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Phone/ fax: +387 36 571-216

Address: Nastavnički fakultet, Sjeverni logor bb, 88104 Mostar, Bosnia and Herzegovina

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EFFECTS OF TRAINING ON THE DEVELOPMENT OF FOOTBALLERS AGILITY

Darko Božić and Oliver Krička

ABSTRACT: The aim of the systematic review was to determine the effects of training on the development of football agility based on the collected data and analyzed papers published in scientific and professional articles between 2009 and 2018. The electronic databases used in the creation of the review paper are the following: ResearchGate, Google Scholar, PubMed Scopus and SCI. Papers were selected based on several criteria: type of study, results, age group. The results of the research showed that the plyometric training method is most often used for the development of agility. Some research has shown us that agility can also be developed by combining plyometric training with some other training (dynamic stretching, strength exercises). In addition to plyometric training, proprioceptive training and SAQ training (a combination of strength training, endurance and football technique) are increasingly used to develop agility.

Keywords: *motor skills, football, agility, situational motor skills*

INTRODUCTION

Football is a sports game that belongs to the group of polystructural sports, in which the complex structure of the acyclic and cyclic type with the highest degree of complexity dominates. It is a sport based on movements of a complex nature, including cyclic and acyclic movements, in which the result depends on the cooperation of team members. Football is characterized by numerous and varied actions, complex, dynamic activities, which are performed in variable situations, with and without the ball in conditions when the players of the opposing team individually or in cooperation try to hinder the construction of the attack or gain possession of the ball.

Success in any kinesiological activity, and this also applies to the football game, depends on a large number of anthropological characteristics and abilities that are interconnected. The importance of the influence of certain characteristics for achieving success in the game is different. It is certain that the individual with whom these relationships are optimal will achieve better results. Among the factors that improve the anthropological status of a player and significantly influence his success, a special place is certainly occupied by motor and situational-motor abilities, the level of adoption of elements of football game technique, cognitive abilities and conative characteristics, motivation, sociological status, etc. Certainly, training as a transformational process occupies a significant place among these factors.

To be agile in the motor sense means being agile. This ability means performing maximum acceleration on a short distance (in two or three steps), but successfully stopping with a step or landing (one step) or in two steps and maximum acceleration in the other direction.

We can say that agility is an important component of many sports (especially sports games), which is not sufficiently defined compared to other motor skills. The position of agility in the general motor space has so far been considered in various ways. Agility can be seen as an isolated motor ability, but due to its complex and still insufficiently researched structure, and cognitive requirements, agility may be more optimally viewed as a very complex motor skill.

Agility can be defined in several ways:

Ability to quickly change the direction of movement, (Gredelj et al., 1975).

Ability to accelerate, decelerate and quickly change direction while maintaining control of movement and without losing speed (Brittenham, 1996; Graham 2000).

Ability to change direction without loss of balance, speed, power and movement control (Pearson, 2001).

Agility is a rapid change of direction. This is related to the ability to accelerate the body, ie to achieve maximum acceleration, and to the ability to stop, ie. achieving the greatest possible deceleration. When repeating the change of direction of movement, it is constantly necessary to achieve maximum acceleration and stopping of movement on the shortest possible path (Milanović, 2013).

METHODS

The subject of this review paper are segments of motor space, agility and situational-motor abilities of football players, which are included in systematic training work.

The aim of this paper is to unite in one place the previous research related to determining the significance and magnitude of the impact of segments of the motor space defined as agility on the performance of situational-motor tests in football.

Literature search

The papers of researchers who have dealt with this issue, and whose results are analyzed in this paper, were collected on the basis of electronic search engines: ResearchGate, Google Scholar, PubMed Scopus and SCI. In addition to the mentioned electronic search engines, literature in the form of textbooks, master's theses, and doctoral theses was also used. The search is limited to papers published from 2009 to 2018 and papers in which the authors explored agility in the football game, as well as the connection with the situational-motor abilities of football players. The search selected works that were selected on the basis of key words: motor skills, football, agility and situational motor skills in football.

Theoretical consideration of the problem

The method used in the preparation of the paper was the collection of scientific and professional papers, descriptive method which was used together with the theoretical analysis. After searching using electronic

search engines (ResearchGate, Google Scholar, PubMed Scopus and SCI), some scientific professional papers were selected that were related to the subject of research and met all the criteria for further consideration.

RESULTS AND DISCUSSION

Most research shows that the effects of programmed training of football players can affect the improvement of agility, which is increasingly playing a crucial role in football. Table 1. highlights research that shows us the positive impact of training. Azmi and Kusnanik (2015) conducted a study where they analyzed the impact of programmed training on the development of speed, agility and acceleration on a sample of 26 respondents aged 18 years. The program lasted 8 weeks where the respondents were divided into 2 groups with 13 respondents each. One group did the SAQ program and the other group did the conventional training program. Both groups were found to have made significant progress in terms of speed, agility and acceleration. In their work, Dragosavljević, Sekulić and Ilić (2018) investigated the validity of 12 football skills tests from the Soccer Tutor Skill Tester battery test on a sample of 80 football players aged 13-16. These were tests to assess the control of the ball in motion, specific agility in football, and one test each of specific ball control and a test to assess the elevation accuracy of the pass. The construct validity of the tests was determined using the method of difference between known groups. In this paper, respondents are grouped into three groups (dominant, good, weak) based on subjective coaching assessment. Based on the results of the analysis of variance, a statistically significant difference between the groups was determined based on the results of 6 tests. These are tests of slalom with the ball, slalom without the ball, eights with the ball, long passes, running with the ball back and juggling the feet. Thomas, Kevin, French, Duncan, Hayes, Philip (2009) determined the influence of two types of plyometric training on the influence of muscle strength and agility in young football players. Respondents were divided into two groups, where it was found that there are no statistically significant differences between these two groups and that both types of

training equally affect the development of strength and agility. In his work, Grbović (2013) wanted to determine the intensity and character of the connections between certain morphological characteristics, selected motor abilities and agility. The agility study was performed on a sample of 113 students. A transversal experiment was applied in which the interactions of morphological characteristics and motor abilities in relation to the results in different agility assessment tests were monitored. The most important findings in this study suggest that morphological characteristics directly impede the manifestation of agility. The difficulty in expressing agility is a consequence of the role of body mass, as an inertial factor, in conditions of acceleration, deceleration and change of direction.

CONCLUSION

Motor abilities are an integral part of a person's abilities, and the manifestations of motor abilities, in various ways, indicate his overall abilities. A review of previous research shows that agility as a motor skill is very important in football. We have also seen that with many different types of training we can influence the improvement of agility, for example that plyometric training influences the development of agility by influencing muscle strength. We have also seen that the development of different motor skills also influences the development of agility. Football-specific exercises have in some of the studies had a negative impact on sprint performance and reactive agility, while on the other hand they improve technical performance. There are some morphological characteristics that make it difficult to show agility, some of them are the length of the lever of the athlete, but also the role of body weight on the development of agility. What we can conclude is that monitoring the development and sensitive phases on the body of tested football players is should be monitored and conducted in every type of training, especially in working with young athletes. In today's sport increasingly is dedicated to individual work, as well as situational training, which comprehensively contributes to the development of motor skills, and also agility.

Table 1. Review of scientific research works

Author and year of publication	The aim of the research	Sample of respondents		Agility assessment tests	Statistical analysis	Results
		Number	Age			
Thomas, K., French, D., & Hayes, P.R. (2009)	The effect of two plyometric training techniques on muscle strength and agility in young football players.	15	18	505 agility test	Mean value, Kolmogorov Smirnov test, ANOVA	After 6 weeks of training, the time to perform the agility test improved.

Janjić A., Suzović D., & Janković A. (2010)	Investigate the character of changes in motor skills in the preparation period.	20	Seniors average age 20.83 (\pm 2.48) years	Running with a change of direction, running the ball with a change of direction	Descriptive and comparative statistics, t-test	The obtained results indicate that during the summer preparation period, the motor abilities of football players change.
Ejup, M., Hodžić, M., Hadžiahmetović, A., & Ferić A. (2010)	To determine the influence of basic motor skills on the results in situational football tests to assess the speed of running the ball and accuracy in the football game.	88	12 -14	MKLSNL - Slalom with two balls - MAGKUS - Steps to the side - MKTOZ - Agility in the air	Regression analysis	Results in motor tests significantly affect ($p = .01$) the level of achievement in all analyzed situational football tests.
Sporiš, G., Milanović, Z., Trajković, N., & Joksimović, A. (2011)	The aim of the research was to determine the correlation between speed, agility and speed, and to determine the connection between tests with and without the ball in young football players.	25	15.19 \pm 0.32	Zig zag test, zig zag test with the ball	Kolmogorov-Smirnov test, Spearman correlation test	Research has confirmed that the structure of agility with the ball is much more complex compared to that without the ball. In addition, this research showed that basic skills without the ball have a much stronger relationship between speed, agility, and speed than skill with the ball.
Ćeremidžić, D., Kovačević, V. (2012)	The primary goal of this paper is to determine the relationship between motor abilities as a predictor set of variables with situational-motor abilities.	12	14 years \pm 6 months	Zigzag test without the ball, MCC	Regression analysis, t-test	The results of the study show that there is a significant correlation only between the effect of sprint ability at 20m and on the Illinois test.

Kutlu, M., Yapıcı, H., Yoncalı, O., & Çelik, S. (2012)	Comparison of agility and skill test in football with other agility tests	113	21.2 ± 3	T-drill agility, Zig zag test, Illinois test	ANOVA, T test, Pearson correlation test	The correlation coefficient of the new test was 88, with no significant difference ($p > 0.01 > 0.01$) between the test results obtained in the first and second test sessions. The results of the analysis of variance revealed a significant ($p < 0.01$) difference between the results of the agility of the T-test and the results of the strength test for football players. A new agility and skill test is an acceptable and reliable test when the reliability of retesting and reliability among assessors is taken into account. The findings of this study suggest that a new football-specific agility and shooting test can be used to test and identify football talents.
Bullock, W., Panchuk, B., Broatch, J., Christian, R., & Stepto, N. (2012)	The aim of this study was to evaluate the effect of 45 minutes of football-specific exercise in a reactive motor test (RMST); a new test that measures sprint, pass and reactive agility (RAT) performance.	42	18.5 ± 3.5	RMST tests	Coefficient of variation T - test	Football-specific exercises reduced sprint performance and reactive agility, but improved technical skills performance on a new, integrative, and reliable football skills performance test. The overall execution time of the RMST has largely not changed.
Hadžić, E., Guzina, B. (2013)	Determining the influence of football / football players' motor abilities (as a predictor set of variables) on the situational-motor readiness of football players / football players (as a criterion set of variables).	64	19-26	Running in a rectangle Envelope test, Steps to the side, Eight with a bend	Multiple regression analysis	A significant influence of basic basic-motor abilities (speed, explosive power and agility) on situational-motor abilities was determined.
Grbović, M. (2013)	Determining the influence of basic motor skills on the results of SMS in boys aged 11-13 years.	113	20 - 25	T-test, 505 test, zigzag running, 4 x 5 m running and 10 x 5 m running.	Factor analysis	Motor abilities directly, through strength and speed, have a positive effect on the manifestation of agility.
Dokić, M., Veselinov, D. (2014)	Determine if there are differences in motor ability depending on age.	40	16 – 18	Slalom 20m without ball	Multivariate analysis of variance (MANOVA) Univariate analysis of variance (ANOVA)	Agility is at almost the same level in both groups of footballers.

Marinković, D., Pavlović, S., & Božić, V. (2014)	To determine the extent to which the organized treatment implementation of the SAQ training program affects certain motor abilities of children of younger school age.	65	9-10	Slalom with the ball and the back polygon	T-test of paired samples	Significant improvement of certain motor abilities was found in children of younger school age.
Gardašević, J., Bjelica, D., & Ćorluka, S. (2018)	Determine the level of quantitative changes in agility in cadet football players.	120	15– year olds ± 6 months	Running with a change of direction at right angles Curvy running Conical running 10x5m	T-test	It can be concluded that the training program in the preparatory period led to positive transformations in all variables that assessed, according to the structure of the hypothetically set model, agility.
Azmi, K., Kusnanik, N.W. (2019)	The aim of this study was to analyze the effect of speed, agility, and speed training programs to increase speed, agility, and acceleration.	26	18	Speed test 30m, T - test, Acceleration test 10m	T test and t test for independent samples	In short, it can be concluded that a training program for speed, agility and speed can improve the speed, agility and acceleration of football players.
Božić, D., Bajrić, S., Ilić, N., & Goranović S. (2018)	To determine the significance and magnitude of the influence of segments of motor space defined as agility on the results of performing situational-motor tests in football.	52	14 - 16	Test 20 yards Running 4 x 5 meters with a change of direction under 900 and 1800 T- test	Regression analysis	The system of predictor variables represented by agility assessment tests had a statistically significant effect on each specific speed test.
Ćeremidžić, D. (2018)	The aim of this paper is to determine the connection between motor abilities and situational motor abilities of young football players aged 9 to 10 years.	65	9 - 10	Zigzag with and without the ball	Regression analysis	A statistically significant correlation of predictor variables with the criterion was established.
Dragosavljević, P., Sekulić, Ž., & Ilić, N. (2018)	The aim of this research was to determine the validity of tests of specific skills in football.	80	13-16	Slalom without ball, Agility eights, Agility slalom	Calculation of descriptive statistical indicators. arithmetic means, standard deviations, minimum and maximum score for each test.	The obtained values confirm that there are no statistically significant deviations of the obtained results from the normal distribution and that the data can be analyzed by parametric statistics.

