball. In the basketball game, it is especially emphasized because of the narrow space where the activity is performed, and because of that, the player with better agility will more often find himself in a more favorable position for realization, that is because this ability will enable efficient movement and closing of his own basket.

The main aim of the research is to determine and compare the differences in structural skill jump shot in basketball, explosive strength, running speed, agility and some biomechanical parameters, among young basketball players representing Macedonia at the age of 14, 15 and 16 years.

Method of Work

Sample of respondents

The sample of respondents is drawn from the male youth basketball representations of Macedonia U14, U15 and U16.

A sample of variables

The sample of variables consists of tests for the estimation of explosive strength (countermovement jump with arm swing, countermovement with the hands of the hips, countermovement jump with arm swing after landing, basketball throw from the chest while sitting on the floor), speed (20m run), agility (t-test) and biomechanical indicators for assessing the technique of performance of the jump shot element (jump shot ball release angle, jump shot duration, relative elbow angle before extension).

Testing Protocol

To register part of the test results was used the Physical Ability Test 02 system, which is composed of a photocell module and an optojump module.

The tests were conducted in a registered hall according to FIBA standards and propositions, before the start of the preparations of the selected representatives.

The measurement was carried out by experts in the field of kinesiology, with many years of experience in the field of kinesiology and practical knowledge of the use of systems for testing of sports performances.

Before the test, the examinees had several minutes of warming up and then were introduced with the tests. The best result of the three test attempts was followed for analysis. The temperature in the hall was from 17 to 22 °C. All respondents were in sports equipment and divided into groups.

To record the movements, was used a high-speed camcorder Casio Exilim FH 100 with a recording speed of 120 frames per second and a spatial resolution of 640x480 pixels were used. The camera was positioned perpendicularly at a distance of 12 m from the plane of movement in order to avoid the errors in the perspective (Payton, C.J. and Bartlett, R, 2008).

Three superficial contrast markers were placed at appropriate anatomical points according to the Dempster's model (Robertson, E.G.D. et al. 2014) (glenohumeral joint, elbow axis, wrist axis) for defining two body segments (forearm, forearm).

Then using the software KINOVEA 0.8.25, the biomechanical indicators of the performance technique of the element were determined. To determine the relative elbow angle, the moment was not taken before the subject began to extend elbow.

The release angle was determined 10 frames after throwing the ball, ie from the moment of finishing the fingertip contact with the ball to the tenth frame.

To determine the duration of the jump shot, the time interval from the moment of contact with the two feet of the ground was taken until the point of release of the basket.

Statistical analysis

For all applied general and specific motor tests and biomechanical variables, the basic descriptive statistical parameters are calculated: arithmetic mean (\bar{X}), standard deviation (SD), lower and upper limit of the range in which the results are moving (Min-Max), coefficient of variation (CV), standard arithmetic mean error (SE), skewness symmetry (Skew), Kurt's Kurtosis, and Kolmogorov-Smirnov test (KS), which tests the distribution's normality.

The univariate and multivariate analysis of variance (ANOVA, MANOVA) was used to determine the quantitative and qualitative intergroup differences, and the univariate differences in the analyzed variables were determined by applying the LSD - post-hoc test.

The statistical program package Statistica 5 was used to process the obtained data.

Results

Table 1. Descriptive statistics and the normal distribution of basic and specific motor tests and biomechanical variables in basketball at the age of 16 years

	Mean	Minimum	Maximum	SD	CV.	S.E.	Skewness	Kurtosis
OSVISM	43,66	37,20	58,20	5,15	11,79	1,21	1,30	2,62
OSVISRK	32,63	25,20	41,70	3,56	10,92	0,84	0,47	2,05
OSDVIS	39,19	28,70	52,30	5,51	14,05	1,30	0,48	0,94
TRC20MVS	3,09	2,84	3,29	0,12	3,81	0,03	-0,40	-0,38
FRLBGRS	12,33	11,00	14,33	0,93	7,51	0,22	0,41	-0,32
TTEST	10,83	10,06	11,82	0,43	4,00	0,10	0,22	0,42
RALPESS	64,39	38,00	83,00	10,50	16,31	2,47	-0,74	1,13
AIBSS	43,53	37,00	48,30	3,01	6,91	0,71	-0,50	0,10
VREMSS	0,52	0,38	0,68	0,08	14,85	0,02	0,31	-0,16

Table 2. Kolmogorov-Smirnov test for basketball players at the age of 16 years

	N	max D	K-S
OSVISM	18	0,19	p > .20
OSVISRK	18	0,15	p > .20
OSDVIS	18	0,16	p > .20
TRC20MVS	18	0,13	p > .20
FRLBGRS	18	0,11	p > .20
TTEST	18	0,11	p > .20
RALPESS	18	0,10	p > .20
AIBSS	18	0,10	p > .20
VREMSS	18	0,14	p > .20

From the overview of Table 1, it can be seen that scoring values in most variables in basketball players aged 16 are in the range of the recommended values from -1 to +1, indicating that the distribution of the results is approximately symmetrical. Positive asymmetry - epicurtic it is noted only in the OSVISM variable ($Sk = 1.30$). From the values of the kurtosis, it can be seen that all general and specific motor tests and biomechanical variables show platykurtic distribution.

The homogeneity of the sub-example of basketball players at the age of 16, based on the calculated coefficients of variability, is at a satisfactory level. The highest level of scattering of the results is observed in the variable RALPES (CV = 16.31).

The value of the basic central and dispersive parameters of the applied variables, in the minimum and maximal result, contains about four or more standard deviations (SD), on the basis of which a satisfactory sensitivity of all variables can be established. Based on the values of the standard deviations (SD) and its ratio with the mean, we can conclude that in most variables there is no statistical significance of the results of the arithmetic mean.

The numerical values of the standard error show a minimum burst, because they are proportionately insignificant to the corresponding value of the standard deviation.

The results of Kolmogorov-Smirnov's test showed that all variables for basketball players at the age of 16 were normally distributed.

Table 3. Descriptive statistics and the normal distribution of basic and specific motor tests and biomechanical variables in basketball players at the age of 15 years

	Mean	Minimum	Maximum	SD	CV.	S.E.	Skewness	Kurtosis
OSVISM	41,72	33,90	55,20	5,54	13,27	1,31	0,74	0,57
OSVISRK	33,66	25,30	47,00	5,24	15,56	1,23	1,24	1,75
OSDVIS	37,14	31,10	45,50	4,63	12,47	1,09	0,53	-0,82
TRC20MVS	3,32	3,00	3,68	0,23	6,97	0,05	0,09	-1,50
FRLBGRS	10,88	8,60	13,70	1,58	14,48	0,37	0,31	-1,04
TTEST	11,13	9,88	12,15	0,81	7,33	0,19	-0,11	-1,54
RALPES	64,17	38,00	73,00	9,39	14,63	2,21	-1,48	2,21
AIBSS	47,78	42,90	52,80	3,44	7,20	0,81	0,08	-1,39
VREMSS	0,47	0,24	0,60	0,09	19,09	0,02	-1,02	1,55

From the overview of Table 3, which presents the results of the central and dispersive parameters of general specific motor tests and biomechanical variables, in basketball players at the age of 15, it can be concluded that most results in the mean are valid because the standard error of the arithmetic mean (SE) in all variables is five times smaller than its mean value. The value of the basic central and dispersive parameters of the applied variables in the invariants minimum (Min) and Max (Max) result, contains about four or more standard deviations (SD), based on which a satisfactory susceptibility of all variables can be established.

The homogeneity of the sub-example basketball players at the age of 15, on the basis of the calculated coefficients of variability, is satisfactory. The highest level of scattering of the results is observed in the variable VREMSS (CV = 16.31).

Table 4. Kolmogorov Smirnov test in basketball players at the age of 15 years

	N	max D	K-S
OSVISM	18	0,14	p > .20
OSVISRK	18	0,26	p < ,15
OSDVIS	18	0,13	p > .20
TRC20MVS	18	0,14	p > .20
FRLBGRS	18	0,18	p > .20
TTEST	18	0,15	p > .20
RALPES	18	0,21	p > .20
AIBSS	18	0,15	p > .20
VREMSS	18	0,15	p > .20

From the overview of Table 3, it can be seen that the values of the skewness in most variables are within the limits of the recommended values from -1 to +1, indicating that the distribution of the results is approximately symmetric. Negative asymmetry (hipokurtic) is observed only in the variable RALPES (Sk

= -1,48), Positive asymmetry - epikurtic (the greater number of results are in the zone of the better ones), it is noted only in the OSVISRK variable ($Sk = 1,24$).

From the values of the kurtosis (Table 3), it can be seen that all applied variables show a consistency (platykurtic distribution).

The results of Kolmogorov-Smirnov test showed that all variables for basketball players at the age of 15 are normally distributed.

Table 5. Descriptive statistics and the normal distribution of basic and specific motor tests and biomechanical variables in basketball at the age of 14 years

	Mean	Minimum	Maximum	SD	CV.	S.E.	Skewness	Kurtosis
OSVISM	41,61	30,30	49,30	5,24	12,59	1,35	-0,44	-0,06
OSVISRK	29,72	22,70	35,70	3,27	11,00	0,77	-0,44	-0,05
OSDVIS	34,23	20,40	44,00	6,19	18,10	1,46	-0,87	0,93
TRC20MVS	3,50	3,23	3,97	0,18	5,13	0,04	1,11	1,61
FRLBGRS	9,68	7,60	10,94	0,98	10,13	0,23	-0,59	-0,61
TTEST	11,08	10,19	11,45	0,30	2,74	0,07	-1,54	3,33
RALPESS	60,00	21,00	87,00	17,53	29,22	4,13	-0,43	-0,16
AIBSS	48,13	39,80	55,50	4,25	8,84	1,00	0,14	-0,27
VREMSS	0,46	0,33	0,84	0,12	26,67	0,03	1,89	5,17

From the overview of Table 5, it can be seen that scoring values in most variables for basketball players aged 14 are in the range of the recommended values from -1 to +1, indicating that the distribution of the results is approximately symmetrical. Positive asymmetry-epikurtic (most of the results are in the zone of the better ones), it is only noted in the variable TRC20MVS ($Sk = 1.11$). Negative asymmetry (hypokurtic) is observed in the T-TEST variable ($Sk = -1.54$).

From the values of the kurtosis in Table 5, it can be seen that most of the applied anthropometric measures, general and specific motor tests and biomechanical variants show solidity (platokurtic distribution). Mesokurtic (normal distribution) shows only the T-TEST variable, while the leptokurtic distribution shows the variable VREMSS.

The homogeneity of a sub-example of basketball players at the age of 14, based on the calculated coefficients of variability, is at a satisfactory level. The highest level of scattering of results is observed in the variable RALPESS ($CV = 29,22$).

Table 6. Kolmogorov-Smirnov test for basketball players at the age of 14 years

	N	max D	K-S
OSVISM	15	0,09	$p > .20$
OSVISRK	18	0,13	$p > .20$
OSDVIS	18	0,21	$p > .20$
TRC20MVS	18	0,18	$p > .20$
FRLBGRS	18	0,15	$p > .20$
TTEST	18	0,19	$p > .20$
V20MDR	18	0,12	$p > .20$
V20MNDR	18	0,12	$p > .20$
VODTMS	18	0,15	$p > .20$
RALPESS	18	0,08	$p > .20$
AIBSS	18	0,09	$p > .20$
VREMSS	18	0,18	$p > .20$

The value of the basic central and dispersive parameters of the applied variables in the minimum and maximum results intervals contains about four or more standard deviations (SD), on the basis of which a satisfactory sensitivity of all variables can be established. Based on the values of the standard deviations (SD) and its ratio with the mean (Mean), it can be concluded that in most variables there is no statistically significant deviation of the results from the arithmetic mean.

The numerical values of the standard error show a minimum burst, because looking proportionally, they are insignificant in relation to the corresponding value of the standard deviation.

The results of Kolmogorov-Smirnov procedure showed that all variables for basketball players at 14 years of age are normally distributed.

Although this is a small selective sample of respondents (top young basketball players), the results of the analysis indicate that in all variables there is a normal distribution of their results, based on which it can be concluded that the degree of normality of distributions of applied manifest variables, meets the necessary methodological and statistical criteria for the application of correct and justified multivariate and univariate statistical procedures for further processing of the received data. Indeed, this created conditions for sufficient precise scientific determination, analysis and comparison of data.

Differences between groups in general and specific motor tests and biomechanical variables

The results of the research were analyzed in order to address the basic problem of the research, ie. what differences exist in basic and specific motor tests and biomechanical variables among basketball players 14, 15 and 16 years of age.

Table 7. Significance of differences between basketball sub-examples of 16, 15 and 14 years of age

	Value	F	Hypothesis df	df	Sig.	n ²
Pillai's trace	1,218	3,633	30	70	,000	,609
Wilks' lambda	,137	3,866	30	68	,000	,630
Hotelling's trace	3,726	4,098	30	66	,000	,651
Roy's largest root	2,799	6,530	15	35	,000	,737

Table 8. Significance of individual differences between basketball sub-examples of 16, 15 and 14 years of age

	16		15		14		F	Sig.	n ²
	Mean	SD	Mean	SD	Mean	SD			
OSVISM	43,66	5,15	41,71	5,54	41,61	5,24	0,82	0,446	0,11
OSVISRK	32,63	3,56	33,66	5,24	29,72	3,27	4,43	0,017	0,10
OSDVIS	39,19	5,51	37,14	4,63	34,23	6,20	3,73	0,031	0,45
TRC20MVS	3,09	0,12	3,32	0,23	3,50	0,18	22,01	0,000	0,44
FRLBGRS	12,33	0,93	10,88	1,58	9,68	0,98	22,21	0,000	0,05
TTEST	10,83	0,43	11,13	0,81	11,08	0,30	1,43	0,250	0,31
RALPESS	64,39	10,50	64,17	9,39	60,00	17,53	0,65	0,525	0,25
AIBSS	43,53	3,01	47,78	3,44	48,13	4,25	9,09	0,000	0,06
VREMSS	0,52	0,08	0,47	0,09	0,46	0,12	2,10	0,133	0,42

With the use of multivariate analysis of variance (MANOVA), ie by testing the significance of differences in arithmetic mean in all variables between sub-examples of young top basketball players (14, 15 and 16 years old), a statistically significant difference was found because Wilks' Lambda .131 and for degrees of freedom $df = 68$, gives a statistical significance at level $Q = .000$. The size of the partial effect of the determinants (partial n^2) shows high values, 630.

In order to determine in which measures and tests there are statistically significant differences, univariate analysis of variance (ANOVA) for each variable has been calculated. From the overview of Table 8, it can be seen that there are statistically significant differences in all the variables studied: countermovement with the hands of the hips ($F = 4.43$; $p = 0.017$), a countermovement jump after landing ($F = 22.01$; $p = 0.000$), basketball throw from the chest while sitting on the floor ($F = 22.21$; $p = 0.000$), running 20m ($F = 3.73$; $p = 0.031$), and jump shot ball release angle in the jump-shot ($F = 9.09$; $p = 0.000$). The partial effect of the partial- n^2 determinants is ranked between .01 and .45 and shows little effect on impact. The greatest effect in determining the differences is shown by the variables: countermovement jump with arm swing after landing (partial- $n^2 = .45$) and running 20 m (partial- $n^2 = .44$)

To determine which suppressers there are statistically significant differences in each individual variable, LSD (least significant difference test) tests have also been applied.

Table 9. LSD post-hoc tests on the variable arrayed countermovement jump with arm swing

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Interval	Confidence
OSVISM	16	15	1,945	1,77	,278	-1,62	5,51
		14	2,053	1,86	,275	-1,68	5,79
	15	16	-1,945	1,77	,278	-5,51	1,62
		14	,108	1,86	,954	-3,63	3,84
	14	16	-2,053	1,86	,275	-5,79	1,68
		15	-,108	1,86	,954	-3,84	3,63

From the overview of Table 9, it can be seen that in the variable countermovement jump with arm swing, there are no intergroup statistically significant differences.