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AUTHORS INFORMATIONS

Darko Božić
 Paneuropean University Apeiron, Faculty of Sports
 Science, Banja Luka
 email: darko.m.bozic@apeiron-edu.eu

Oliver Krička
 Paneuropean University Apeiron, Faculty of Sports
 Science, Banja Luka
 email: oliver.r.kricka@apeiron-edu.eu

ANALYSIS OF DIFFERENCES BETWEEN BOYS AND GIRLS IN THE SIXTH GRADE OF PRIMARY SCHOOL IN THE DEGREE OF NUTRITION AND BODY COMPOSITION

Elvira Nikšić, Edin Beganović and Amel Mekić

ABSTRACT: The research was conducted on a sample of 94 6th grade students, of which 44 were boys and 50 girls. The aim of the research was to determine the degree and differences in the degree of nutrition and body composition between boys and girls of the 6th grade of primary school. Based on the obtained results, t-test for small independent samples, it was determined that there are statistically significant differences between boys and girls of the 6th grade of primary school in the degree of nutrition. Certain variations were observed in body composition, estimated by 34 variables using the InBody 720 bioelectric impedance, but they were not statistically significant. Looking at 6th grade male and female respondents separately, it can be noticed that overweight is more prevalent in the 6th grade boys than girls, and obesity is equally prevalent in both sexes. Of the total number of male respondents in the 6th grade, 44, 17 (38.6%) are overweight, and 9 (20.5%) are obese, while 18 (40.9%) boys in the 6th grade are of normal body weight, and there were no malnourished students in this group. Of the total number of female respondents in the 6th grade, 50, 10 (20.0%) are overweight, and 9 (18.0%) are obese, while 30 (60.0%) girls in the 6th grade have a normal body weight, and 1 (2.0%) 6th grade student belongs to the category of malnourished. The obtained data indicate a big problem of today, which is conditioned by bad habits and lifestyle. Today, students are increasingly exposed to the negative influences of the environment. Television, cell phone, computer and games lead to spending too much time indoors, sitting. That is why the greatest influence on shaping the personality and adopting eating habits, have the parents, but also the school and the society. Elementary school students buy their own food, choose what tastes best to them, even though it may not be healthy. It is necessary to act preventively on time through more frequent monitoring and analysis of proper growth and development and motivating students to get involved in sports actively or recreationally. Proper habits that are adopted in childhood, in most cases, remain at other stages of development.

Keywords: *body mass index, sixth grade students, body composition, degree of nutrition, gender.*

INTRODUCION

Monitoring the nutritional status is a very useful activity because it indicates the adequacy of the process of growth and development of children, helps to understand the current, and can also serve as a prognostic factor for their future health. The nutritional status of children can be assessed on the basis of clinical examination, laboratory procedures and anthropometric measurements. Height and body weight are most often used to determine nutrition (Caccaiari et al., 2002; Vlaškalić and Vlaški 2005). Adolescents (10 - 19 years of age) belong to the category of vulnerable categories of the population with regard to intensive growth and development (WHO, 2005). Hunter states that physical activity is the factor that prevents the appearance of excess weight. Research shows that there is an increasing number of children suffering from type 2 diabetes precisely because of obesity (Hunter et al., 2000). If we look at the American continent we will see that in the last 10 years the number of obese has increased by 50%, and two-thirds of Americans are overweight or obese. The situation with children is also worrying and from the data we can see that 4 million children aged 6 to 11 and more than 5 million children aged 12 to 19 are obese (Westcott, 2006). Anthropometry is used to determine the degree of nutrition. Anthropometric methods are the most important procedures in assessing the nutritional status of children, they involve measuring different body

dimensions using recommended aids and standardized techniques. The most important and most frequently used anthropometric quantities are: body height - length, body weight, thickness of subcutaneous adipose tissue above the triceps or scapular angulus, upper arm circumference, waist circumference, etc. (Krebs et al., 2007). Children and adolescents who are at risk of being overweight often also become obese adults. Nutritional status is an indicator of physical fitness and health status of an individual and the entire population (Rakić et al., 2008). The average amount of body fat at birth is about 13.0% of body weight, and at the end of the first year about 28.0%. In the following years, the amount of fat decreases, and a re-increase occurs around the age of 12 in girls and 16-17. years in boys. Gender differences in the amount of fat in the body appear in early childhood. Girls show a higher percentage of adipose tissue than boys as young as 5 to 6 years of age. In boys, a significant decrease in the relative fat content between 12-13 and 16-17 year is most often observed, ie. in the period of sexual maturation. During this period, boys experience a large increase in lean body mass and a consequent decrease in the relative share of fat in total body weight. At the end of adolescence, the difference in the percentage of fat between the sexes is about 10.0%. From the onset of adulthood until the age of 60, the percentage of body fat increases by about 1.0% per decade, while after the age of 60

the relative share of fat in total body weight decreases slightly primarily due to a decrease in adipose tissue (WHO, 1995). Adipose tissue redistributes with age and increasingly accumulates in the abdominal area (visceral fat) (Seidell & Visscher, 2000). During the aging process, there is an increase in visceral fat, while subcutaneous fat in other parts of the body decreases due to the redistribution of fat in the body (Zamboni et al., 2005). Therefore, the diagnosis of the state of body composition is often the subject of research based on which a realistic insight into the current state of the defined population and possible negative or positive trends of growth and development over a period of time (Dopsaj et al., 2005). The influence of diet and physical activity changes the relationship between fat and non-fat mass, and thus the composition of the body. Most methods of determining body composition are based on a two-component model (non-fat and fat mass), while some methods are based on a three-component (water, non-fat and fat mass) and four-component (water, bone minerals, proteins and fat) model (Mišigoj-Duraković, 2008). The aging process affects the increase in adipose tissue and decrease muscle mass, which in general leads to changes in body composition and shape (Krznačić et al., 2011). Due to its simplicity and accuracy, the body mass index (BMI) is widely used in assessing nutritional status. Although it does not provide information on body composition, in combination with other methods that determine body composition, information on the degree of nutrition of an individual or an observed group can be obtained (Mišigoj-Duraković et al., 2014). The most significant disorder is obesity which is more and more prevalent in children in adolescence. Ten years ago, statistical data showed that 10.5% of children in Croatia have increased body weight, and 3.8% of them are obese. The latest data from the Croatian Institute of Public Health (Croatian Institute for Public Health) say that 26.4% of school-age children are overweight, while 11.2% are obese. Croatia is in a worrying fifth place in Europe in terms of the number of overweight children (Kolarić & Nožinić, 2016). A large survey conducted in Greece in 2011 at the age of 11-12 shows that 36.6% of children are overweight and obese (Šimestin Pavić, 2016). According to the World Health Organization (WHO, 2018), childhood obesity is one of the greatest global public health challenges of the 21st century. It is estimated that in the last 40 years, the number of obese school-age children and adolescents has increased as much as tenfold. Baranowski & Taveras (2018) point out that the current approach to the issue of childhood obesity has not yielded the expected results and that it is necessary to strengthen preventive activities at all levels, starting with parents. Nutrition and school are related for several reasons and thus affect the analysis of nutritional status and body composition of primary school age students. Own choice and consumption of food, nutrition is no longer completely under the control of parents, unsupervised eat at least one meal a day or even

several snacks, modern, fast lifestyle also affects diet, lack of time, life dynamics and increasing employment of parents affect that children and young people more often consume food outside the home, more often they eat meals that are rich in energy in terms of nutritional composition, but do not contain a sufficient amount of nutrients and protective substances - vitamins and minerals (Taljić, 2019). In the research conducted on the ITOF criterion, the majority of children, 165 or 65.74% of them were normally fed, as many as 21.51% were malnourished, while children with increased body weight were 7.97% and 4.78% obese (Paić, 2019).

MATERIAL AND METHODS

Participants

The study included a sample of 94 students divided into two subsamples: 44 boys and 50 girls. Mean values for boys Body Height (BH) 151.93 ± 7.28 cm, Body Weight (BW) 46.28 ± 10.06 and Body Mass Index (BMI) 19.88 ± 3.26 kg / m². Average values for girls Body Height (BH) 154.07 ± 7.91 cm, Body Weight (BW) 46.70 ± 11.62 kg and Body Mass Index (BMI) 19.43 ± 3.49 kg / m².

The sample of variables

The sample of measuring instruments used in the research represents a set of 34 variables. To assess the anthropometric characteristics, 3 variables were taken: Body Height (BH), Body Weight (BW) and Body Mass Index (BMI). All anthropometric variables were measured according to standard procedures of the International Society for the Advancement of Kinanthropometry (ISAK) (Marfell-Jones, et al., 2006). The following variables were used to assess body composition:

- 10 variables for assessing body composition: Total Body Water (TBW), Proteins, Minerals, Body Fat Mass (BFM), Soft Lean Mass (SLM), Fat / non-fat tissue ratio (Ratio BFM / SLM), Fat Free Mass (FFM), Skeletal Muscle Mass (SMM), Minerals in the Bones (MB), Percent Body Fat (PBF).
- 10 variables for segmental display of body muscle mass: right arm muscle mass (FFM of Right Arm), right arm muscle mass percentage (% FFM of Right Arm), left arm muscle mass (FFM of Left Arm), left arm muscle mass percentage (% FFM of Left Arm), muscle mass trunk (FFM of Trunk), percentage of torso muscle mass (% FFM of Trunk), right leg muscle mass (FFM of Right Leg), right leg muscle mass percentage (% FFM of Right Leg), left leg muscle mass (FFM of Left Leg), left leg muscle mass percentage (% FFM of Left Leg).
- 10 variables for segmental display of adipose tissue: right arm adipose tissue (BFM of Right Arm), right arm adipose tissue percentage (% BFM of Right Arm), left arm adipose tissue (BFM of Left Arm), left arm adipose tissue percentage (% BFM of Left Arm), adipose tissue trunk (BFM of Trunk), body fat percentage (% BFM of Trunk), right leg fat (BFM of Right Leg), right leg fat (% BFM of Right Leg), left leg fat (BFM of Left Leg), the percentage of adipose tissue of the left leg (% BFM of Left Leg) and
- a variable to assess the waist-to-hip ratio (WHR)

Waist-Hip Ratio).
 • Body composition was measured with an InBody720 Scale (Aandstad, Holtberget, Hageberg, Holme, & Anderssen, 2014).

Research Desing

Anthropometric variables were measured according to standard procedures of the International Society for the Advancement of Kinanthropometry (ISAK) (Marfell-Jones et al. 2006). Based on the variables BH and BW, BMI [$BMI = BH (kg) / BW (cm)^2$] was calculated. BMI values for both subsamples were classified into 4 nutritional levels, according to the recommendations of the Centers for Disease Control and Prevention, 2000 (Kuczmarski et al., 2000) Table 1.

Table 1. Categorization of nutrition based on percentiles

BMI ≥	95th percentile	Obesity
BMI =	85-95th percentile	Tendency towards obesity
BMI =	5-85th percentile	Normal nutrition
BMI ≤	5th percentile	Malnutrition

Centers for Disease Control and Prevention, 2000 (Kuczmarski et al., 2002).

Body composition was measured with an InBody720 scale (Aandstad, et al., 2014). The validity of determining the body composition with InBody720 scales on a sample of children has been positively

evaluated in some previous studies (Lim et al., 2009; Tompuri et al., 2015). The research was approved by the Ethics Commission of the Faculty of Education, University of Sarajevo (World Medical Association, 2013). All parents are informed in advance about the implementation of the research which explains the purpose and goal of the research. Therefore, the research was supported by all parents, with written consent.

Statistical Analysis

All data collected by the research were processed by descriptive and comparative statistics. From the space of descriptive statistics, the arithmetic means, and standard deviation were calculated for each variable, while the T-test for small independent samples was used to determine the differences. The statistical program for personal computers SPSS for Windows-version 20.0 was used for data processing.

RESULTS

Table 2 presents the results of the basic parameters of descriptive statistics, minimum value (Min.), Maximum value (Max.), Arithmetic mean (M) and standard deviation (SD) for body height, body weight and body mass index (BMI), of boys and girls in the 6th grade. The average height for 6th grade boys is 151.9318 cm and the weight is 46.2886 kg, while the average value for BMI is 19.8818. The average height value for 6th grade girls is 154.0700 cm and the weight is 46.7000 kg, while the average value for BMI is 19.432.

Table 2. Descriptive statistics related to body height, weight of subjects and BMI, and by sex

6 th grade boys	N	Xmin.	Xmaks.	M	SD
Body height	44	137.00	169.90	151.9318	7.28614
Weight	44	29.50	73.00	46.2886	10.06022
BMI	44	14.90	28.10	19.8818	3.26990
6 th grade girls	N	Xmin.	Xmaks.	M	SD
Body height	50	129.30	173.60	154.0700	7.91571
Weight	50	22.80	77.70	46.7000	11.62288
BMI	50	13.80	27.60	19.4320	3.49229

Table 3. shows the percentile values for the BMI variable, based on which it is possible to see the nutritional status of 6th grade students by gender. A very high percentage of overfed and obese students is obvious, given that this is a small sample of respondents. Looking at all respondents, out of the total number of respondents 94 (100%), 45 of them (47.8%) are overweight or obese. Looking at 6th grade boys and girls separately, it can be observed

that overweight and obesity are more prevalent in boys than in girls. Out of a total of 44 boys, 9 (20.5%) are obese, 17 (38.6%) are overweight, while 18 (40.9%) boys are of normal weight and there were no malnourished people. Out of a total of 50 girls, 9 of them (18.0%) are obese, 10 (20.0%) are overweight, while 30 (60%) girls are of normal body weight, and 1 girl (2.0%) belongs to the category of malnourished.

Table 3. Frequencies and percentage values of body mass index by categories for 6th grade respondents, and by sex

Nutritional status	Boys			Girls		
	N	Percentiles	%	N	Percentiles	%
Obesity	9	≥95	20,5	9	≥95	18,0
Overeating	17	85-95	38,6	10	85-95	20,0
Normal nutrition	18	5-85	40,9	30	5-85	60,0
Malnutrition	0	<5	0,0	1	<5	2,0
Total:	44		100,0	50		100,0

Analyzing the results shown in Table 4, we can notice that there are certain variations between boys

and girls in body composition parameters, but no t-test is statistically significant, and it can be concluded that there are no statistically significant differences between boys and girls.

Table 4. Value and level of significance of t-test in examining differences between boys and girls of 6th grade in values of parameters related to general body composition

Variable	Difference	St. error	t-test	p	95% confidence interval	
					Lower limit	Upper limit
TBW	-0.382	0.893	-0.428	0.670	-2.156	1.392
Proteins	-0.068	0.240	-0.283	0.778	-0.545	0.409
Minerals	-0.062	0.091	-0.677	0.500	-0.243	0.119
BFM	0.103	1.360	0.075	0.940	-2.598	2.803
SLM	-0.453	1.149	-0.394	0.694	-2.736	1.829
Ratio BFM/SLM	0.012	0.036	0.337	0.737	-0.059	0.083
FFM	-0.314	1.226	-0.256	0.798	-2.748	2.120
SMM	-0.219	0.727	-0.300	0.765	-1.663	1.226
MB	-0.080	0.077	-1.031	0.305	-0.233	0.074
BMI	0.446	0.709	0.629	0.531	-0.963	1.855
PBF	0.519	1.797	0.289	0.774	-3.051	4.088

p- significance level

Analyzing the results shown in Table 5, it is noticeable that no statistically significant difference was found between boys and girls when it comes to muscle mass values (no t-test is statistically significant), but significant differences were found

when it comes to the percentage of muscle mass on all examined body parts. On average, girls have a significantly higher percentage of muscle mass in the left and right arms, torso, and left and right legs.