Table 10. LSD post-hoc tests on the variable countermovement jump with the hands of the hips

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Interval	Confidence
OSVISRK	16	15	-1,0333	1,37	,455	-3,787	1,721
		14	2,9056*	1,37	,039	,152	5,660
	15	16	1,0333	1,37	,455	-1,721	3,787
		14	3,9389*	1,37	,006	1,185	6,693
	14	16	-2,9056*	1,37	,039	-5,660	-,152
		15	-3,9389*	1,37	,006	-6,693	-1,185

From the overview of Table 10, it can be seen that basketball players at the age of 15 and 16 show better results in the variable of the variable countermovement jump with the hands of the hips compared to basketball players aged 14 years. Among basketball players aged 15 and 16, no statistically significant differences were found in the variable countermovement jump with the hands of the hips.

Table 11. LSD post-hoc tests on the variable countermovement jump with arms after landing

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Interval	Confidence
OSDVIS	16	15	2,0539	1,83	,266	-1,615	5,722
		14	4,9656*	1,83	,009	1,297	8,634
	15	16	-2,0539	1,83	,266	-5,722	1,615
		14	2,9117	1,83	,117	-,757	6,580
	14	16	-4,9656*	1,83	,009	-8,634	-1,297
		15	-2,9117	1,83	,117	-6,580	,757

From the overview of Table 11, it can be seen that basketball players at the age of 16 show better results in the variable countermovement jump with arms swing after landing compared to basketball players aged 14. Among basketball players aged 15 and 16 and 14 and 15, no statistically significant differences were found in the variable countermovement jump with arms swing after landing.

Table 12. LSD post-hoc tests on the variable running 20 m

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Interval	Confidence
TRC20MVS	16	15	-,22144*	0,06	,001	-,3433	-,0996
		14	-,40194*	0,06	,000	-,5238	-,2801
	15	16	,22144*	0,06	,001	,0996	,3433
		14	-,18050*	0,06	,004	-,3023	-,0587
	14	16	,40194*	0,06	,000	,2801	,5238
		15	,18050*	0,06	,004	,0587	,3023

From the overview of table 12, we can see that basketball players at the age of 16 show better results (the variable is inverse-the lower value indicates a better result) in the variable running at 20m with basketball players from 14 and 15 years of age. Basketball players of 15 years of age show better results in the variable running 20m against basketball players aged 14.

Table 13. LSD post-hoc tests on the variable basketball throw from the chest while sitting on the floor

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval
FRLBGRS	16	15	1,4506*	0,40	,001	,649 2,252
		14	2,6561*	0,40	,000	1,855 3,457
	15	16	-1,4506*	0,40	,001	-2,252 -,649
		14	1,2056*	0,40	,004	,404 2,007
	14	16	-2,6561*	0,40	,000	-3,457 -1,855
		15	-1,2056*	0,40	,004	-2,007 -,404

From the overview of Table 13, it can be seen that basketball players at the age of 16 show better results in the variable basketball throw from the chest while sitting on the floor in relation to basketball players aged 14 and 15. Basketball players from 15 years of age show better results in the same variable compared to basketball players aged 14 years.

Table 14. LSD post-hoc tests on the agility T-test variable.

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval
TTEST	16	15	-,294000	0,19	,122	-,66938 ,08138
		14	-,246556	0,19	,193	-,62194 ,12883
	15	16	,294000	0,19	,122	-,08138 ,66938
		14	,047444	0,19	,801	-,32794 ,42283
	14	16	,246556	0,19	,193	-,12883 ,62194
		15	-,047444	0,19	,801	-,42283 ,32794

From the overview of Table 14, it can be seen that the variable agility t-test did not determine intergroup statistically significant differences.

Table 15. LSD post-hoc tests on the variable relative elbow angle before extension In the jump-shot

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval
RALPESS	16	15	,222	4,33	,959	-8,47 8,91
		14	4,389	4,33	,315	-4,30 13,08
	15	16	-,222	4,33	,959	-8,91 8,47
		14	4,167	4,33	,340	-4,52 12,86
	14	16	-4,389	4,33	,315	-13,08 4,30
		15	-4,167	4,33	,340	-12,86 4,52

From the overview of Table 16, it can be seen that basketball players at the age of 16 show a smaller angle of jump throwing the basketball in terms of basketball players aged 14 and 15. Among basketball players aged 14 and 15, no statistically significant differences were found in the variable jump shot ball release angle.

From the overview of Table 17, it can be seen that in the variable the duration of the jump-shot , no statistically significant difference was detected.

Table 16. LSD post-hoc tests on the variable jump shot ball release angle

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval
AIBSS	16	15	-4,2500*	1,20	,001	-6,662 -1,838
		14	-4,6000*	1,20	,000	-7,012 -2,188
	15	16	4,2500*	1,20	,001	1,838 6,662
		14	-,3500	1,20	,772	-2,762 2,062
	14	16	4,6000*	1,20	,000	2,188 7,012
		15	,3500	1,20	,772	-2,062 2,762

Table 17. LSD post-hoc tests on the variable duration of the jump-shot.

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval
VREMSS	16	15	,050667	0,03	,127	-,01498 ,11631
		14	,063333	0,03	,058	-,00231 ,12898
	15	16	-,050667	0,03	,127	-,11631 ,01498
		14	,012667	0,03	,700	-,05298 ,07831
	14	16	-,063333	0,03	,058	-,12898 ,00231
		15	-,012667	0,03	,700	-,07831 ,05298

Discussion

Analyzing the variables for assessing explosive strength, it can be concluded that basketball players at the age of 14 show weaker results in the variable countermovement with the hands of the hips in relation to basketball players 15 and 16 years of age. Also, 14-year-old basketball players achieve weaker results in the variable countermovement jump with arm swing after landing compared to basketball players aged 16 years. In the variable, the countermovement jump with arms swing did not determine statistically significant differences between players 14, 15 and 16 years of age.

If we compare the variables for assessing the explosive strength of this research with the results of young players from other countries, it can be concluded that the Portuguese young players at the age of 15 in the variable countermovement jump with their hands on the hips reach 32 cm (Silva et al. 2008), Turkish players 33.53 cm (Emre et al. 2014), Lithuanian at 14 years 45.1 cm, 15 years old 46.6 cm and at 16 years 50.1 cm and Australian players at the age of 14 up to 17 years of age, achieved a score in the 65.5 cm test (Drinkwater et al., 2008). On the other hand, the Macedonian players achieve poorer results in the same variable versus their colleagues from abroad (the Macedonian players at the age of 14 are 19.27 cm, at 15 years 33.66 cm and at 16 years 32.63 cm).

Analyzing the speed estimation variable (running at 20 meter), it can be concluded that basketball players at the age of 16 show better results than basketball players aged 14 and 15. Basketball players at the age of 15 show better results in the 20 meter running against basketball players aged 14 years.

If we compare the variables for estimating the speed of this research with the results of the young players from other countries, it can be concluded that the Turkish young players at the age of 15 achieve weaker results in the variable run of 20 m (Macedonian 3.32 s, Turkish 3,75 sec.). Lithuanian players in the same 14-year age variable score 3.27 sec at 15 years of age 3.21 sec and 16 at age 3.07 sec. Austrian players in the variable running 20 m at the age of 14 to 17 achieve an average score of 3.04 sec.

Concerning basketball players from this research with their peers from the sports academy (Daskalovski et al., 2017), it can be concluded that at the age of 15 young athletes from the sports academy in the 20 meter test score an average score of 3.27 seconds, is a better result than the respondents of the same age in this research (3.32 sec), while at the age of 16 they achieve an average score of 3.20 sec, a weaker score than the respondents of the same age in this research (3.09 sec).

Basketball players at the age of 16 show better results in the variable basketball throw from the chest while sitting on the floor than basketball players aged 14 and 15. In the variable relative elbow angle before

extension in the jump-shot, no statistically significant difference was found. Basketball players at the age of 16 show a smaller elbow angle than at age 14 and 15.

In agility (t-test), no statistically significant difference was found between basketball players 14, 15 and 16 years of age.