Table 5. Differences in the representation of muscle mass between 6th grade boys and girls – Descriptive statistic, t-test

Variables	Gender	Mean±Std.Dev.	t-test	
			t-value	P
FFM of Right Arm	Male	1.51± 0.33	-0.093	0.926
	Female	1.51± 0.43		
% FFM of Right Arm	Male	87.05± 15.94	-3.568	0.001 **
	Female	98.69± 15.62		
FFM of Left Arm	Male	1.50± 0.34	0.044	0.965
	Female	1.50± 0.43		
% FFM of Left Arm	Male	86.77± 16.42	-2.392	0.019 *

	Female	95.29± 17.89		
FFM of Trunk	Male	14.92± 2.33	-0.148	0.883
	Female	15.00± 2.89		
% FFM of Trunk	Male	96.18± 6.93	-4.224	0.000 **
	Female	102.26± 6.98		
FFM of Right Leg	Male	5.06± 0.97	-0.469	0.640
	Female	5.17± 1.31		
% FFM of Right Leg	Male	93.83± 7.05	-3.356	0.001 **
	Female	99.79± 9.73		
FFM of Left Leg	Male	5.04± 0.98	-0.201	0.841
	Female	5.09± 1.21		
% FFM of Left Leg	Male	93.31± 6.88	-3.532	0.001 **
	Female	99.59± 9.86		

p-significance level

* t-test is statistically significant on a level lower than 5%

** t-test is statistically significant on a level lower than 1%

Analyzing the results shown in Table 6, it is noticeable that no t-test is statistically significant. There are no significant differences in the presence

of adipose tissue in the body between boys and girls in the 6th grade of primary school.

Table 6. Differences in body fat representation between the 6th grade boys and girls – Descriptive statistic, T-test

Variables	Gender	Mean±Std.Dev.	t-test	
			t-value	P
BFM of Right Arm	Male	0.84± 0.50	-0.190	0.850
	Female	0.86± 0.54		
% BFM of Right Arm	Male	32.52± 10.95	-0.128	0.898
	Female	32.79± 9.48		
BFM of Left Arm	Male	0.84± 0.49	-0.128	0.899
	Female	0.85± 0.47		
% BFM of Left Arm	Male	32.72± 10.85	-0.288	0.774
	Female	33.31± 9.02		
BFM of Trunk	Male	5.37± 3.76	-0.022	0.982
	Female	5.39± 3.61		
% BFM of Trunk	Male	22.89± 11.68	-0.031	0.975
	Female	22.96± 10.54		
BFM of Right Leg	Male	2.00± 0.94	0.317	0.752
	Female	1.94± 0.85		
% BFM of Right Leg	Male	26.35± 7.95	0.370	0.712
	Female	25.79± 6.83		
BFM of Left Leg	Male	2.00± 0.94	0.317	0.752
	Female	1.94± 0.85		
% BFM of Left Leg	Male	26.36± 7.93	0.373	0.710
	Female	25.79± 6.82		

p-level of significance

Analyzing the results shown in Table 7, differences between 6th grade boys and girls are noticeable. On

average, girls have higher values than boys at the waist-to-hip ratio variables.

Table 7. Differences in the values of the parameters of the waist-to-hip ratio between 6th grade boys and girls – Descriptive statistic, t-test

Variables	Gender	Mean±Std.Dev.	t-test	
			t-value	P
	Male	0.81± 0.04		
WHR	Female	0.82± 0.04	-1.126	0.263

p-level of significance

Based on the results of previous analyzes, it was found that there are statistically significant differences between boys and girls in the values on

DISCUSSION

The results of the research showed that almost half of the 6th grade students (45 students, 47.87%) are overweight or obese. Overweight and obesity are more prevalent in boys than in girls. Out of a total of 44 boys, 26 of them (59.1%) are obese or overweight, while out of a total of 50 girls, 19 (38.0%) are obese or overweight. The obtained results showed that there are certain variations between boys and girls in body composition parameters. Based on the results of the values of t-tests, it can be concluded that there are no statistically significant differences between boys and girls of 6th grade in the above indicators of body composition. Girls have slightly higher values of all indicators of muscle mass. No statistically significant differences were found between boys and girls when it comes to muscle mass values, but significant differences were found when it comes to the percentage of muscle mass on all examined body parts. On average, girls have a significantly higher percentage of muscle mass in the left and right arms, torso, and left and right legs. There are no significant differences in the presence of adipose tissue in the body between boys and girls in the 6th grade of primary school. On average, girls have higher values than boys on the waist-to-hip ratio variables. Based on the results of previous analyzes, it was found that there are statistically significant differences between boys and girls in the values on the variables of the percentage of muscle tissue of the right and left arm, torso, right and left leg. No significant differences were found in the other variables.

Đurković (2012) points out that obesity, in addition to affecting a person's health status, also affects work productivity, as well as financial expenses for the treatment of overweight and obese people. If in this period intensive growth and development are not based on healthy habits, the risk of developing various diseases, both in youth and in adulthood, is inevitable. In our country, as in the region, every third child spends three to five hours a day in front of a computer or TV, which significantly affects weight gain (Despotović, Alexopoulos, Despotović, & Ilić, 2013). The results on a sample of respondents aged 11 to 14 indicate that only 62% of students are properly fed, while 33% fall into the category of overweight and 5% are obese. This fact indicates a

the variables of the percentage of muscle tissue of the right and left arm, torso, right and left leg.

significant and worrying relative increase in body weight and obesity in this age group (Podnar et al., 2013). The human body contains about 19.5% protein, 1-2% glycogen, 8% minerals and 72.5% water, where about 50% is extracellular water (WHO, 1995). The composition of the human body can be observed through two components, namely fat (adipose) and non-fat mass. Fat mass is considered metabolically inactive, however, it plays an important role in hormone metabolism and in adiponectin levels. The lean mass is heterogeneous and extremely metabolically active as it encompasses bone, muscle tissue, extracellular water, nerve tissue, various organs, and all cells except adipocytes (Willett, 2013). Childhood obesity increases the risk of adulthood obesity and is associated with a range of comorbidities, from type 2 diabetes, hypertension, nonalcoholic fatty liver, respiratory distress, and many others. Children are exposed to stigmatization and have poorer socioeconomic status and consequently poorer quality of life and lower life expectancy (Sahoo et al., 2015). The level of child nutrition in Sarajevo Canton shows that 78.10% have normal nutrition, 12.30% are overfed, 7.10% are obese and 2.50% are malnourished (Taljić and Nikšić, 2016). Insight into the Croatian Health Statistics Yearbook issued every year by the Croatian Institute of Public Health, based on data collected from the County Institutes of Public Health and the Institute of Public Health of the City of Zagreb obtained from the School Medicine Services, 3.73% of students were malnourished, 12.85% overweight and 17.74% obese in primary schools. If we exclude children of normal body weight, 34.32% of primary school children are in other categories (Puharić et al., 2016). The results of the research on the body mass index (BMI) of children in the Sarajevo Canton in 2016 show that in the sixth grade there were a total of 3548 respondents, of which 1708 were girls and 1840 boys. Of the total number of respondents of VI grade, included in this study, most respondents had normal TM, 912 (53.4%) girls and 852 (46.3%) boys. Observing separately the respondents of VI grade by gender, overt TM and obesity were more prevalent in boys. More specifically, out of a total of 1840 boys, 424 (23.0%) were overweight and 405 (22.0%) were obese, while, out of a total of 1708 girls, 395

(23.1%) were overweight body weight, and 226 (13.2%) were obese. Comparing the results of the percentage of body mass index by grades (first, third, fifth and seventh) and categories for girls and boys of primary schools in Sarajevo Canton and primary schools in the City of Mostar, we conclude that in Sarajevo Canton there are more children with lower body mass index than normal, and the highest in the first grade 10.3%, while in the City of Mostar this percentage is highest in the seventh grade and amounts to 8.0%. Also, the highest percentage of children with increased body mass index in KS and the City of Mostar is in the fifth grade and amounts to 44.6% for KS and 43.1% for the City of Mostar. When we take into account all the results of the research conducted in KS and the City of Mostar, we come to the conclusion that somewhat more favorable results were obtained by research in the City of Mostar, and that the closest results of KS and the City of Mostar are those recorded in the fifth grade (Abazović et al., 2016; Čolakhodžić et al., 2017). A large study conducted on a sample of respondents aged 11-12 shows that 36.6% of children are overweight and obese (Šimestin Pavić, 2016). According to the World Health Organization (WHO, 2018), childhood obesity is one of the greatest global public health challenges of the 21st century. It is estimated that in the last 40 years, the number of obese school-age children and adolescents has increased as much as tenfold (WHO, 2018). The etiology of childhood obesity is very complex, but eating and living habits play a very important role (Kumar and Kelly, 2017). Observing the general results based on the conducted research of determining the obesity of primary school children in the City of Mostar, in which a total of 1940 students participated, an extremely large number of children with increased body weight was recorded. Of the total number of students included in this study, as many as 36.4% (707) were obese, while 56.1% of children had a normal body weight. In addition, it is worth noting that 7.4% (144) of respondents were malnourished. According to the obtained results, almost every other child has an eating disorder (43.9%), which is extremely worrying and alarming (Čolakhodžić et al., 2017). Although BMI does not show body composition, and thus the proportion of fat that determines obesity (Mišigoj Duraković et al., 2014), the results of the nutritional status of most respondents show obesity, but also in the analysis of body composition a very high proportion of adipose tissue. That is, a comparison of BMI values with adipose tissue percentage shows a positive correlation of data in both sexes. The strong association of BMI with adipose tissue shows that subjects with a higher body mass index also have a higher proportion of adipose tissue. Similar research (Akindele et al., 2016) also confirms the knowledge about the interrelationship between BMI and adipose tissue content. Puberty is a succession of anatomical and physiological changes in early adolescence that mark the transition period from sexually immature to fully mature and is characterized by the development of

reproductive functions, changes in body size, composition and function in response to sex hormones (Perroni, et al., 2018). The study was conducted on a sample of 67 boys and 69 girls, with an average age of 11.56 years. The aim of the study was to determine the degree and differences in the degree of nutrition and body composition in boys and girls of pubertal age. Based on the obtained results, it was determined that there are no statistically significant differences between boys and girls, both in nutrition and body composition in students of VI and VII grade of elementary school. Based on the obtained results, it was determined that there are statistically significant differences between students of VI and VII grade, both in the degree of nutrition and in body composition, estimated by 34 variables using the bioelectric impedance InBody 720. It was found that out of a total of 94 (69.1%) students of VI grade, 27 of them (28.7%) have excessive TM, and 18 (19.1%) are obese, while 48 (51.1%) students of VI grade have a normal TM, and 1 (1.1%) student of VI grade falls into the category of malnourished. Out of a total of 42 (30.9%) students of VII grade, 15 of them (35.7%) have excessive TM, 7 (16.7%) are obese, while 20 (47.6%) students of VII grade have a normal TM, and there were no malnourished. On average, students of VII grades have higher values on total body fluid in the body, the presence of proteins, minerals, bone minerals, lean tissue, muscle mass, skeletal muscle mass, body mass index, muscle mass of the left and right arm and trunk, muscle mass and its percentage in lower extremities, target weight and muscle control in relation to VI grade students. The obtained data indicate a big problem of today, which is conditioned by bad habits and lifestyle. Today's modern society is characterized by markedly reduced motor activity and improper diet, and an increasing number of people whose lifestyle can be described as "sedentary". It is necessary to act preventively on time through more frequent monitoring and analysis of proper growth and development and motivating students to get involved in sports actively or recreationally. The correct habits that are adopted in childhood, in most cases remain in other developmental stages (Nikšić, Beganović, Mekić, 2020). In a study conducted on a sample of 136 students (67 boys and 69 girls), with an average age of 11.56 years, the aim was to determine the degree and differences in the degree of nutrition and body composition in boys and girls of pubertal age. Based on the obtained results, t-test for small independent samples, it was found that there are no statistically significant differences between boys and girls, both in the degree of nutrition and in body composition, estimated by 10 variables using bioelectric impedance InBody 720. It was also found that 19.70% of boys are obese, as well as 17.40% of girls. Collectively, with the percentage of malnourished respondents, a total of 61.50% of boys are not normally fed, as well as 37.70% of girls (Nikšić et al., 2021).

CONCLUSION

Based on data showing that 47.87% of respondents are overweight or obese, it can be concluded that this is a major problem today, which indicates an urgent solution to this health problem through more frequent monitoring and analysis of students, their proper growth and development, inclusion in social communities in problem solving, motivating students for more frequent involvement in various sports activities. The level of nutrition is one of the indicators of the state of the organism and in order to maintain it in normal values, it is necessary to consume a variety of foods, divide daily meals into five smaller ones and adhere to the guidelines of proper nutrition. It is necessary to take in about two liters of fluid, and engage in regular physical activity. This is the only way to burn as many calories as possible so that fat deposits do not accumulate on the stomach and other parts of the body. Be sure to exercise, run or walk 3-5 times a day for 30 to 60 minutes. Prolonged lying down next to the TV or sitting at the computer for a long time should be reduced or eliminated. Daily energy intake in the body should be equivalent to its consumption through daily activities. From all the above we can conclude that physical activity, regardless of age and gender, plays a very important role in preventing obesity. Regardless of the stage of being overweight, controlled physical activity contributes to maintaining optimal health status. It is very important to create the habit of physical exercise at the earliest age in order to later grow into a way of life, and thus affect the quality of life.

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AUTOR'S INFORMATION

dr. sci. Elvira Nikšić, van. prof.
Faculty of education science, University of sarajevo
e-mail: elvira.beganovic1982@gmail.com

Edin Beganović, Ba
Faculty of sport and physical education, University of sarajevo
e-mail: edinn.beganovic@hotmail.com

dr. sci. Amel Mekić, van. prof.
Faculty of sport and physical education, University of sarajevo
e-mail: amelmekic21@gmail.com

DIFFERENCES IN SPRINT ABILITY, AGILITY AND VERTICAL JUMP BETWEEN PROFESSIONAL AND AMATEUR SOCCER PLAYERS IN BOSNIA AND HERZEGOVINA

Enes Šunje, Ekrem Čolakhodžić, Rijad Novaković and Stjepan Skoko

ABSTRACT: The aim of investigation was to determine the differences in linear speed (SPRINT30), agility (TT), and the explosive power of vertical jump (CMJ) between adult professional and amateur soccer players in Bosnia and Herzegovina. Forty-seven (47) soccer players were included in the research and were divided in two sample groups: professional soccer players of CSC Zrinjski Mostar who play at the elite level of competition - BiH Premier League (n = 22) and amateur soccer players of FC Velež Mostar who play at the second level of competition - First League of FBiH (n = 25). The study was conducted in February 2019, at the beginning of the second part of 2018/19 soccer season in BiH. The results of descriptive statistics show that professional soccer players are, on average, older (24.59 ± 4.15 vs 22.00 ± 2.95), taller (185.04 ± 6.33 vs 182.44 ± 6.99), and have a larger body mass (80.77 ± 6.92 vs 76.96 ± 8.64). The values of lower-limb explosive power, flight time CMJTIME ($.63 \pm .56$ s vs $.65 \pm .57$ s) and jump height CMJHIGH (40.95 ± 4.70 cm vs 39.70 ± 4.15 cm) show that, on average, professional soccer players have better results. The values of the ability to change the direction quickly (TT) are higher in professional soccer players ($9.43 \pm .33$ s vs $10.07 \pm .43$ s), and it is the case with the linear speed tested by the test SPRINT30 ($4.15 \pm .12$ s vs $4.33 \pm .15$ s). As for the variables defining lower-limb explosive power, the average values of CMJTIME and CMJHIGH are again slightly on the side of professionals as compared to amateurs (0.57 ± 0.03 s vs 0.56 ± 0.03 s) and (40.95 ± 4.70 cm vs 39.70 ± 4.15 cm). T test for independent samples determined the differences in arithmetic mean between professional and amateur soccer players in Bosnia and Herzegovina in the treated variables. We noted here a statistically significant age difference between these two groups at the level of .95% ($p \leq 0.05$) (sig. 0.017) and the difference between the variables defining the linear speed in SPRINT30 and TT agility at the level of .99% ($p \leq 0.01$) (sig.0.000). In the variables defining lower-limb explosive power, the groups did not differ statistically in jump height and flight time.

Based on the analysis of the results obtained, we may conclude that professional and amateur soccer players in BiH differ statistically significantly by age, linear speed and agility, and that there is no statistically significant difference in terms of lower-limb power/strength and the ability to jump vertically. We may conclude that professional teams rely more on more experienced players, while the second-level teams rely on young players who are eager to prove themselves, and that in training selection and technology, professional teams pay more attention to sprint speed and agility ability compared to amateur soccer players and second-level players. The soccer players do not differ statistically in their ability to jump vertically, so we can say that training technology, selection and programs in that domain are the same at both competition levels.

Keywords: *soccer, speed, agility, explosive power.*

INTRODUCTION

We are witnessing the rapid development of modern soccer in all components of the game, but particularly in terms of players' physical quality (Bangsbo, 2014). Many authors have found out that top soccer players run 8-12 km on average during a match. It depends on their position in the team (Bangsbo, Nørregaard and Thorsøe, 1991; Reilly, Thomas, 1976; Reilly, 1996; Čolakhodžić et al., 2017), their energy status, and aerobic fitness (Jacobs, Westlin, Karlsson, Rasmusson and Houghton, 1982; Smaros, 1980; Helgerud, Engen, Wisløff and Hoff, 2001). It is also evident that the amount of running at higher speed during a soccer match constantly increases with the high level of performance (Mohr, Krustup and Bangsbo, 2003). General opinion is that sprinting skills in all their forms are becoming increasingly important in modern soccer (Haugen, Tonnessen, Hisdal and Seiler, 2014). According to Reilly and Thomas (1976), the sprint in a football match occurs approximately every 90 seconds and each lasts 2-4 seconds on average (Bangsbo, Nørregaard, Thorsøe, 1991).

The sprint counts for 1%-11% of the total running distance in a match, and it is equal to 0.5%-3.0% of the effective playing time, i.e. when the ball is in play (Bangsbo, Nørregaard, Thorsøe, 1991; Reilly, Thomas, 1976; O'Donoghue, 2001; Ali, Farrally, 1991; Bangsbo, 1992). Top players perform about 50 turns in a match, including strong contractions to maintain the balance and to control the ball because of the opponent's pressure. In all these actions, the strength, agility and explosive power, together with endurance, are of quintessential importance for a top soccer performance. The ability to create the level of maximum strength in players' lower limbs in the shortest period is the foundation for achieving the best performance in soccer (Haugen, Tonnessen, Hisdal and Seiler, 2014; McFarland, Dawes, Elder and Lockie, 2016). A significant relationship was also observed between one repetition maximum (1RM), acceleration and movement speed. The relationship between maximum strength, explosive power and soccer performance is supported by jumping results and 30 m sprint tests. The results show that the increase in the available muscle contraction force in respective muscles or muscle groups leads to the increase in acceleration and speed in the skills,

which are crucial for a soccer match, such as turning, sprinting, changing of direction and pace (Buhrle, Schmidbleicher, 1977; Schmidbleicher, 1992; Hoff, Berdahl, Braten, 2001). The results of the study by Wisloff, Castagna, Helgerud, Jones and Hoff (2004) also confirmed the existence of the strong relationship between maximum strength, sprint, and jumping ability in the performance of elite soccer players.

The ability to maintain and control the position of the body while rapidly changing the direction in a series of movements is called agility (Twist, Benicky, 1995; Sheppard, Young, 2006). Agility is also defined as the combination of strength, speed, balance, and coordination (Draper and Lancaster 1985). Agility, therefore, is not defined precisely, but it is most often defined as the ability to rapidly change direction, to react, and to stop (Gambetta, 1996; Sheppard, Young, 2006). In addition to the data we referred to earlier, the importance of sprint, agility and vertical jump in soccer is evidenced by the fact that the players make 30 sprints on average, about 600 changes of direction, and 10-15 jumps (Čolakhodžić, Rađo, Alić, 2016) in a match. One way to examine the relationship between these abilities and top performance in soccer, and their impact on the performance is to determine the degree of their correlation. The results obtained by Pauole, Madole, Garhammer, Lacourse, and Rozenek (2000) show a significant degree of correlation between the agility T-test and the 40-yard dash test in male and female athletes. Buttifant, Graham, and Cross (1999) and Young, Hawken, and McDonald (1996) did not prove significant correlation between sprint and agility tests in soccer players and Australian football players. Young, McDowell, and Scarlett (2001) proved that linear sprint and agility are specific abilities having limited impact on each other. Some authors have defined agility as a skill or simply the ability to change the direction rapidly (Mathews, 1973), and some as the ability to change the direction rapidly and accurately (Barrow & McGee, 1971; Johnson & Nelson, 1969).

Some authors have defined agility in more recent publications as including a whole-body change of direction as well as a rapid movement and direction change of limbs (Baechle, 1994; Draper & Lancaster, 1985). We also need to emphasize the results of some studies that highlight the advantages of high aerobic fitness in soccer and its association with the quality of match performance. It has also been proved that improving the aerobic fitness of elite junior soccer players leads to an increase in the running distance, match intensity, number of sprints and contacts with the ball in a match (Helgerud, Engen, Wisloff and Hoff, 2001). Although such relationships and results are also expected in top soccer players in Bosnia and Herzegovina, this study is a little empirical support to such assumption. The aim of this study was to investigate the abilities of sprint, agility and vertical jump and to determine the differences between professional and amateur soccer players in Bosnia and Herzegovina who represent two competition levels (first competition

level is the Premier League of BiH and second competition level is the First League of FBiH).

METHODS

Research Subjects

The sample comprised 47 senior soccer players. They were divided into two groups. The first group were professional soccer players of HFC Zrinjski Mostar who play at the elite competition level - BiH Premier League ($n = 22$; age: 24.59 ± 4.15 years, height: 185.4 ± 6.33 cm, weight: 80.77 ± 6.92 kg). The second group were amateur football players of FK Velež Mostar who play at the second competition level – the First League of FBiH ($n = 25$; age: 22.00 ± 2.95 years, height: 182.44 ± 6.99 cm, weight: 76.96 ± 8.64 kg). The research was conducted in February 2019, at the beginning of the second part of the 2018/19 football season in BiH.

Assessment Methods

The assessment and testing of anthropological characteristics and vertical jump (CMJ) took place indoors in a gym, and the testing of sprint (SPRINT30) and agility (TT) in the open fields of the clubs tested, on the same day and under the same conditions. Prior to assessment and testing, a ten-minute warm-up drill was applied. The drill comprised activation and mobilization exercises, light running, stretching, skipping, and acceleration drills. The break between individual assessments lasted 10-15 minutes. The testing was conducted by the experienced researchers of the Institute of Kinesiology of the Faculty of Teacher Education, at Džemal Bijedić University of Mostar.

Lower-Limb Power Ability Test: CMJ (Counter Movement Jump)

The lower-limb power ability was evaluated by the evaluation of vertical jump height. The jump height during CMJ was evaluated by using an infrared photocell connected to a digital computer (Optojump System, Microgate R, Bolzano, Italy). This made it possible to measure flight time (tf) with 1/1000 s accuracy. For CMJ testing, the subjects started from standing position with the hands on the hips. After a verbal signal, downward movement to a 90-degree knee angle was made, and the subjects then jumped upward as quickly as possible. Three attempts were made for the evaluation of CMJ and the average used for the analysis was taken.

Change of Direction Speed Ability: T-test

For testing the change of direction ability (Change Of Direction Performance - CODP) we used the effective, reliable, and sensitive soccer T-test (Sporiš i sar., 2010). The T-test was applied under the protocol as described by Semenick (1990). One cone was placed at the distance of 9.14m in front of the first cone and the other two cones were placed at the distance of 4.57m on either side of the second cone. Times were recorded by an electronic timer (Photocells, Microgate R, Bolzano, Italy). Photoelectric cells were placed at the height of 0.7 m above the floor. The subjects were running in T-

shape, running forward 9.14m to the first touching its top with the right hand. Then they were running 4.57m left to the second cone touching its top with the left hand. Then they were running to the opposite side 9.14m right to the third cone touching its top with the right hand. Then they returned 4.57m left to the middle cone touching its top with the left hand, before finally running backwards to 2 meters wide starting line. The testing failed if the participants failed to touch a particular cone, if they crossed over a leg while migling or if they failed to face forward all the time. Prior to performance, all the participants had tests to familiarize themselves with three final assessment tests with one-minute recovery intervals before performance. The average of three measurements was used for the analysis.

Linear Speed Ability: 30 m Sprint

The assessment of S30m linear sprint test was performed by Witty Gate Training System photocells (Microgate R, Bolzano, Italy). Two photocells were located at the starting point at the distance of 30m. The sprint started from the starting position. Each participant started sprinting when he was ready. The time was recorded from the passing by the first photocell until the participants crossed the 30-meter line, on which the other photocells were placed. All the participants performed 2 runs with 5-minute break to recover between runs. The fastest test time S30m was used for further statistical analyzes.

Statistical Analysis

SPSS (version 26.0; SPSS, Inc., Chicago, IL, SAD) was used for statistical analysis. Standard statistical parmeters (arithmetic mean, SD and minimum and

maximum results) were calculated for each experimental agility test.

Kolmogorov-Smirnov test was used for examining distribution, while variance homogeneity was tested by Levene's test.

Ethical Approval

The study included adults only in accordance with the applicable domestic legislation and institutional policies, and it followed the principles of the Declaration of Helsinki and the ethical code of conduct in human research of Džemal Bijedić University of Mostar.

RESULTS AND DISCUSSION

The results of the descriptive statistics of this study can be seen in Table 1. A review of the table shows that professional soccer players were, on average, older (24.59 ± 4.15 vs 22.00 ± 2.95), taller (185.04 ± 6.33 vs 182.44 ± 6.99) and that they had higher body weight (80.77 ± 6.92 vs 76.96 ± 8.64). If we look at the values of lower-limb explosive power, flight time CMJTIME ($.63 \pm .56$ s vs $.65 \pm .57$ s) and jump height CMJHIGH (40.95 ± 4.70 cm vs $39.70 \pm .415$ cm), we can see that professional soccer players had better results. The values of the ability to quickly change the direction of movement (CODP), which was examined by the T-test, also showed better results in professional soccer players, as did the linear speed SPRINT30 ($4.15 \pm .12$ s vs $4.33 \pm .15$ s) test. As for the variables defining lower-limb power, the average CMJTIME and CMJHIGH values were again slightly on the side of the professionals as compared to the amateurs (0.57 ± 0.03 s vs 0.56 ± 0.03 s) and (40.95 ± 4.70 cm vs $39, 70 \pm 4.15$ cm).

Table 1. Descriptive statistics of the sample

Variable	Professionals (HFC Zrinjski)					Amateurs (FK Velež)				
	n	Min	Max	Mean	SD	n	Min	Max	Mean	SD
Age (year)	22	18.00	31.00	24.59	4.15	25	17.00	31.00	22.00	2.95
High (cm)	22	172.00	195.00	185.04	6.33	25	168.00	198.00	182.44	6.99
Mass (kg)	22	65.00	92.00	80.77	6.92	25	63.40	91.90	76.96	8.64
SPRINT30 (s)	22	3.95	4.41	4.15	.12	25	3.94	4.62	4.33	.15
TT (s)	22	8.85	10.05	9.43	.33	25	9.41	11.00	10.07	.43
CMJTIME (s)	22	.52	.65	.57	.03	25	.50	.63	.56	.03
CMJHIGH (cm)	22	33.10	52.00	40.95	4.70	25	31.10	49.00	39.70	4.15

The T test for independent samples (Table 2) determined the differences in arithmetic means between professional and amateur soccer players in Bosnia and Herzegovina in the treated variables. Based on the T test, we can see that these two groups of soccer players differ statistically

significantly by age at the level of .95% ($p \leq 0.05$) (sig. 0.017) and in the variables defining linear speed SPRINT30 and TT agility at the level of .99 % ($p \leq 0.01$) (sig.0,000). In the variables defining lower-limb power, the groups do not statistically differ in jump height and flight time.