Differences in basic and specific motor skills and biomechanical variables among basketball players 14, 15 and 16 are probably conditioned both by external (exogenous) and by internal (endogenous) factors. In addition to the quality of the training process, the selection as well as the processes of growth and development was of course influenced. To determine the quality of the training in the difference between the different age groups in future studies, it is necessary to include a normal population of the same age, on which the same measures and tests will be applied, and the results obtained will be compared with the elite youth basketball players. In this way, it will be determined how much a measure is influenced by growth and development, and how much is affected by the training process.

Every motor skill has its own developmental path, which coaches need to know to plan and program the training properly. The maximal speed develops from 16 to 18-19 years. A critical period is between 11 and 15 years. By the age of 12, the exponent increases at the expense of the speed of movement, from 12 to 14 as a result of body growth, the explosive strength and increase in muscle mass, and from 16 to 18 increases mainly as a result of the improvement of the explosive strength (Trunic, 2007).

Sensitive periods in the development of the explosive strength and the endurance of the force begin sometime about 8 years of life. Critical phases in the age range from 7 to 17 years, which should be divided into periods from 8-9, 10-11, 13-14, and especially from 14-15 years. The sensitive period in the development of the maximal force is in the period of 12-13 to 18 years. Critical phases are ages 10-11, 13-16 and especially 16-17 years of age (Trunic, 2007).

Conclusions

On a sample of 54 young basketball players aged 14 to 16, of which 18 at 14 years of age 18 at age 15 and 18 at 16 years of age.

Based on the results obtained, following the application of the appropriate statistical methods, the following conclusions have been drawn:

- In the variable for estimating the level of the structural basketball element jump-shot, it can be concluded that in the variable relative elbow angle before extension in the jump-shot no intergroup statistically significant differences were determined. Basketball players at the age of 16 show a smaller elbow angle players at age 14 and 15.

- In the explosive strength variables, it can be concluded that basketball players at 14 years of age show weaker results in the variable countermovement with the hands of the hips compared to basketball players 15 and 16 years of age. Also, 14-year-old basketball players achieve weaker results in the variable countermovement jump with arms swing after landing compared to basketball players aged 16 years. In the variable, countermovement jump with arm swing did not determine statistically significant differences between players 14, 15 and 16 years of age. Basketball players at the age of 16 show better results in the variable basketball throw from the chest while sitting on the floor than basketball players aged 14 and 15.

- In the speed estimation variable (running 20 m), it can be concluded that basketball players at the age of 16 show better results than basketball players aged 14 and 15. Basketball players at the age of 15 show better results in the 20 meter run running from a high start against basketball players aged 14 years.

- In agility variable (t-test), no statistically significant difference was found among basketball players of 14, 15 and 16 years of age.

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THE KICK VELOCITY, THE POSITION OF THE CENTER OF GRAVITY OF THE BODY OF KARATE ATHLETE AND THEIR RELATIONS IN THE PERFORMANCE OF ASHI MAVASHI GERI

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(Original scientific paper)

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Abstract

For the successful performance of the leg technique ashi mavashi geri it is necessary for the karate athlete to place the body correctly and as soon as possible to finish the kick in the head or other part of the opponent's body. The main goal of the research is to describe and determine the relations of the time-velocity parameters and the positions of certain parts of the body (foot, hip, knee, etc.) from the karate athlete who performs the technique. Six top athletes perform the technique in conditions: when the opponent is passive and when attacked by the opponent (diae). For all six respondents, one successful performance for the two variants is analyzed, which means that a total of 12 kicks of the technique ashi mavashi geri are analyzed. The performance of the technique is recorded with three digital cameras with a frequency of 60 Hz. Ariel Performance Analysis System (APAS) was used to analyze the kick, and then all the modules of the system were processed to obtain accurate information about the overall motion. When performing ashi mavashi geri, a maximum foot speed of 12.69 m / s was achieved, while the time from the starting position to the maximum foot speed was 0.42 seconds. The time taken to kick from the starting position to the end of the foot movement was 0.53 seconds. The knee angle, at maximum foot speed, reaches a mean value of 89.83 degrees, while the mean value of the knee angle at impact is 165.41 degrees. A higher value in the movement of the foot was achieved in the vertical direction (upward to 152.33 cm), while the center of gravity has a greater displacement value in the forward direction (17.4 cm). The velocity of the kick was in a negative relation with the increase in the angle of the hip joint when performing the ash mavashi geri, with a value of the coefficient of correlation of -0.61 ($p < 0.05$). A positive correlation of 0.58 ($p < 0.05$) was also achieved between the movement of the foot in the vertical direction (upward) and the angle in the hip. These values confirm that the velocity of the kick is greater when the trunk and the femur cover a smaller angle, that is, the trunk tends to have upright position with the leg.

Keywords: *ashi mavashi geri, velocity, angle, time, relations*

Introduction

The success of the leg kicks depends on several factors. Among the most important factors are the velocity of the kick in the direction of the opponent's body and the position of the body of the performer of the technique and the specific parts of his body. The proper placement of the karate athlete, a high level of perceptiveness and the adequate action in relation to the opponent are subject to analysis by many researchers (Chananie, 1999; Shuji, 2002). Bearing in mind that the leg kicks are widely used in the karate competitions, the interest of the athletes and coaches for proper learning and overcoming these techniques is very high.

In sports practice, the studies of precisely determining these factors are of a great importance. On the basis of these findings, coaches and experts plan methods for proper study and effective refinement of the techniques (Ciubucciu-Ionete, G., Mereuta, M., 2008). The technique ashi mavashi geri is performed at high speed and in a short period of time, whereby the visual-motor reaction is of primary importance for the defense of it. Also, the quality of the performance depends on the behavior of the opponent. If the reaction of the opponent is fast, with elements of avoiding, with a good block, etc. the impact will not have the desired effect. Professional karate performers show a shorter performance compared to the

amateur (Camomilla et al., 2009), while in defense of the leg kicks, professional karate athletes are quick to avoid hitting either by avoiding the body or by blocking the impact. There are many possibilities for determining the useful forms of mastering the technique. Biomechanical analysis of techniques gives a clear picture of the whole body movement, and of the important moments of technique performance. Using kinematic motion analysis systems, it is possible to extract all useful indicators, such as velocity, positions in certain parts of the body, time, etc.

Direct impacts in karate sports take a special place in their use. Because of this, the analysis of the kick with a leg in the head and in the body *ashi mavashi geri* is of a great importance. For the successful performance, learning and perfecting of *ashi mavashi geri* from a scientific point of view it is necessary to know the relationships between all contributors. The main goal of the research is to describe and determine the relations of the time-velocity parameters and the positions of certain parts of the body (foot, hip, knee, etc.) from the karate athlete who performs the technique *ashi mavashi geri*.

Methods

The sample of respondents includes six top athletes in karate sports, seniors, with longer training and competition experience, who have a defined motor stereotype in the performance of the kick. During the recording, the examinees are barefoot in panties so that the points of the joints of the model of the levers can be better registered. The impact of *ashi mavashi geri* is performed in two variants: 1. when the karate athlete performs the kick in offence and, 2. when the karate athlete performs the kick in situation of *diae* (when attacked by the opponent). For all six respondents, one successful performance for the two variants is analyzed, which means that a total of 12 kicks of the technique *ashi mavashi geri* are analyzed. To study the impact in this research, the entire karate movement in all three planes has been taken into account. The impact is derived from the initial position (*Fudo daci*). The body is upright and the weight is evenly placed on the both feet, the trunk is facing forward and the projection of the body center of gravity is projected in the middle between the two feet, making the angle of confidence even greater. The hands are folded in the elbow joint and placed in front of the trunk in the battle guard.

The sample of variables consists of: maximum foot velocity, time from starting position to maximum foot velocity, total time from starting position to kick, movement of the foot and the body center of gravity in the three directions (mediolateral, anteroposterior and vertical), knee angle at maximum foot velocity, knee angle when kick with foot, hip angle at maximum foot velocity, hip angle when kicked. Ariel Performance Analysis System was used for the purpose of this research and for analyzing the kick with leg *ashi mavashi geri*. The performance of each leg kick individually for each subject is recorded with three digital cameras (60fps - images per second). Then those recordings are entered into the computer (Kinematics Analysis System - APAS). This way, all the modules of the system (APAS) are analyzed and processed, and then precise information for the entire movement is obtained.