Table 2. Independent Sample 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
Age (year)	Equal variances assumed	4.088	.049	2.483	45	.017	2.59091	1.04342	.48935	4.69246
	Equal variances not assumed			2.430	37.375	.020	2.59091	1.06602	.43167	4.75014
High (cm)	Equal variances assumed	.031	.861	1.331	45	.190	2.60545	1.95716	-1.33647	6.54738
	Equal variances not assumed			1.340	44.955	.187	2.60545	1.94461	-1.31130	6.52221
AMAS (kg)	Equal variances assumed	2.340	.133	1.650	45	.106	3.80473	2.30635	-.84050	8.44996
	Equal variances not assumed			1.673	44.629	.101	3.80473	2.27360	-.77559	8.38504
SPRINT30 (s)	Equal variances assumed	.821	.370	-4.418	45	.000	-.18067	.04090	-.26304	-.09830
	Equal variances not assumed			-4.477	44.735	.000	-.18067	.04035	-.26196	-.09939
TT (s)	Equal variances assumed	1.195	.280	-5.555	45	.000	-.63045	.11350	-.85906	-.40185
	Equal variances not assumed			-5.649	44.239	.000	-.63045	.11161	-.85535	-.40556
CMJTF (s)	Equal variances assumed	.272	.605	.786	45	.436	.00725	.00922	-.01133	.02583
	Equal variances not assumed			.781	42.827	.439	.00725	.00928	-.01147	.02597
CMJH (cm)	Equal variances assumed	.373	.545	.971	45	.337	1.25509	1.29264	-1.34843	3.85861
	Equal variances not assumed			.963	42.275	.341	1.25509	1.30317	-1.37431	3.88449

CONCLUSION

The aim of this study was to determine the differences in linear running speed (SPRINT30), agility (TT), and the lower-limb explosive power in vertical jump (CMJ) between adult professional and amateur soccer players in Bosnia and Herzegovina. We assumed that there was statistically significant difference at the level of physical performance taken between the two groups of soccer players, who represent the two largest ranks of competition in Bosnia and Herzegovina. Based on the analysis of the results obtained, we can conclude that professional and amateur soccer players in Bosnia and Herzegovina differ statistically significantly by age, linear speed ability and agility, and that there are no statistically significant differences in lower-limb

explosive power in vertical jump. These the two teams represent in the best way the first and the second level of competition in BiH. We may conclude that professional teams rely more on more experienced players, while the teams at the second level of competition rely more on young players who are eager to prove themselves. We also concluded that in training selection and technology they pay more attention to the speed of movement-sprint and the agility than do amateur soccer players or the second competition level players. In the ability to jump vertically, soccer players do not differ statistically, so, based on these results, we can say that training technology, selection and programs in this domain are the same at both competition levels.

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AUTHORS INFORMATION

Enes Šunje
Kinesiology Doctoral Degree Program at Džemal Bijedić University of Mostar
sunje.enes@gmail.com

Ekrem Čolakhodžić
Faculty of Education at the Džemal Bijedić University of Mostar

Rijad Novaković
Faculty of Education at the Džemal Bijedić University of Mostar

Stjepan Skoko
Kinesiology Doctoral Degree Program at Džemal Bijedić University of Mostar

COMPARISON OF WINNING POINTS AND PENALTIES BETWEEN DIFFERENT WEIGHT CATEGORIES FOR FEMALE CADETS IN JUDO

Husnija Kajmović and Fikret Bečić

ABSTRACT: The aim of this research is the comparison of winning points (Ippon and Waza-ari) and penalties (Shido), which were the reason for the victory in judo fight between different weight categories for female cadets. The sample consisted of 1459 winning points and 163 penalties between eight different weight categories for female cadets in judo. Variables for this research are winning points Ippon and Waza-ari and penalty Shido. The data were collected from official competition reports for each weight category from European, World and EYOF competitions from 2017 - 2019 year. The results from Pearson's Chi-square test showed the existence of statistically significant differences ($p \leq .05$) between weight categories for female cadets. The variable that contributes most to this difference is the Waza-ari point in the + 70kg weight category. The results of this research can contribute to the improvement of cadets training practice and new ways of researching this issue at different age categories of both genders.

Key words: *women, combat sport, performance analysis, victory*

INTRODUCTION

Ways to win in judo are defined by awarding certain points such as Ippon and Waza-ari (IJF Rules, Article 14 and 15, 2017 and 2020) as a result of a successful throw and successfully performed techniques on the floor: arm lock, chokes and immobilization. (IJF Rules, Article 7, 2017 and 2020). Also, victory can be achieved by winning light (Shido) and heavy (Hansoku make) penalties as a consequence of negatively performed fight (IJF Rules, Article 18, 2017 and 2020). Angus (2006) emphasizes the existence of several intentions of judo rules, such as: protecting competitors from being injured, providing competitors with fair opportunities to achieve Ippon, making judo a dynamic and friendly sport for viewers, and ensuring new and innovative ways for judo to evolve and grow. The points in judo represent the level of competitors excellence to perform a throwing technique and grappling technique, which are evaluated by judges and based on criteria for excellence defined by the rules of judo and International Judo Federation (IJF Rules, 2017; IJF Rules, 2020).

Ippon in judo is said to be derived from feudal times when warriors needed the spirit to end a fight to ensure their survival and similarly, a judoka scoring Ippon finishes his or her opponent of decisively (Takahashi et al., 2005). The other way to win a tournament match is by causing the opponent to accumulate penalties, which can be very effective strategy (Nishioka, 2010). The penalties in judo represent sanctions against those competitors who obstruct the fight and thus the intensity of the fight is not at high level, which has its repercussions in the dissatisfaction of the audience. Therefore, judges have the authority to give certain penalties for fouls during the fight, which criteria are also defined by the rules of judo.

Takahashi et al. (2005.) indicates that violation of rules results in giving the penalties, because of negative performed judo fight and actions which are contrary to the spirit of judo. In judo, analysis of performance can be done in three main areas, which are: technical, tactical and time-motion analysis,

where Ippon and Waza-ari can be classified in technical, and Shido penalties into tactical variables (Challis, Mataruna-Dos-Santon, 2018). Cadets competitions are closely fitted in Long-term athlete development (LTAD), in which cadet's age fits the phase Training to Train (Balyi, Way, & Higgs, 2013), and at this age, Judo-Specific Objectives are: consolidate and refine tokui-waza (4-8 techniques tailored to the individual), consolidation/development of under-developed skill sets (gripping, tactics, mat position, transition from tachi-waza to ne-waza), high volume of training, including strength training and endurance, development/refinement of all psychological factors leading to Ideal Performance State, introduce, develop and refine at least 4 new techniques per year- one each for offence and defense in tachi-waza and ne-waza (Judo Canada, 2020). Miarka et al. (2014) established that the female competitors differentiate in gripping time before performing a throw and that it lasts 73 seconds for senior female competitors, 38 seconds for female juniors, 45 seconds for juveniles and 41 second for pre-juveniles. Kajmovic, et al. (2017) compared the performance of Top-level female competitors from different levels of competition, which indicated that cadets differ in the attack efficiency index (AEI) of judo techniques from the competition, where the most effective technique is Kesa Gatame, Ouchi Gari and Sumi otoshi, and where they show different tendencies in the use of judo techniques compared to junior, U23 and senior competitors. The aim of this research is the comparison of winning points (Ippon and Waza-ari) and penalties (Shido) between different weight categories of female cadets in judo.

METHODS

Subjects

The sample of subjects consists of 1622 winning points and penalties, of which 1081 Ippon points, 378 Waza-ari points and 163 Shido penalties in different weight categories: -40kg (62 Ippon points; 34 Waza-ari points; 18 Shido penalties), -44kg (106 Ippon points; 40 Waza-ari points, 13 Shido penalties), -48kg (157 Ippon points; 54 Waza-ari

points; 17 Shido penalties), -52kg (153 Ippon points; 65 Waza-ari points; 31 Shido penalties), -57kg (156 Ippon points; 63 Waza-ari points; 23 Shido penalties), -63kg (178 Ippon points; 60 Waza-ari points; 22 Shido penalties), -70kg (139 Ippon points; 41 Waza-ari points; 17 Shido penalties) and +70kg (130 Ippon points; 21 Waza-ari points; 22 Shido penalties).

Variables

Variables for this research are: a) Winning point Ippon (whole point), and the judge criteria are: speed, strength, throwing rival on the back, mastering move until the end, arm lock, choking, holding for 20 seconds; two Waza-ari points make one Ippon; b) Winning point Waza-ari (half point), and the judge criteria are: lack in one of four elements needed to win Ippon, holding 10 to 19 seconds, rolling rival on the back without interruption and rolling rival on the back with interruption and c) Penalties (Shido) which was the deciding factor in the fight.

DATA COLLECTION

The data were collected from European Youth Olympic Festival (Gyor, 2017 and Baku, 2019), European Cadets Championships (Kaunas, 2017; Sarajevo, 2018 and Warsaw, 2019) and World Cadets Championships (Santiago de Chile, 2017 and Almaty, 2019) based on official reports from www.ippon.org.

Statistical analysis

Table 1. Comparison of winning points and penalties between different weight categories for female cadets in judo

CATEGORY		WINNING POINTS & PENALTY			TOTAL
		Ippon	Waza-ari	Shido	
-40kg	Count	62	34	18	114
	% within Category	54.4 %	29.8%	15.8 %	100.0%
	% within Points & Penalty	5.7%	9.0%	11.0 %	7.0%
	Std. Residual	-1.6	1.5	1.9	
-44kg	Count	106	39	14	159
	% within Category	66.7 %	24.5%	8.8%	100.0%
	% within Points & Penalty	9.8%	10.3%	8.5%	9.8%
	Std. Residual	.0	.3	-.5	
-48kg	Count	157	54	17	228
	% within Category	68.9%	23.7%	7.5%	100.0%
	% within Points & Penalty	14.5%	14.3%	10.4%	14.1%
	Std. Residual	.4	.1	-1.3	
	Count	153	65	31	249

Pearson's Chi-square test at the significance level of $p \leq 0.05$ was used to determine the differences between the frequencies expressed in the winning points and the

penalties. For analyzing the strength of the association, Cramer's V was implemented. To determine the significance of differences between cells in different weight categories, standard residuals (Std. Residual) were calculated. Data were processed using SPSS 22.0 Premium IBM Corporation, USA).

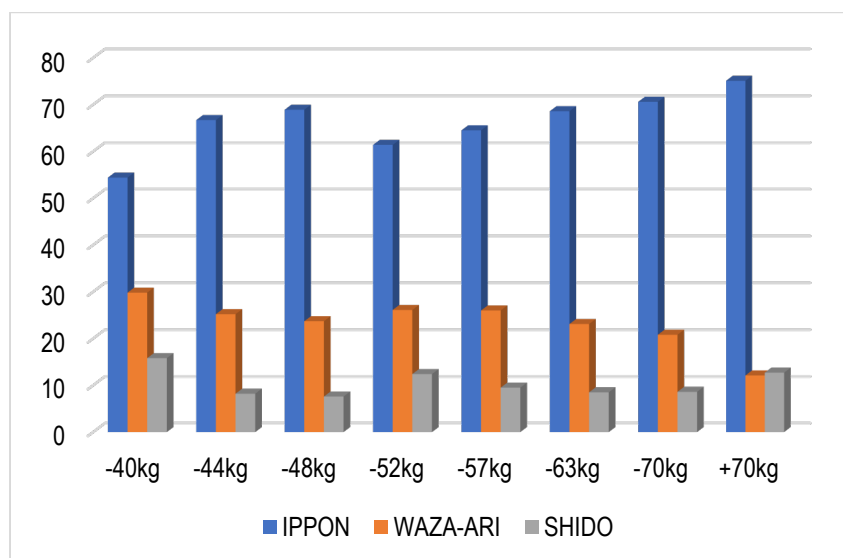
RESULTS

Table 1 and Figure 1 shows the percentages of winning points and penalties in judo between different weight categories for female cadets in judo. The results showed statistically significant differences (Pearson's Chi-square: 29.2; p-value: .010; Cramer's V = .095; Sig=.010) in winning points and penalties in judo between different weight categories for female cadets. By analyzing individual cells in different weight categories, the biggest contributor to this difference is the cell Waza-ari in the weight category +70kg, whose amount of standardized residual is

-3.0. There was a decrease in wins by a point Waza-ari to the lowest level in comparison with other categories, and at the same time the highest number of wins by Ippon points.

-52kg	% within Category	61.4%	26.1%	12.4%	100.0%
	% within Points & Penalty	14.2%	17.2%	18.9%	15.4%
	Std. Residual	-1.0	.9	1.2	
-57kg	Count	156	63	23	242
	% within Category	64.5%	26.0%	9.5%	100.0%
	% within Points & Penalty	14.4%	16.7%	14.0%	14.9%
	Std. Residual	-.4	.9	-.3	
-63kg	Count	178	60	22	260
	% within Category	68.5%	23.1%	8.5%	100.0%
	% within Points & Penalty	16.5%	15.9%	13.4%	16.0%
	Std. Residual	.4	-.1	-.8	
-70kg	Count	139	41	17	197
	% within Category	70.6%	20.8%	8.6%	100.0%
	% within Points & Penalty	12.9%	10.9%	10.4%	12.1%
	Std. Residual	.7	-.7	-.7	
+70kg	Count	130	21	22	173
	% within Category	75.1%	12.1%	12.7%	100.0%
	% within Points & Penalty	12.0%	5.6%	13.4%	10.7%
	Std. Residual	1.4	-3.0	1.1	
Total	Count	1081	377	164	1622
	% of Total	66.6%	23.2%	10.1%	100.0%

Figure 1. Percentages of winning points and penalties in judo between different weight categories for female cadets



DISCUSSION

By comparing the winning points and penalties between different weight categories for female cadets from different levels of competition (World, European and EYOF), there were indications that there were differences between categories in the achieved winning points and penalties. By analyzing the winning

points and penalties, some interesting information came up: The total percentage value of the winning points in all weight categories is 89.9%, while the total contribution of the Shido penalty to the rival's victory is 10.1%. By analyzing individual points and penalties, the results showed that the total percentage value in all weight categories for female cadets for the point

Ippon is 66.6%, for the point Waza-ari is 23.3% and for the Shido penalty is 10.1%.

These ratios are understandable because, according to the rules of judo, Ippon can be achieved in more ways than Waza-ari and penalty Shido, and they are: throwing, holding on the floor for 20 seconds, arm lock, choke; two Waza-ari make one Ippon, while for Waza-ari, there are fewer options: throwing on the back without moves required for the Ippon, holding the rival for 10 to 19 seconds. Similar results were obtained by Handler, et al (2017) by investigating the technical-tactical preparation of Austrian judoka at the Austrian national championships and reporting that female competitors in the gold medal competition achieved 90.9% points and 9.1% penalties, and in third place fights achieved 96.2% points and 3.8% penalties. Since the Ippon point is the most dominant winning point for female cadets in all weight categories.

Sacripanti (2015) points out that Ippon is the final goal of judo athletes and coaches and Ippon is the part of judo that best approximates the ideal of aesthetic beauty of Dr. Jigoro Kano where timing, speed, strength, power, coordination and control are the basic ingredients of this aesthetic expression, which fascinates every viewer - world's experts or inexperienced. Also, Carratalá, et al. (2010) analyzed the effective ways of struggles applied by teenage female judoka during the Spanish Judo Cadets Championship divided into seven weight categories, but under different rules of judo fighting. Old judo rules until 2009 year, gave competitors more opportunities in assessing the quality of performance of a particular throwing technique (Ippon, Waza-ari, Yuko and Koka), as well as the possibility that, if were tactically and physically at a high level, victory could be achieved with the help of penalties (Shido, Chui, Kei-koka and Hansoku-make).

The results showed that in -44kg category combat efficiency level is reflected on the 38.8% victories achieved through yuko, 34.7% by ippon, 18.4% by koka, 8.2% by waza-ari and 14,3% penalties; in -48kg category combat efficiency level is reflected on the 29.8% victories achieved through koka, 28% yuko, 26.3%, waza-ari 34.7%, ippon 15.7% and 33,3% penalties; in -52kg category combat efficiency level is reflected on the 35.8% victories achieved through yuko, 26.9% ippon, 20.9% koka, 16.4% waza-ari and 16,4% penalties; in -57kg category combat efficiency level is reflected on the 37.7% victories achieved through ippon, yuko 30.2%, koka 17%, and waza-ari 15.1% and 15,0% penalties; in -63kg category combat efficiency level is reflected on the 31.5% victories achieved through koka, 30.1% by yuko, 20.5% by waza-ari and 17.8% by ippon and 20,2% penalties; in -70kg category combat efficiency level is reflected on the 30.8% of victories achieved through ippon, 25% by yuko, 23.1% by koka and 21.1% by waza-ari and 23,1% penalties and in +70kg category combat efficiency level is reflected on the attainment of 31.1% victories through ippon, 21.3% yuko, waza-ari 21.3% and koka 16.4% and 28,0% penalties.

The reason for this dispersion of winning points is that, in addition to points Ippon and Waza-ari, there were Yuko and Koka points, but also Shido, Chui, Kei-koka and Hansoku-make penalties had different ways influencing the victory in the fight. Today's way of winning with 10% penalties can be attributed to the changes in the rules, which have changed several times in the last ten years by the International Judo Federation (IJF). In order to promote judo as an attractive sport for spectators, media and sponsors, the IJF has changed the rules of judo several times. Since 2010 year, Koka (3 points), the lowest score, was removed from the competition (Adam, Smuraj, & Tyszkowski, 2011), and after Olympic Games in Rio 2016 year, Yuko (5 points), was removed from the competition (Calmet, et al., 2017).

Some of the specifics are that the number of Ippon points, as a way to direct victory of the -40kg category is the smallest, but in the -44kg, -48kg categories is growing, in -52kg category comes to minor falls and rises again from the -57kg, -63kg, -70kg categories.

The highest number of Ippon points is in the +70kg category, while at the same time the number of Waza-ari points is the smallest in the +70kg category and the largest in the -40kg category. This indicates that female competitors from heavier weight categories win easier with Ippon point, while in the lower weight categories it is much more demanding given their morphological characteristics and motor skills. Regarding penalties, the weight category of -52kg female cadets stands out for a greater number of penalties, which contributed to the victory of the more active female athlete during the match, while the smallest number of wins with penalties is in the categories of -44kg, -48kg and -40kg, which indicates the dynamism of fighting in the lower weight categories. Takahashi et al. (2005) suggests that due to the intensity of the fight and the audience, the goal of Ippon judo is to achieve Ippon, and the judo rules make it possible to achieve Ippon in many ways, which from a strategic point of view allows competitors to, if they achieve Ippon score, have the opportunity to economize their energy consumption during the competition and turn such a situation to their advantage in difficult matches. Judoka seeking to score Ippon are typically offensive and possess a dynamical fighting style that is a pleasure to watch (Takahashi et al., 2005). By winning matches with Ippon points, the contestants gain confidence and focus for further matches in which their performance is raised to the maximum. What is obvious from the results is that the cadets behave differently depending on the weight category, and that their competitive experience contributes to this, since the cadets are aged between 15 and 18 years. A possible reason for these various indicators can be attributed to their different morphological characteristics, motor skills and current technical and tactical performance.

CONCLUSION

In order to get a clearer picture of the structure of winning points and penalties for female cadets in different weight categories, the scientific judo

community should determine exactly which throwing and grappling techniques are involved in winning by Ippon and Waza-ari points, as well as which individual contestants' negative actions affect the loss of fight due to the penalties awarded by the judges for each category. By doing so, the feedback could be incorporated into the training process. Finally, cadets of varying quality (regional, national and international) need to develop a desire to win as many fights as possible with maximum - Ippon point and thus respect the first judo principle of "maximum efficiency with minimum energy input" in training and competition, and not underestimate the value of Waza-ari point and winning with the help of penalties.

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AUTHORS INFORMATION

Dr. Sci. Husnija Kajmović, full professor
Faculty of Sport and Physical Education, University of Sarajevo, Sarajevo, Bosnia and Herzegovina
e-mail: hkajmovic@gmail.com

Fikret Bečić
IJF Academy Foundation,
International Judo Federation
Bihać, Bosnia and Herzegovina
e-mail: fico_una@yahoo.com

PSYCHOMOTOR DEVELOPMENT OF CHILDREN AND DEVELOPMENTAL STIMULATION

Kenela Zuko and Adnana Muratspahić

ABSTRACT: Family is the primary community and environment that provides unconditional love and attention to the child. Parenting is an extremely serious and responsible mission that promises many different and unpredictable situations where it is necessary to know how to react correctly. To justify the mission of parenthood, it is necessary to be educated in that sphere of life. For persons who have not encountered this topic through schooling and practice, there are numerous useful programs for collecting basic information related to this topic (education, seminars, lectures, workshops...). The most important thing is to be involved and be aware of your task, but also to be aware of the responsibilities that this task entails. Child development is one of the most important segments of parenting. The word development is extremely extensive and an important term that has multiple areas. We will be mostly based on psychomotor development. The psychomotor development of a child implies proper coordination of the brain and body (body parts). The most important period for the development of psychomotor skills in the early period of childhood a period that begins at birth and is reflected throughout life. It is the task of the parents related to monitoring and emphasizing the child's movements and his proper development. If parents notice certain deviations, irregularities, or stagnation in the progress of their child, it is necessary to ask for help from professionals. After some time, it is also necessary to involve other institutions which will certainly contribute to the development of the child.

Keywords: *family, child, psychomotor development, parents, educational institutions*

INTRODUCCION

The family is the initial and most important segment in child development. It can be bigger or smaller, depending on how many members there are, but its main actors are parents. They are the leaders and managers of an institution. We know that the early period of life is the most precious time to encourage the development of cognitive, but also all other abilities of the child, which obliges us to act in a timely manner. A competent parent who understands his role responsibly from the very beginning can stimulate his child's development in the right way. This means the following: educating oneself, following the child, encouraging his development (through games, tasks, responsibilities), noticing certain changes (irregularities), and reacting in time. This largely reflects the stimulation of development. Also, over time, the child reaches a stage when it is necessary to involve other institutions in his development process, which further contributes to his development. In all this, the most important thing is to establish balance and harmony and try to create stable, supportive interactions with the appropriate number of adults, professionals, and peers, but also various stimuli of all the senses through their own activity.

PARENTING

The family is the basic cell of human society, created as a social need and a necessary condition for survival and development, and over time it has transformed into the personal choice of each individual. The term society lets us know that it is a community and the family community is usually made up of parents and children. Maleš and Kušević (2011) believe that living together is primarily a consequence of the emotions of love and attachment to a partner and the desire to share everyday life with him. Equally, parenting is increasingly a matter of individuals' personal choices, with individual needs and goals more important than environmental expectations (according to Sinan,

2020). In addition to its wider social significance, its activities represent an extremely important stage in children's development. The main employees of this social community are parents. Their basic task is presented through the establishment and execution of basic family principles, but also the expansion of their own community. However, the most responsible and demanding task is reflected in the upbringing of children. "Throughout history, the family has been and remains an unavoidable educational factor, a new man is born in it, the process of education, its psychophysical development and shaping begin" (Musić, Musić, 2018). A stable family and a healthy family climate are necessary for the proper growth and development of children. Most realistically described as a pillar and support for every child, the family also represents the environment in which he spends most of his childhood, that is, the fundamental part of development. In addition to the basic, existential conditions, parents should provide their child with a sufficient dose of love, attention, empathy, security, support, help and provide an opportunity for a beautiful and productive future. Ogris (2016) states that the role of parents is to provide support to the child so that he grows into a responsible member of society, develops a sense of empathy and sensitivity to the needs of others. A nicely built relationship with children in early childhood contributes to the achievement of parental goals. Čudina-Obradović and Obradović (2006) point out that parenting refers to a series of processes that consist of tasks, roles, rules, communications, and interpersonal relationships that adults have in contact with their children (according to Bešić, 2020). What we want to emphasize is that the basic role and task of parents is reflected in the proper upbringing of children and their preparation for adulthood, or by creating a responsible member of society.

CHILD DEVELOPMENT

Looking at global development represents the growth and maturation of a particular species, organ, system, individual. To achieve proper development, each area that is in the process needs to meet certain conditions and requirements. Child development is certainly one of the most demanding processes. The very fact that there is physical, intellectual, moral, emotional, social, cognitive, aesthetic development gives us a clear enough picture of its severity, and that parenting is one of the most difficult tasks speaks to the fact that the parent is considered the most responsible person for this process. Man is a living being who learns throughout life but lays the most important foundations in early childhood. Musić and Musić (2018) states that one of the basic requirements of proper psychophysical development is education in early childhood. Childhood is accompanied by upbringing, and upbringing is presented as a support and encouragement to development, therefore, upbringing and development are one unique whole. The World Health Organization emphasizes that early physical, socio-emotional, and cognitive development is a critical factor in future health and overall well-being. The quality of the environment in which a child grows directly affects the shaping of the brain. Never later, during life, is the brain more sensitive to stimuli from the environment that shape the fundamental patterns of social, emotional, and cognitive functioning, as in the first years of life (according to Ćosić, Jaška, et al., 2019). All these facts confirm the importance of early childhood education and testify to how desirable it is to grow up in a productive and healthy environment. Different types of development are just meaningful and connected parts, none of which we can single out as irrelevant or less important, just as different factors of education itself are meaningful and connected. In addition to parents, the environment in which the child spends a certain period (extended family, society, various institutions) also plays a major role in the development of children. Schaffer (2000) states: "The diversity of family structures does not mean that all family structures meet the needs of the child with equal quality. However, some research shows that psychologically healthy people can develop into more social groups. Likewise, research shows that compliance with a specific norm is not crucial for a child's well-being" (according to Ogris, 2016). It is innate for a child to strive for something new and different and to contribute to his development through new experiences. In addition, there is a growing need to involve various institutions in the upbringing and development of children, because over time the structure, role but also the way of life changes, which brings with it many consequences (among them problems in psycho-physical development). Ogris (2016) points out that the increasing involvement of institutions in the educational process also affects changes in parents' attitudes towards education and the quality of education itself.

Psychomotor development of children

The psychomotor development of children represents only one area in their complex development. It means the driving force in humans and the culmination of psychomotor development occurs in early childhood. This development implies mobility and proper use of the whole body. Motor abilities and the brain represent one unique and inseparable whole. Krmpotić (2015) defines the development of motor skills in a child as his increasing ability to use his own body and handle objects. Our activity is a mirror of the development of our motor skills and our body is a means for activities that are a product of our brain. One without the other simply cannot function. Psychomotor development has its course. The child uses the whole body primarily during movement and action, then larger parts (limbs) and then the smallest parts of the body (fingers). "The development of motor skills is monitored through its phases which are visible in the improvement of posture (postural control), movement (locomotion) and handling of objects (manipulation)" (Peternel, 2015). Every movement in the earliest period can tell us a lot. The way he uses his body and body parts is one big indicator. Deviations from proper development can be noticed very early and therefore it is very important to constantly monitor children's development and react in time. Observing certain deficiencies and irregularities in psychomotor development in early childhood and responding adequately (activating experts) can be of great help and importance. "Due to the unpredictability of psychomotor development of a child with neurodevelopmental risk, early diagnosis of neurodevelopmental disorders, interdisciplinary monitoring, and early habilitation are important" (Peternel, 2015). Development goes its course, in every child about the same and there should be no big deviations if everything is fine. "Monitoring growth and development can detect different deviations in time. Variations in growth and development are possible because each child is an individual, but also monitoring can detect larger deviations that could affect the further development of the child" (Benčić, 2016).

KNOWLEDGE OF CHILD DEVELOPMENT

Each parent, treating their role, gradually becomes aware that there are different stages of parenting that are marked by many ups and downs and that ultimately result - a well or less well-behaved child. There are different types of parents. Responsible, resourceful, interested, patient, familiar with the stages of child development, and ready to face all challenges. These are parents who are fully prepared to justify the role of a true parent. They are accommodating, wide-eyed, know their goal well and it is very easy to work with them. On the other hand, there are those with opposite characteristics (disinterested, careless, carefree, with limited views ...), which represent a problem for the child and the environment. Parents are the people who spend the most time with their child and to get to know him fully, they must be involved in the whole process of his development. It is very important to be able to notice and recognize if something is wrong and seek

adequate help. Sometimes children need help and sometimes parents themselves. Several ways can be of great help. Among other things, various workshops, lectures, educations, etc. can be of great help to parents, and when it comes to children, the parent should try to stimulate his development in many ways and, if necessary, including professional associates in preschool and school period (speech therapist, psychologist, special educator, pedagogue, etc.). Only an educated and competent parent can properly monitor their child's development. We must understand education as a form of helping parents who want to achieve 'good parenting' and stimulate children's development. Parents often make mistakes when not knowing their role, they reflect their mistakes on their children, so it often happens that they rely too much on other institutions or blame children and society as a whole, but also resort to various forms of punishment and neglect of children. Yet some of such parents feel the need to seek help and are willing to participate in various programs to encourage successful parenting. Programs can be important to all parents, however, it would be most desirable to include those parents who need help the most (parents with lower education, lower economic status, single parents, unemployed, overworked, etc.). It is very difficult to activate such parents, so the programs must be well organized, widespread, and attractive in terms of content (Bešić, 2020). It is very important to try to be a conscious and conscientious parent and not allow resentment and pride to be greater than taking adequate steps to seek professional help and support.