Results and Discussion

The main indicators of the velocity, time, foot position and the position of the karate athlete's body during the performance of the technique *ashi mavashi geri* are shown in Table 1. When performing *ashi mavashi geri*, it has been recorded a maximum foot velocity of 17.59 m / s or mean value of 12.69 m / s, while the minimum values are 8.78 m / s. In a survey of the identical kick conducted by Y-H Nien and co-workers (2007) with six top athletes from Taiwan's National Taekwondo team, found that the maximum foot velocity reaches 17 m / s. Comparing these results, with the results obtained from this research, it can be concluded that nearly the same results have been achieved. These are the expected results if we take into account the manner of conducting the combat in Taekwondo. While talking about an identical kick, it must be noted that the emphasis on practicing the combat in Taekwondo is with a round kick.

The required time from the starting position to reach the maximum foot velocity is from a minimum of 0.25 seconds to a maximum of 0.62 seconds with a mean value of 0.42 seconds. The time required for performing the kick from the starting position to the end of the foot movement ranges from 0.36 to 0.70 seconds, with a mean value of 0.53 seconds. The standard deviation for all time parameters ranges within one standard deviation, indicating that the results are moving around the center or around zero, which can be concluded that it is a relatively homogeneous group of respondents. In the research of Waşık, J. (2010), which he performed on a 17-year-old karate athlete, set the time for the kick at 0.75 seconds. He points out that the round kick (*Ashi mavashi geri*) is the most commonly used kick in the combat. These results

are relatively weak in compared to the results obtained from this research, but given that the research is carried out with karate junior, they are also expected.

Table no. 1. Ashi mavashi geri kinematometric-goniometric parameters

	N	Minimum	Maximum	Mean	Std. Deviation
MAX. B. S	12	8,78	17,59	12,6992	2,91782
VR. M. BR	12	,25	,62	,4242	,11024
TOTL. VR	12	,36	,70	,5300	,09863
POM. ST. - X	12	1,00	30,00	14,3333	10,83205
POM. ST. - Y	12	3,00	73,00	39,7500	22,16929
POM. ST. - Z	12	137,00	166,00	152,3333	8,20569
POM. T.T. - X	12	1,00	8,00	3,5833	2,50303
POM. T.T. - Y	12	2,00	36,00	17,4167	12,68111
POM. T.T. - Z	12	7,00	20,00	12,5833	3,57919
AGO. KOL. - MAX. BR.	12	34,00	116,00	89,8333	21,71649
AGO. KOL. - UDAR	12	155,00	174,00	165,4167	5,77547
AGO. KOLK. - MAX. BR.	12	105,00	142,00	127,0833	11,18000
AGO. KOLK. - UDAR	12	104,00	127,00	112,7500	6,81075

The position of the karate athlete’s body is described by the values of the angles of the leg and the movement of the foot and the center of gravity of the karate athlete. The maximum foot velocity reaches at a knee angle from a minimum of 34 to a maximum of 116 degrees, with a mean value of 89.83 degrees. Due to the different physical structure and belonging to a different weight category, the different performance of the technique of the kick is also reflected. Because of this data, larger deviations in the standard deviation are visible, which is 21.71 degrees. In a research carried out by Wąsik, J. (2010), obtained a knee-angle result of 54 degrees, which results ranges in the average mean values of these results. The knee angle in the phase of the maximum reached path, ie when the foot movement is complete, has relatively similar values in all subjects, with a minimum angle of 155 while the maximum angle is 174 degrees. The mean value of the knee angle during kick is 165.41 degrees. The standard deviation moves in a standard deviation indicating the fact that the results are around zero. The hip angle at the maximum foot velocity is at least 105 degrees, while the maximum values are 127 degrees. The mean value of the hip angle is 142.00 degrees. The standard deviation is 13.58 degrees, which is relatively smaller in relation to angle of the knee at maximum foot velocity. The hip angle during the foot kick moves within a range of 104-127 degrees with mean value of 127 degrees. The standard deviation is 6.81 degrees and moves within one deviation, ie around zero.

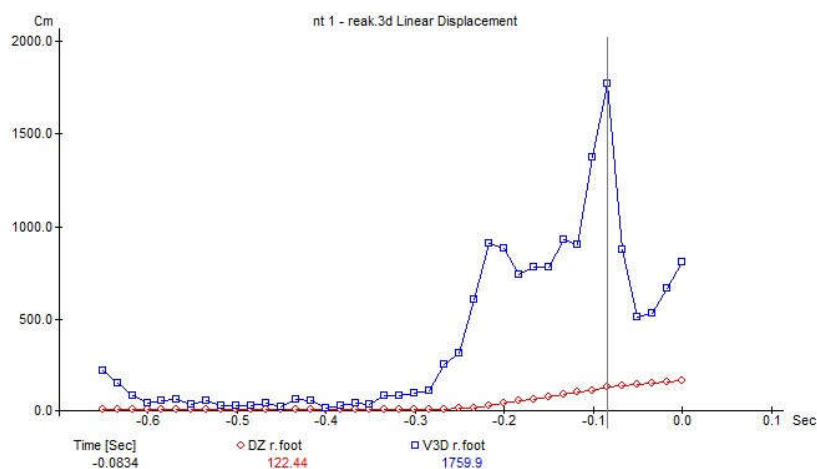


Fig. 1. Graphic display of the maximum impact velocity Ashi mavashi geri and the movement of the foot in the vertical direction (for one subject)

The value of the movement of the foot in the vertical direction (upwards) has a greater value in the impact (152.33 cm), compared with the values of forward displacement (anteroposterior) and on side (medialateral). Moving the center of gravity has a greater value in the forward direction (17.4 cm) compared to the vertical direction (12.5 cm) and the medialateral direction with a minimum value of 3.58 cm (Fig. 1).

The correlation analysis (Table 2) shows that the velocity of the kick is in a negative relation with the increase in the angle of the hip joint while performing the ashi mavashi geri (-0.61 *), and the statistical significance is at level of 0.05. This value of the correlation coefficient confirms that the velocity of the kick is greater when the trunk and the femur cover a smaller angle, that is, the trunk tends to have upright position with the leg. A high positive correlation with a value of 0.97 (**) has between the variables time of reaching the maximum impact velocity and the total execution time of the technique, which means that the maximum velocity of the impact is achieved just before the target strike. A positive correlation of 0.58 (*) is achieved between moving the foot in the vertical direction (upward) and the angle of the hip, while the other variables do not have mutually significant correlations.

Table no.2. Correlations

	MAX. B. S	VR. M. BR	TOTL. VR	POM. ST. - X	POM. ST. - Y	POM. ST. - Z	POM. T.T. - X	POM. T.T. - Y	POM. T.T. - Z	AGO. KOL. - MAX. BR.	AGO. KOL. - UDAR	AGO. KOL. - MAX. BR.	AGO. KOLK - UDAR
MAX. B. S	1	-0,03	-0,06	0,061	0,529	-0,13	-0,1	-0,06	-0,12	0,61(*)	0	-0,31	-0,33
VR. M. BR	-0,03	1	0,97(**)	0,2	-0,15	0,44	0,207	0,34	0,16	0,43	0,53	-0,4	0,19
TOTL. VR	-0,06	0,97(**)	1	0,14	-0,18	0,45	0,26	0,39	0,18	0,35	0,44	-0,33	0,21
POM. ST. - X	0,06	0,2	0,14	1	0	0,08	-0,38	-0,18	-0,35	0,2	0,34	0,18	0,4
POM. ST. - Y	0,52	-0,15	-0,18	0	1	0,22	0,17	0,41	-0,52	-0,63	0	-0,09	0,17
POM. ST. - Z	-0,13	0,44	0,45	0,08	0,22	1	-0,09	0,52	-0,31	0	0,63(*)	0,15	0,58(*)
POM. T.T. - X	-0,1	0,2	0,26	-0,38	0,17	-0,09	1	0,23	0,39	0,033	-0,16	-0,22	-0,17
POM. T.T. - Y	-0,06	0,34	0,39	-0,18	0,41	0,52	0,23	1	-0,27	-0,11	0,18	-0,31	0,33
POM. T.T. - Z	-0,12	0,16	0,18	-0,35	-0,52	-0,31	0,39	-0,27	1	0	-0,16	0,03	-0,54
AG. KO. - M. BR.	-0,61(*)	0,43	0,35	0,2	-0,63(*)	0	0,03	-0,11	0,54	1	0,25	0,02	-0,01
AG. KO. - UDAR	0	0,53	0,44	0,34	0	0,63(*)	-0,16	0,18	-0,16	0,25	1	-0,13	0,48
AG. KOLK - M. BR.	-0,31	-0,4	-0,33	0,18	-0,09	0,15	-0,22	-0,31	0,03	0,02	-0,13	1	0,32
AG. KOLK - UDAR	-0,33	0,19	0,21	0,4	0,17	0,58(*)	-0,17	0,33	-0,54	-0,01	0,48	0,32	1