The importance of inclusion of other institutions

The primary community in every child's life is the family. As we have stated, the child in the family acquires the first steps and learns the first life lessons. Therefore, it is the first and most important community in his life, but not the only one. Over time, the child feels the need to expand that community and it is in the child's nature to want something new and something more. The desire for new experiences, knowledge, challenges is growing. Therefore, it is necessary to gradually include the wider community, peers, but also various institutions in his life to complete his development. Among other things, it is about kindergartens, playrooms, various schools, etc. By attending these institutions, the child develops his intellectual, physical, social, and other values. What is important to emphasize is that by including the child in a new sphere of life challenges, parents do not lose their status, their role, and their task, on the contrary, they become part of these institutions. For the child to accept the new and different, to be accepted, to achieve optimal development and expected results, parents should be in constant contact (communication, interaction) with these institutions to have full insight into the child's progress and development, exchange information. Rosić (2005) states that as a child grows up, he expands his educational environment and the parental home is not

a closed educational environment but operates in a social environment (according to Bešić, 2020). In this case, the most important task for parents is to include the child in institutions that will contribute to his development, paying attention to creating good relationships with people involved in the process. In addition, it is necessary to pay attention to the child's interests, abilities, and burden on the child, and the most important thing is to know how to strike a balance.

CONCLUSION

The main actors in child development at an early age are parents. These are the people who are most attached to their child and with proper work and upbringing can contribute the most to his development. The most important task is to be a good parent. If we were to describe a good parent, we would say that it is a person who provides his child (in addition to basic existential needs) with unconditional love and attention, security, which imposes moral and aesthetic values, a person who is fully involved in the child's development (from birth) and which encourages the same. This is the person who, even if he does not know, wants and tries to learn to justify the role of a good parent, all for the benefit of his child. Simply, to stimulate the psychomotor development of a child, we must have a good knowledge of the course and process of child development, the child and his possibilities, as well as the ways of adequate action. Psychomotor development is an extremely sensitive area of development in a child and therefore it is important to pay special attention, especially in the earliest period (up to the third year of life). This period needs to be marked by various stimuli, experiences and forms of play because these are the basic elements that contribute to psychomotor development. The involvement of other persons and institutions also makes a great contribution. The first years of life are indeed a period of immense vulnerability, but also enormous possibilities. The child needs a person who will guide, teach, stimulate and help him to do it himself, to eventually become a person who will manage his body and brain without any problems and in the right way, and nurture his acquired and built psychomotor functions.

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AUTHORS INFORMATION

Kenela Zuko
Nastavnički fakultet Univerziteta „Džemal Bijedić“
e-mail: zuko.k7@gmail.com

Adnana Muratspahić
e-mail: adnana0812@gmail.com

THE CANONICAL CONNECTION OF MOTOR SKILLS AND PERFORMANCE OF TECHNICAL ELEMENTS OF GOAL SHOOTING IN WATER POLO

Nermin Nurković, Dženana Imamović – Turković, Edin Mirvić

ABSTRACT: The main goal of this research is to determine and explain the connection between motor skills and the performance of technical elements of goal shooting in a water polo game. The sample includes 80 water polo players from Water Polo Clubs Sarajevo City Club, Varepolo Club Torpedo, Water Polo Club Akademija, and Water Polo Club Dabar. The testing included a sample of 80 water polo players, registered in Bosnian-Herzegovinian clubs. The determination of the level of basic motor abilities was performed using measuring instruments. Movement structuring mechanism: Air maneuverability (MOKZ), Hand taping (MTAP), Foot taping (MTAN), The synergistic-tone and tone control mechanism: Deep bench press (MDPK), Leaning with reach in sitting (MSJED), Transverse standing on the beam (MGRED), Excitation intensity control mechanism: Running at 20m - flying start (M20M), Triple jump from the place (MTRS), Long jump from the place (MDALJ), Excitation duration control mechanism: Hinge height (MVZG), Hull lift in 30 seconds (MDT30), Push-ups (MSKL). The sample of variables for assessing the performance of technical elements of shooting on goal in a water polo game - Shot accuracy test: Shooting from the left wing from a static position from six (6) meters - STLK, Shooting from the center from a static position from six (6) meters - STC and Shooting from the right-wing from a static position from six (6) meters - STDK. The canonical correlation analysis obtained a significant and homogeneous structure of the connection between the set of motor abilities and the set of performing the technical elements of shooting on goal in a water polo game. It has been shown that there is no high ability of precision when shooting and that more attention should be paid to the training process of precision in water polo players who are aged 12 to 14 years.

Keywords: *water polo, canonical correlation analysis of motor skills, and goal shooting*

INTRODUCTION

Water polo is a game that originated in the second half of the 19th century and was invented by the English who gave it the name water football. The first rules were made in 1870. Until then, it was played without any rules and was very rough. The ball was made of Indian rubber and the space was not limited. It was not until 1876 that the dimensions of the 50-yard court were prescribed and the number of players was limited to 7 per team, one head, and two-line referees. Instead of goals, rafts were used, and the task of the players was to place the ball on the raft of the opposing team if they wanted to score a goal. The water was not clean, and the ball would become heavier and heavier because it would absorb water. It was not forbidden to immerse the ball in the water, and players might hide the ball in large bathing suits and sometimes dive with it to the opponent's goal (Mirvić & Nurković, 2018). Water, as a medium in which kinesiological activity takes place, as well as most of the training process in water polo, represents a certain specificity concerning other sports (Hraste and Granić 2007). Water polo, as a poly structural and complex sport, requires a high level of many motor skills, among which are fundamental strength, speed, and endurance (Garbolewski et al., 2002). The influence and importance of coordination in water polo is still a rather unexplored space, but it is quite clear that it is important for the best possible performance of all technical and tactical elements of the water polo game. (Modrić, Veršić and Popović, 2011). The research tried to see the connection between motor skills and the performance of technical elements of shooting on goal in a water polo game. A person's motor abilities participate in solving motor tasks and condition a successful movement, regardless of whether they were acquired through training or not. Motor abilities include strength, speed, endurance,

coordination, flexibility, balance, and precision (Malacko, Radjo, 2004). The game uses different movement techniques, with and without the ball (Trumbić, 2010). In the last ten years, there have been some changes in the rules of the game, such as the duration of the time attack from 35 to 30 seconds, and the shortened attack time with the player, from 25 to 20 seconds, which requires faster swimming with and without the ball. The influence of the training process on the development of some basic motor skills in young water polo players was examined (Šimenc et al. 1990). In their study, the authors Dopsaj et al. (2007) dealt with the assessment of the adoption of different modalities of swimming crawl technique in water polo players, as a function of age and competitive level. The main goal of this research is to determine and explain the connection between motor skills and the performance of technical elements of goal shooting in a water polo game.

RESEARCH METHODS

Definition of the sample of respondents

The sample of respondents includes 80 water polo players from Water Polo Clubs Sarajevo City Club, Varepolo Club Torpedo, Water Polo Club Academy, and Water Polo Club Dabar. All respondents are active members of water polo clubs and are therefore subject to regular medical examinations. The test included a sample of 80 water polo players, registered in Bosnian-Herzegovinian clubs.

A sample of variables for assessing motor skills

Determination of the level of basic - motor abilities was performed using measuring instruments recommended by Kurelić et al. (1975) and Eurofit battery tests. Movement structuring mechanism: Air maneuverability (MOKZ), Hand taping (MTAP), Foot

taping (MTAN), Synergistic and tone regulation mechanism: Deep bench press (MDPK), Leaning with reach in sitting (MSJED), Transverse beam standing (MGRED), Excitation intensity control mechanism: Running at 20m flying start (M20M), Triple jump from a place (MTRS), Long jump from places (MDALJ), Excitation duration regulation mechanism: Hinge height (MVZG), Hull lifting in 30 seconds (MDT30), Push-ups (MSKL).

A sample of variables to assess the performance of the technical elements of goal-scoring in a water polo game

- The shot accuracy test

1. Shooting from the left wing from a static position from six (6) meters - STLK

2. Shooting from the center from a static position from six (6) meters - STC

3. Shooting from the right-wing from a static position from six (6) meters - STDK

(The test is performed from three different positions, ie two wings and one central. Each subject performs one shot from each position.)

- Shooting from the left wing from a static position from six (6) meters -STLK respondent comes to the left wing, a distance of 6 meters, and takes a basic position, and shoots at the goal with a basic shot in water polo. A goal is scored.

- Shooting from the center from a static position from six (6) meters - STC respondent comes to the center, a distance of 6 meters, and takes a basic position and shoots at the goal with a basic shot in water polo. A goal is scored.

-Shooting from the right-wing from a static position from six (6) meters - STDK The respondent comes to the right-wing, a distance of 6 meters, and takes a basic position, and shoots on goal with a basic shot in water polo. A goal is scored.

Research description

- Mentoring supervision from the Faculty of Sports and Physical Education,

- The assistance of experts in the field of sports and physical education (verified pedagogues) in the implementation of the project. All subjects under the same conditions were subjected to measurement and testing (the entire study was conducted in the morning, from 08 to 12 h, the temperature was 18 to 24 degrees Celsius, the place of testing was the Olympic swimming pool of the island (indoor 50-meter pool).

- characteristics, motor skills, and then goal shooting tests.

- Before the measurement and testing process, the respondents were explained in an acceptable way what awaits them in the period of research implementation and what is required of them in their work. The main motive for the work will be curiosity and understanding of testing as an opportunity to check one's knowledge and cognition about one's abilities.

- Measurement was performed in groups of 20 to 25 respondents, up to 80 respondents during the day,

- One surveyor and recorder worked at each measuring point,

- During the measurement, the subjects were in the prescribed testing equipment,

- The team of surveyors consisted of professors of sports and physical education, who are familiar with the research project, measurement lists, and how to fill them,

- Measurements were performed according to the following schedule:

- from 08 to 12 h, during four days of motor ability,

- from 08 to 12 h, during five days from 08 to 12 h, during five days of goal shooting tests,

- After data collection, measurement lists were completed, and data were processed in the appropriate program.

Data processing methods

To determine the connection between some motor skills, and to perform the technical elements of shooting on goal in a water polo game, basic canonical correlation analysis was applied using the statistical package SPSS 12 for windows.

RESULTS

Canonical correlation analysis was used to determine the relations of motor abilities, and to perform technical elements of shooting on goal in a water polo game, which is an extremely suitable mathematical-statistical procedure in cases when it is necessary to determine the connection between two sets of variables.

The results of the canonical analysis for this research are presented in Tables 1 to 3.

Canonical correlation analysis of motor abilities and success in performing technical elements of goal shooting in water polo

Table 1.

	Canonical R	Canonical R-sqr.	Chi-sqr.	df	p	Lambda Prime
0	,56	,32	56,90	36	,01	,45
1	,47	,22	29,95	22	,12	,66
2	,39	,15	11,85	10	,30	,85

Table 2.

	KF 1
MOKZ	-,16
MTAPR	,07
MTAPN	-,44
MDPK	,65
MSJED	,27
MGRED	-,05
M20M	-,29
MTRS	,75
MSDALJ	-,71
MVZG	-,25
MDT30	-,42
MSKL	,17

Table 3.

	KF 1
STLK	,51
STC	-,12
STDK	-,94

Canonical relations of motor abilities and derivation of technical elements of goal shooting.

Canonical correlation analysis (Table 1), isolated one significant and positive canonical function (Canonical R) which explains the general relationship between motor skills and success in performing technical elements of goal shooting, at the level of significance $p = .05$. The only isolated canonical function of these two sets of variables is quite high (Canonical R) = .56, which could explain (Canonical R-SGR.) = 32% of the common variability of the set of motor variables and the set of variables for goal shooting performance. The significance of the connections of the investigated spaces is (Chi-SGR.) = 56.9.

The canonical factor (Table 2), in the space of variables for assessing motor abilities, can be seen that the largest number of variables has significant correlations with the isolated canonical dimension. Correlated variables can be divided into three groups:

- A group with a relative connection of conative space, in which we have a high coefficient from .75 to .65, and negative from -.71 to -.42, which is expected because the motor space assumes the expected connection when shooting at goal.

- In the group with a moderately significant correlation, in which we have a correlation of .27 in the positive sense, and in the negative, there is from -.29 to -.16.

- Small correlation in other variables moving in the positive state, .07 and negative -.05.

Considering that the first canonical factor in the space of motor abilities is most often projected by representatives of speed and exposure. This factor can be called the general factor of speed and exposure.

The canonical factor in the space of performing the technical elements of shooting on goal in a water polo game (Table 3) is the best-defined variable shooting from the left wing from a static position from six (6) meters –

STLK with the coefficient, .51, then shooting from the right-wing from a static position from six (6) meters - STLK -, .12 and shooting from the center from a static position from six (6) meters - STC (-, .94). This factor can be called the precision factor of the right-hand shot. The connection of the first pair of significant canonical dimensions suggests the conclusion that motor skills have a negative impact on the performance of technical elements of goal shooting in water polo on the accuracy of hitting the target, except in the abdomen.

Dealing with the relations of the isolated canonical function and the variables of both spaces, depending on the height of the mutual correlation

(correlation with the canonical function), the following relations can be defined:

- The greatest connection exists between the variables of motor skills and the performance of technical elements of shooting on goal in a water polo game in the first group,

- “High connectivity group” (MTAON, MDPK, MTRS, MSDALJ, MDT30, MSTLK, MSTDK, and MSTC) from the right-wing shooting variable.

- Statistically, a slightly lower correlation exists between the variables of motor abilities classified in the second group “Group with significant correlation” (MOKZ, MSJED, M20M, MVZG, and MSKL).

DISCUSSION

It can be said that the canonical correlation analysis obtained a significant and homogeneous structure of the connection between the set of motor abilities and the set of performing the technical elements of shooting on goal in a water polo game. These connections are real and significant, with medium and small projections of correlation coefficients on the isolated canonical factor, both in the space of motor abilities and in the space of performing technical elements of goal shooting in water polo and performing technical elements of goal shooting in water polo. Mirvić and associates (2016) in a similar study aimed to determine and explain the connection of some motor skills with the situational-motor abilities of the water polo game in water polo players 13 to 15 years of age. In the area of motor skills, 12 tests were applied, which represent the basic motor skills of the water polo game. And in the space of situational-motor tests, 6 tests of the basic elements of the water polo technique were applied in the situational conditions of the game. Based on the set goal of the research and based on the obtained results, it can be concluded that there is a connection between the researched areas, ie. between motor skills and situational-motor skills in the water polo game. Popo et al. (2011) in their research determined the hierarchy of water polo players classified according to their position in the team that is juniors, but many participated in senior leagues.