In Table 3 and Table 4 the regression model and the testing of the statistical significance of regression are shown. In this analysis, the criterion of regression is the achieved maximum impact velocity, and the other variables are predictors. Although the multiply correlation of the predictors has bigger value, the regression of the above-mentioned model has not statistical significance, from which it can be concluded that the impact of these indicators on the maximum velocity is not significant.

Table no.3. Regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,916(a)	,839	,408	2,24467

Table no.4. ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	78,535	8	9,817	1,948	,316(a)
	Residual	15,116	3	5,039		
	Total	93,651	11			

Conclusion

In this research, the respondents, which are six top athletes from karate sports, seniors, aimed to perform the impact of ashi mavashi geri in two variants of performance. The technique ashi mavashi geri is an automated movement in karate athletes with a longer training experience. The velocity and the time needed to perform the two options: without the pressure of an opponent (when the opponent stands calm while performing the kick) and with the pressure of an opponent (when the opponent exercises pressure over the performer) does not depend largely on the position of the foot and the center of gravity of the body of the karate athlete. However, the achievement of the maximum impact velocity is in significant negative correlation with the value of the angle of the hip. From the position of the leg and the center of gravity of the body in the three directions, only the vertical upward movement of the kick has a significant difference from the value of the angle in the hip.

Regardless of the situation from which the technique is carried out, one can conclude that once learned and formed movement is performed along the same trajectory and thus the same sequence of activation of the muscles responsible for the movement. All this leads to the taking of the angles in the joints with similar values and velocity of performance.

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AUTONOMY AND INDEPENDENCE OF THE OLYMPIC AND SPORT MOVEMENT IN MACEDONIA

UDC: 796.032.2

(Original scientific paper)

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Abstract

National Olympic and Sport Organisations around the world, should be autonomous and self-governed within reinforced good governance frameworks and partnerships with public authorities which main task is to to promote the good side of sport (health, education, integration) and fight the negative side of sport (like match fixing, doping, violence, corruption...). The International Olympic Committee (IOC), in coordination with the Continental Olympic Organizations^[1](EOC, OCA, ONOC, PASO and ANOCA) and the International and Continental Sport Federations (e.g. FIFA, FIBA, UWW, FINA, IAAF, UEFA, LEN, Sport Accord, ASOIF, AWOIF, etc) are giving a high priority on the question of the Autonomy and Independence of the Olympic and Sport Movement, national, continental and global level.

Key words: *autonomy, independence, Olympics, government, governance.*

Introduction

This paper aims to identify which factors influence the Autonomy and Independence of the Olympic and Sport Movement in Macedonia, as well as on global level. This issue have been increasingly studied since the last decades. To the best of our knowledge, no study has examined the factors influencing the diffusion of standards in Macedonia. National Olympic and Sport Organisations around the world, should be autonomous and self-governed within reinforced good governance frameworks and partnerships with public authorities which main task is to to promote the good side of sport (health, education, integration) and fight the negative side of sport (like match fixing, doping, violence, corruption...). The International Olympic Committee (IOC), in coordination with the Continental Olympic Organizations (EOC, OCA, ONOC, PASO and ANOCA) and the International and Continental Sport Federations (e.g. FIFA, FIBA, UWW, FINA, IAAF, UEFA, LEN, Sport Accord, ASOIF, AWOIF, etc) are giving a high priority on the question of the Autonomy and Independence of the Olympic and Sport Movement, on national, continental and global level.

Materials and methods

The Autonomy and Independence of the Olympic and Sport Movement was always at the top of the agenda of many researches in this area. In the research of the Council of Europe, "The autonomy of sport in Europe" by Jean-Loup Chappelet, April 2010, page 7, it is stated that "In Europe, as from the end of the 19th century, the bodies responsible for the codification of sports rules and the organisation of competitions generally took the form of non-profit-making associations. In this capacity, thanks to national legislation guaranteeing freedom of association, they enjoyed considerable autonomy from government in most European countries. It can even be said that, for most of the 20th century, the majority of European states allowed sports organisations to develop as bodies fully independent of the public authorities. For many years, clubs, regional and national federations and European or international federations, not to mention national Olympic committees (NOCs) and the International Olympic Committee (IOC), operated in virtually complete independence of local and national government and were self-regulating, while sport itself was becoming an increasingly important sociocultural and economic sector".

Later, on page 11, the author of the above research stated that "Under Pierre de Coubertin's concept, which still holds true for the IOC, members were independent of their governments and represented the Olympic Movement within their country, rather than their country on the IOC. They were accordingly

politically autonomous, and this autonomy was often reinforced by their financial independence. This autonomous status enjoyed by each of its members and its own resources allowed the IOC itself to be independent of political institutions, from which it received no subsidies. (The sole exception, in theory, was that members of the IOC belonging to royal families could not easily adopt a position differing from that of their governments.)”

Lately, the Olympic Agenda 2020 was unanimously agreed at the 127th IOC Session in Monaco on the 8th and 9th of December 2014. This recommendation gave us a clear vision of where we are headed and how we can protect the uniqueness of the Olympic Games and strengthen Olympic values in the society. The reforms follow a year of discussion and consultation with all stakeholders of the Olympic Movement, as well as external experts, stakeholders and the public. More than 40,000 submissions were received from the public during the process, generating some 1,200 ideas. Fourteen Working Groups synthesised the discussions and debates throughout the whole Olympic Movement and wider society before the recommendations were finalized by the Executive Board ahead of the 127th Session.

In the research “Diffusion of standards within meta-organization’s members” by Emilie MALCOURANT, Alain VAS and Thierry ZINTZ, page 2 and 3, it is stated that “Meta-organization are also characterized by a lack of formal hierarchy (König & al., 2012; Vifell & Thedvall, 2012). Organizations are free to adhere the metaorganization and are also free to leave it notably if their autonomy, independence or identity is threatened. According to Kerwer (2013), conflicts about autonomy between the members and the meta-organization are common. As meta-organization’s members are organizations, there may be a large differentiation between them regarding their size, their structure or competencies. Conversely, competition and consequently conflict may also arise from similarities between members and meta-organizations as they develop the same purpose (Ahrne & Brunsson, 2005; 2008; König & al., 2012). Another explanation of conflict may be the presence of a more charismatic or powerful leader within the members than within the meta-organization.”

The main purpose of this research is, through brain storming with focus group, create by the Executive Board members (EBm) of the Macedonian Olympic Committee, EBm of the some National Sport Federations (Tennis, Triathlon, Taekwondo, Wrestling and Basketball), Faculty of Physical Education, Sport and Health and representatives of the Local Self-Government responsible for sport, to reach mutually acceptable list of factors directly influenced by the P.E.S.T.E.L. (political, economy, sociology, technical, environment and legal) factors.

Theoretical framework and methodological procedures used

Research results are to be used for reorganizing the work and increasing the efficiency of executing national main stakeholders’ service expectations thus producing higher-level of sports results and higher degree of sport autonomy coinciding with the level of service provided to said stakeholders. The main questions give the direction of the methodological procedures used by the author of this research. With regard to all these questions, for the purpose of the research brainstorming and SWOT analysis with a focus group were taken.

Furthermore, the focus group consisted of people of various profiles who could provide valuable views and opinions on the necessary steps and actions to be taken in the future, as well as identify, define and locate the main stakeholders, upon which the reorganization of the future structure, services and process-oriented of the NOC depends.

The focus group was composed of one representative of the Athletes Commission, one of the National Sports Federation, one of the sponsors, one of the existing Executive Board of the NOC, one professor from the Faculty of Physical Education, one representative responsible for the development of sports in the local self-government, a sports journalist, and the author of this paper, as NOC Secretary General and moderator of the focus group.

The first part of the focus group session involved a SWOT analysis, followed by brainstorming. The schedule of the focus group SWOT analysis and brainstorming was as the one proposed by Professor Joan Duncan of JDI Consulting in MEMOS XIII – Lausanne (2009):

- Introduction and welcoming and Explanation of Purpose
 - Overview of Past and Planning Future Process / Issue
 - Introduction of Leaders / Participants
 - SWOT
 - Mission / Vision / Values

- Explore Issue(s)
- Future Steps
- Closing/ Conclusion

SWOT analysis

The SWOT analysis gave a much clearer view of the strengths, weaknesses, opportunities and threats that we identified if we are to proceed with strategic actions for developing the strengths, overcoming the weaknesses, exploiting the opportunities and blocking the threats (Figure 1 and 2.).

Thus, as well as by pursuing our actions, we shall arrive at the very important issue of strategic objectives.

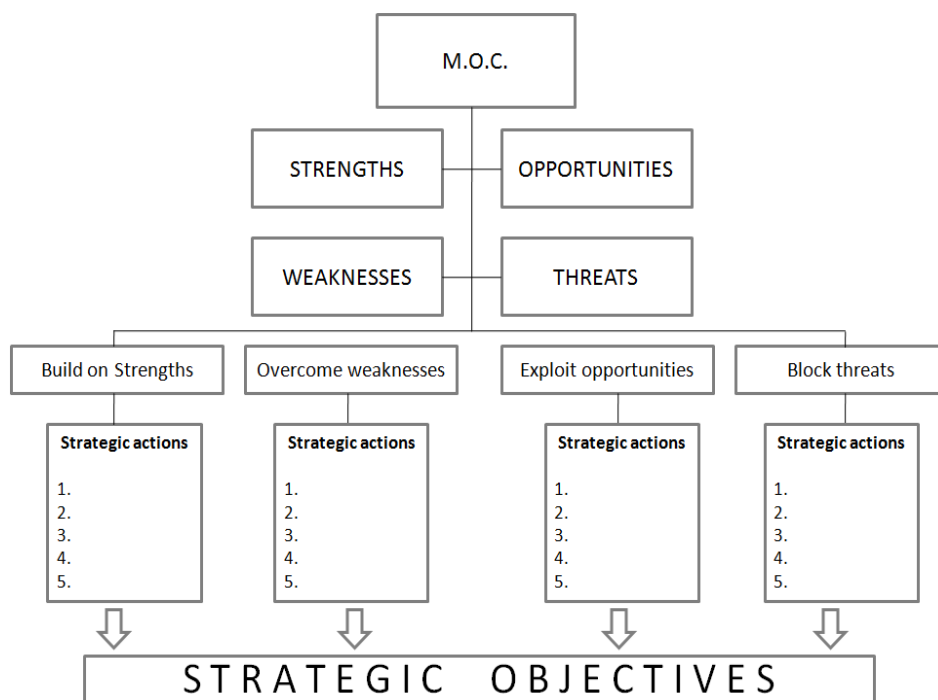


Figure 4. Strategy worksheet

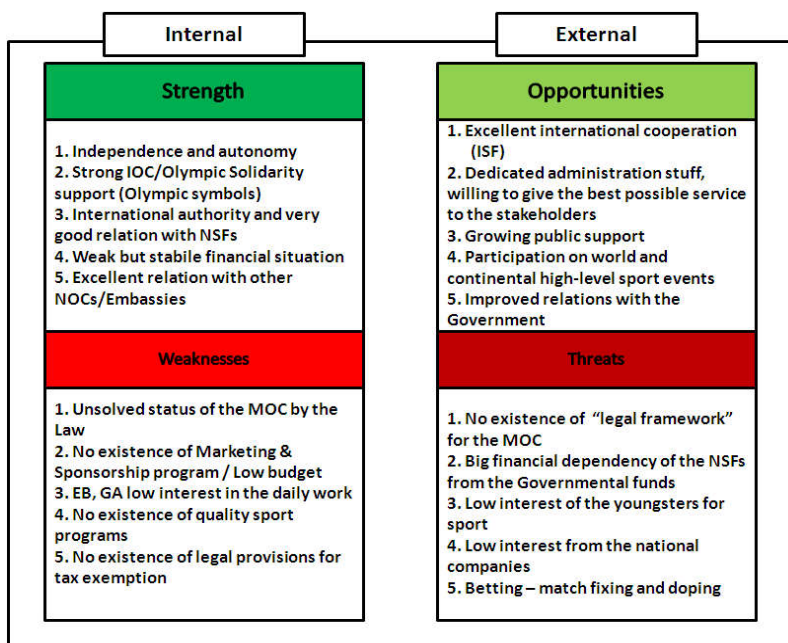


Figure No.2 SWOT analyses

As the biggest strengths of the Olympic system (NOC) in Macedonia, the focus group indicated its independence and autonomy as well as the strong IOC/ISF support. International recognition and close relations with the NSFs, as well as with some ISFs, were also noted as strengths. Weak but stable financial situation and an excellent relationship with other NOCs and NFs in Macedonia was pointed as a strength that provides substantial - financial, logistical and material - resources to the OSOs in the country.

As the biggest opportunities the focus group listed the excellent international cooperation, dedicated administrative personnel, the willingness to give the best possible service to the past, present and future, national and international stakeholders, constantly growing public support, participation in world and continental high-level sport events, and, lately, improved relations with the Government.

On the other hand, as main weaknesses were suggested the unresolved legal status of the NOC (jeopardizing the autonomy and independence of the NOC and NFs system in whole), the lack of financial, marketing and sponsorship program, weak quality and educated human resources, as well as modest budget of the OSOs. It was concluded that the EB and GA do not show great interest in the everyday work, that there are no quality sports programs and no legal regulation of tax exemptions.

Finally, the focus group saw the lack of a "legal framework" for the OSOs in Macedonia as the biggest threat. The financial dependency of the NSFs on governmental financial resources is also considered a threat that may be the most dangerous and could jeopardize the autonomy and independence of the NSFs, especially when the governmental financial support amounts to 80-100% of the annual budget of some NSFs.

Discussion/Conclusion

Having in mind the previous researches as well as document, taking into consideration the official letters that the IOC sent to the NOC (2014 and 2016), in order to reach a mutual understanding and cooperation with the relevant government authorities/institutions, the universal partnership approach by the IOC and IOC stakeholders, namely the National Olympic Committee (NOC) in the country, based on the Olympic Charter, with respect to the autonomy of the NOCs and the Olympic Movement within a country, must be established. Basically, the existence of the NOC in the country, primarily derived from the recognition granted to the NOC by the IOC. In accordance with the provisions with the Olympic Charter, only those NOCs which are recognized by the IOC can designate, identify or refer to themselves as "National Olympic Committees". The NOCs can use the IOC properties (such as the word "Olympic" in their name and the Olympic rings in their emblem), enjoy the status of an "NOC", and exercise the activities and rights conferred upon them by the Olympic Charter and by the IOC. It goes without saying that no NOC is forced to be part of the Olympic Movement. However, it is a prerequisite in order for the country to be represented and for the athletes to take part in international multi-sports events like the Olympic Games. Consequently, if an NOC decides freely to be recognised by the IOC and thus to enjoy the rights granted by the IOC in the interest of sport and the athletes in the country, it must comply, and be in a position to comply, with the principles and rules of the Olympic Charter, in particular with the basic principle of "responsible" or "negotiable autonomy". In paragraph 5 of the Fundamental Principles of Olympism: "Recognising that sport occurs within the framework of society, sports organisations within the Olympic Movement shall have the rights and obligations of autonomy, which include freely establishing and controlling the rules of sport, determining the structure and governance of their organisations, enjoying the right of elections free from any outside influence and the responsibility for ensuring that principles of good governance be applied." The Rule 27.5 says: "In order to fulfil their mission, the NOCs may cooperate with governmental bodies, with which they shall achieve harmonious relations. However, they shall not associate themselves with any activity which would be in contradiction with the Olympic Charter. The NOCs may also cooperate with non-governmental bodies." Rule 27.6: "The NOCs must preserve their autonomy and resist all pressures of any kind, including but not limited to political, legal, religious or economic pressures which may prevent them from complying with the Olympic Charter." As a result of the above, it is clear that the NOCs and the government authorities should work as partners with mutual respect for their jurisdiction and responsibilities. However an NOC is not a government entity and must not be treated as such. It is an autonomous non-government and not-for-profit sports organisation, with its own legal status. The NOC, as a sports organisation, may have to be registered administratively at national level so that it can enjoy legal status (depending on the national procedures). However, this administrative process must not undermine the power of the NOC to decide upon its governance and run its internal operations (including but not limited to membership, decision making mechanisms, holding of meetings, election procedure, internal

reporting and accountability, internal dispute-resolution mechanisms, etc.) in accordance with its own Statutes and the Olympic Charter, without any government interference. In addition, the sports national legislation in a country should serve to establish a general framework for sport and determine the interactions between all concerned partners at national level. However, the sports legislation should fully respect the role, jurisdiction and responsibilities of each institution related to sport in the country and must not be used to regulate the internal operations of an NOC and/or the national federations or as a substitute for their respective statutes and internal rules. To avoid any problem, the sports legislation should be drafted by the authorities concerned in close and prior consultation with the main stakeholders concerned, in particular the NOC and the national sports federations. In the end, the NOC must be in a position to operate in accordance with the Olympic Charter, its own statutes and the general laws of the land. Should there be any issue with a specific law which would interfere with the internal operations of an NOC or which would not be compatible with the basic principles of the Olympic Movement, a constructive dialogue should immediately be established between the government authorities in charge and the NOC, with the assistance of the IOC if required, to address and resolve the issues at hand. As part of the cooperation and fruitful partnership which should prevail between NOCs and government authorities for the benefit of sport, NOCs may be granted structural, technical and/or financial support from government or public authorities, and/or may enjoy specific delegation and corresponding means from the government authorities concerned. In the latter case, NOCs should, naturally, be accountable to the government authorities for the use of these specific funds or other assistance provided by the government. However, this does not mean that the NOCs become “public authorities” or “government bodies”; nor does this imply that the government can interfere with the internal operations of the NOCs. Moreover, this does not mean that the NOCs must be held accountable to the government for any other activity they may exercise and/or other funding they may receive from private partners and/or international sports organisations like the IOC. The NOCs may decide, freely, to disclose any such internal information; however they must not be forced to do so. In view of these basic principles, it is clear that a government body (in this case the Agency of Youth and Sport) is not entitled to send a delegation to the NOC/NFs office to conduct an “inspection”. If such “right” is conferred by the current sports legislation in Macedonia (as it seems to be the case), this means that the corresponding provisions of the sports legislation are not compatible with the basic principles of the Olympic Charter and, consequently, should be reviewed to allow for our NOC and the national federations (NFs) to operate as per the minimum requirements of the international sports institutions. Therefore, the Olympic and Sport Organization in Macedonia must raise these issues with the relevant government authorities and to establish a constructive dialogue and mutual understanding and trust to resolve the current situation. If this situation is not possible to reach, the IOC would not be constrained to consider Rule 27.9 of the Olympic Charter which states: “Apart from the measures and sanctions provided in the case of infringement of the Olympic Charter, the IOC Executive Board may take any appropriate decisions for the protection of the Olympic Movement in the country of an NOC, including suspension of or withdrawal of recognition from such NOC if the constitution, law or other regulations in force in the country concerned, or any act by any governmental or other body causes the activity of the NOC or the making or expression of its will to be hampered. The IOC Executive Board shall offer such NOC an opportunity to be heard before any such decision is taken.” The IOC, of course does not want such extreme action to have to be envisaged, and, on the contrary, everybody will understand the necessity to work together as partners and establish solid cooperation in the interest of the development of sport and the athletes in the country.

Still and unfortunately, the situation in Macedonia has not improved lately and, on the contrary, has deteriorated, in particular with the recent inclusion of new standard provisions in the sports legislation to define who can and must be Executive Board member of the NFs, creating unilaterally specific eligibility conditions and terms restrictions for the office-bearers of the national federations and so on. We fully understand and support the need for ensuring good governance within the sports organisations at all levels and for providing assistance to the sports organisations in this regard. However, at the same time, the principle of “responsible autonomy” of the sports organisations in determining their internal governance and operations must also be respected, as clearly explained in our letter on 29 September 2014. Consequently, no third party / government authority must substitute itself for the responsibility of the sports organisations to address these internal issues and take appropriate decisions for their respective organisations. As mentioned in our letter of 29 September 2014, the sports legislation should not be used to “micro-manage” the sports organisations nor to take the place of the statutes, internal rules and decisions made by the competent bodies of each sports organisation, nor to allow undue interference from government

authorities in the internal governance of the sports organisations. It should rather serve to establish a sufficiently flexible general framework which would define the general organisation of sport in the country and determine the responsibilities and prerogatives of the various parties involved in sport, as well as the necessary interaction between them, in a manner compatible with the basic principles of the Olympic Movement. In view of the above, all concerned parties (government authorities, NOC and national federations) must be engaged in a constructive and serene dialogue and work hand-in-hand to review the sports legislation in the light of the principles and rules of the Olympic Movement. Otherwise, the current situation could unnecessarily expose the Olympic Movement in the country to protective measures and sanctions from the international sports organisations concerned (IOC, IFs).

Nevertheless, it is important to note that past any SWOT analyses or organizational chart, as good or suitable as it may be, what counts the most are the **basic principles of good governance** of the OSOs, as follows:

1. Every OSO must have a clear vision, mission and strategy;
2. There has to be a clear structure of membership, guaranteeing the autonomy, independence and quality of work of the OSOs;
3. Clear and transparent legislative (Statute, rulebooks, criteria etc) must be imperative for all OSOs;
4. Clear situation inside the OSOs regarding conflicts of interest;
5. Competence and jurisdiction of the members of the Executive Board and the management organs of the OSOs;
6. Improved and high-quality regular communication with the ISFs;
7. Professionalism of the administration of the OSOs (professional administration trained by the NOC (IOC-OS), paid by the Government and independent and autonomous in their work);
8. Transparency in the work, followed by independent internal and external audit control;
9. Improving of the education and training of all parties involved in the work of the OSOs;
10. Clear, precise and transparent criteria for distribution and use of all possible resources;
11. Quality development of sports by making mutual decisions by all factors involved in sports;
12. Active involvement of the athletes in the executive organs of the OSOs and creation of an Athletes Commission in all OSOs;
13. Education of the athletes and creation of possibilities for development of the Career after Career program;
14. Existence of the necessary 4Cs (communication, cooperation, coordination and consultation) between the OSOs and the Government. The Government must support the OSOs leading, organizing and managing sports, with the greatest possible degree of autonomy and independence.

References

- Africa (Association of National Olympic Committees of Africa – ANOCA, founded 1981), Americas (Pan American Sports Organization – PASO, founded 1940, Asia), Asia (Olympic Council of Asia OCA, founded 1982), Europe (European Olympic Committees-EOC, founded 1968), Oceania (Oceania National Olympic Committees-ONOC, founded 1981)
 Diffusion of Standards within meta-organization's members.
 J.-L. Chappelet, The actors of world sport, PP Presentation, MEMOS XIII, Lausanne, 2009