The results of the research clearly show the differences between different positions (outer wings, centers, defense, and goalkeepers)

identified after testing 10 variables of specific motor abilities of water polo players. It would probably be a better indicator if more respondents were involved, so the lack of motor tests would also be shown and new tests could be recommended or existing ones retained. This may be the main goal for further research. This research will determine a battery of tests of motor abilities of water polo players aged 12 to 14. And in that way, it will determine the current state of motor skills of cadets, adjust to the new plan and program for improving the competitive form and raise water polo to a higher competitive level. Other tests of motor abilities should be done and checked, to have more efficient indicators in the interest of improving the work program in the diagnosis of motor abilities. Such statements can be supported primarily by reviewing

the results of canonical correlation analysis of sets of variables used, and then by knowing the complexity of the movement structure (complexity of motor structure with success in performing technical elements of goal shooting in water polo, which undoubtedly has an impact here),

by knowing the very complexity of performing variables from success in performing shooting in a water polo game, as well as how to perform variables of motor ability.

CONCLUSION

It can be concluded that the wing positions (from the right and the left-wing) are problematic for performing the technical element of shooting, from the central one. The reason is probably less training during the training process, so this may be an instruction to coaches to pay more attention to it in the future. The greatest correlation exists between the variables of motor skills and the performance of technical elements of goal shooting in the water polo game in the first group, "High connectivity group" (MTAON, MDPK, MTRS, MSDALJ, MDT30, MSTLK, MSTDK, and MSTC) from the right-wing variable. Statistically, a slightly lower correlation exists between the variables of motor abilities classified in the second group "Group with significant correlation" (MOKZ, MSJED, M20M, MVZG, and MSKL). It should be said that the canonical correlation analysis obtained a significant and homogeneous structure of the connection between the set of motor abilities and the set of performing the technical elements of shooting on goal in a water polo game. It has been shown that there is no high ability of precision when shooting, and that more attention should be paid in the training process to precision in water polo players aged 12 to 14 years.

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AUTHORS INFORMATION

Nermin Nurkovic
Patriots lige 41, 71000 Sarajevo, Bosnia and Herzegovina, e-mail:
nermin.nurkovic@fasto.unsa.ba

Dzenana Imamovic – Turkovic
Patriotske lige 41, 71000 Sarajevo, Bosnia and Herzegovina, e-mail:
dzenana.imamovic@fasto.unsa.ba

Edin Mirvic
Patriotske lige 41, 71000 Sarajevo, Bosnia and Herzegovina, e-mail: edinmirvic@gmail.com

THE CANONICAL RELATIONSHIP BETWEEN MORPHOLOGICAL CHARACTERISTICS AND PERFORMANCE OF TECHNICAL ELEMENTS OF GOAL SHOOTING IN WATER POLO GAME

Nermin Nurković, Dženana Imamović – Turković, Edin Mirvić

ABSTRACT: The main goal of this research is to determine and explain the connection between morphological characteristics and derivation of technical elements of goal shooting in water polo. The sample of respondents includes 80 water polo players from Water Polo Clubs Sarajevo City Club, Vapolo Club Torpedo, Water Polo Club Academy, and Water Polo Club Dabar. The test included a sample of 80 water polo players, registered in Bosnian-Herzegovinian clubs. The selection of manifest measures for the assessment of individual latent traits is presented according to the following: Variables for assessing the longitudinal characteristics of the human body: Body height (VISTJ), Leg length (DUZNG), Arm length (DUZRK). Variables for assessing the transference characteristics of the human body: Hand width (SIRSA), Wrist diameter (DIRZG), Elbow diameter (DILAK). Variable for estimating human body mass (weight): Body mass (MASTJ). Variables for assessing circular characteristics of the human body: Upper arm circumference (OBNDL). Medium chest circumference (OBGRU). Variables for the assessment of subcutaneous adipose tissue of the human body: Skinfold of the upper arm (NBNDL), Skinfold of the back (NBLED), and skin fold of the abdomen (NBTRB). A sample of variables to assess the performance of the technical elements of goal-scoring in a water polo game. Goal shot accuracy test: Shooting from the left-wing, from a static position from six (6) meters - STLK, shooting from the center, from a static position from six (6) meters - STC and shooting from the right-wing, from a static position from six (6) meters - STDK. It can be said that the canonical-correlation analysis obtained a significant and homogeneous structure of the connection between a set of morphological characteristics and a set of deriving technical elements of goal shooting.

Keywords: *water polo, canonical-correlation analysis of morphological characteristics, and goal shooting*

INTRODUCTION

The morphological characteristics of the human body have been the subject of research since ancient times. Even from then until today, there have been attempts to classify people into certain constitutional types. The level of muscle mass increased concerning adipose tissue. The observed changes are a consequence of the trend of acceleration and sports-morphological adaptation (optimization) (Lozovina, Lozovin, and Pavičić, 2012). Many researchers have tried to make a unit of specification in different sports. Čolakhodžić, Rađo, and Alić (2009) investigate quantitative changes in morphological dimensions in football players aged 12-15, caused by programmed situational training. The authors conclude that the situational model of work lasting six months had a positive effect on the transformation of almost all morphological dimensions, and especially on the variables that manifest subcutaneous adipose tissue. However, for us, the most interesting in this project are the usual morphological measures or characteristics of the human body. Thus, we have four basic morphological dimensions, which are: longitudinal dimensionality of the skeleton, transfer dimensional dimensionality of the skeleton, volume of the body, subcutaneous adipose tissue. From complex actions, the water polo player must apply for all positions on and in the water, and therefore a large lung capacity is required to withstand this rhythm of swimming (Lupo, Capranica, Cugljari, Gomez, & Tessitore, 2015). Kondić D. and Š. Dorica (2016) aimed to determine the differences in swimming abilities between groups of water polo players according to the four primary positions in the game (center, wing, left or right outer, middle outer). Swimming abilities were found to be differentially related to positions in the game. While the wings are excellent in sprinting,

the mid-outer ones dominate in short-distance swimming. There are no significant differences in anaerobic or aerobic swimming abilities. According to the arrangement of places in the fan, there are two wings (left and right), two outside (left and right) players, one defender, and one anchor (under the new names 1,2,3,4,5,6). Each player shoots with his safer hand (right or left) and thus we determine on which side he plays, but he will also perform the shot with a weaker hand depending on the situation during the game itself. Players are distributed according to abilities that determine morphological and motor characteristics when talking about top players. When it comes to the lower rank of the competition, then the schedule of players depends on whether we have covered all positions with players or not. Melchiorri, G., Viero, V., Tancredi, V., Roberto Del Bianco, R. and M. Bonifazi (2020). The playing time of water polo players by positions in the competition is so diverse, that it is very important to make a good training and recovery strategy for each player and adjust it individually to each water polo player. Aleksandrović, M.; Jorgić, B.; Georgiev, G.; Ozsari, M.; Arslan, D. (2015). In their research, they pointed out the significant influence of anthropological dimensions on the specific motor abilities of selected young water polo players. This enables a proper process of selection of young water polo players. Information that may indicate changes in the specificity of the relationship between anthropometric indicators and physical performance of elite water polo players, and according to the authors, there is no scientific record of such studies (Idrizović et al., 2014). The main goal of this research is to determine and explain the connection between morphological characteristics and the performance of technical elements of goal shooting in water polo.

RESEARCH METHODS

Definition of the sample of respondents

The sample of respondents includes 80 water polo players from Water Polo Clubs Sarajevo City Club, Varepolo Club Torpedo, Water Polo Club Academy, and Water Polo Club Dabar. All respondents are active members of water polo clubs and are therefore subject to regular medical examinations. The test included a sample of 80 water polo players, registered in Bosnian-Herzegovinian clubs.

A sample of variables to assess morphological characteristics

Within the morphological space, a battery of twelve morphological characteristics was selected, which were monitored according to the instructions and in the manner recommended by the International Biological Program (IBP). The list and selection of manifest measures for the assessment of individual latent characteristics are presented according to the following: Variables for the assessment of longitudinal characteristics of the human body: Body height (VISTJ), Leg length (DUZNG), Arm length (DUZRK). Variables for assessing the transference characteristics of the human body: Hand width (SIRSA), Wrist diameter (DIRZG), Elbow diameter (DILAK). Variable for estimating human body mass (weight): Body mass (FAT). Variables for assessing circular characteristics of the human body: Upper arm circumference (OBNDL). Medium chest circumference (OBGRU). Variables for the assessment of subcutaneous adipose tissue of the human body: Skinfold of the upper arm (NBNDL), Skinfold of the back (NBLED), and Skinfold of the abdomen (NBTRB).

A sample of variables to assess the performance of the technical elements of goal-scoring in a water polo game

- Shot accuracy test

1. Shooting from the left wing from a static position from six (6) meters – STLK

2. Shooting from the center from a static position from six (6) meters - STC

3. Shooting from the right-wing from a static position from six (6) meters - STDK

(The test is performed from three different positions, ie two wings and one central. Each subject performs one shot from each position.)

- Shooting from the left wing from a static position from six (6) meters - STLK respondent comes to the left-wing, a distance of 6 meters and takes a basic position, and shoots at the goal with a basic shot in water polo. Only the scored goal is recorded.

- Shooting from the center from a static position from six (6) meters - STC respondent comes to the center, a distance of 6 meters, and takes a basic position, and shoots at the goal with a basic shot in water polo. Only the scored goal is recorded.

- Shooting from the right-wing from a static position from six (6) meters - STDK The respondent comes to

the right-wing, a distance of 6 meters and takes a basic position, and shoots at the goal with a basic shot in water polo. Only the scored goal is recorded.

Research description

- Mentoring supervision from the Faculty of Sports and Physical Education,
- The assistance of experts in the field of sports and physical education (verified pedagogues) in the implementation of the project,
- All subjects under the same conditions were subjected to measurement and testing (the entire survey was conducted in the morning, from 08 to 12 h, the temperature was 18 to 24 degrees Celsius, the place of testing was the Olympic swimming pool of the island (indoor 50-meter pool).
- The research was conducted in such a way that the morphological characteristics of the subjects were first measured, and only then were the goal shooting tests performed.
- Respondents have explained acceptably before the measurement and testing process what awaits them during the research period and what is required of them in the work, and the main motive for work will certainly be curiosity and understanding of that testing as an opportunity to test their knowledge and knowledge of their capabilities,
- Measurement was performed in groups of 20 to 25 respondents, up to 80 respondents during the day,
- There was one measurer and one recorder at each measuring point,
- During the measurement, the subjects were in the prescribed testing equipment
- The team of surveyors consisted of professors of sports and physical education who are familiar with the research project, measurement lists, and how to fill them,
- Measurements were performed according to the following schedule:

from 08 to 10 h during five days, morphological characteristics were measured,

from 08:00 to 12:00 in five days, goal shooting tests were performed,

- After data collection, the measurement lists were completed and the data were processed in the appropriate program.

Data processing methods

To determine the connection between morphological characteristics and the derivation of technical elements of shooting on goal in a water polo game, basic canonical-correlation analysis was applied using the statistical package SPSS 12 for windows.

RESULTS

Canonical-correlation analysis (Table 1) isolated one significant and positive canonical function (Canonical R) which explained the general connection between morphological characteristics and technical elements of goal shooting, at the level of significance $p = .048$.

The only isolated canonical function of these two sets of variables is quite high (Canonical R) = .54, which could explain (Canonical R-SGR.) = 29% of the total variability of the set of morphological variables, and the set of variables for success in performing goal shots. The significance of the connections of the investigated spaces is (Chi-SGR.) = 51.9. Canonical factor (Table 2), in the space of variables for the assessment of morphological characteristics, it can be seen that the largest number of variables (seven out of twelve) has significant correlations with the isolated canonical dimension. Correlated variables can be divided into three groups:

- A group with a relatively high connection of conative space, in which we have a coefficient of .61 to .58, and a negative -.86, which is understandable, because the morphological space shows the expected connection when shooting at goal.

- In the group with moderately significant correlation, in which we correlate .20 to .19 in the positive sense, and in the negative only one variable -.26, where the variables DUZNG, OBNDL, and NBTRB belong.

Canonical correlation analysis of morphological characteristics and performing technical elements of goal shooting.

Table 1.

	Canonid R	Canonid R-sgr.	Chi-sgr.	df	p	Lambda Prime
0	0,54	0,29	51,92	36	0,04	0,48
1	0,47	0,22	27,90	22	0,18	0,68
2	0,37	0,14	10,60	10	0,39	0,86

Table 2.

	KF 1
VISTJ	-,06
UZRK	,58
DUZNG	,20
SIRSA	,18
DIRZG	,01
DILAK	-,12
OBGRU	-,86
OBNDL	,19
MASTJ	-,03
NBNDL	-,06
NBLED	-,26
NBTRB	,61

Table 3.

	KF 1
STLK	,85
STC	-,33
STDK	,60

- Small correlation in other variables moving in the positive state, 01 and negative from -, 01 to -, 06.

Considering that the representatives of the upper extremity of the body have the most frequent projections on the first canonical factor in the space of morphological characteristics, this factor can be called a general factor of longitudinal dimensionality of skeleton and volume. The canonical factor in the space of performing technical elements of shooting on goal in a water polo game (Table 3) is best defined by the variable shooting from the left wing from a static position from six (6) meters - STLK with a coefficient of 85, then shooting from the right-wing from a static position from six (6) meters - STLK, 60 and shooting from the center from a static position from six (6) meters - STC (-, 33). This factor can be called the precision factor of the right-hand shot. The association of the first pair of significant canonical dimensions suggests the conclusion that morphological characteristics have a negative impact on the performance of the technical elements of goal-scoring in a water polo game. By engaging in a discussion of the relations of the isolated canonical function and the variables of both spaces, and depending on the height of the mutual correlation (relations with the canonical function) the following relations can be defined:

The greatest correlation exists between the variables of morphological characteristics of the "High Connectivity Group" (DUZRK, OBGRU, NBTRB, STLK, STDK, and STC) and with most of the left-wing shots. Statistically, a slightly lower correlation exists between the variables of morphological characteristics in the second group "Group with significant correlation" (DUZNG, OBNDL, and NBTRB).

DISCUSSION

It can be said that the canonical correlation analysis obtained a significant and homogeneous structure of the connection between a set of morphological characteristics and a set of the derivation of technical elements of goal shooting. These connections are real and significant, with medium and small projections of the correlation coefficients on the isolated canonical factor, both in the space of morphological characteristics and the derivation of technical elements of goal shooting. Such statements can be supported primarily by reviewing the results of canonical correlation analysis of two sets of variables used, and then by knowing the complexity of the structure of movement that undoubtedly has an impact here, by knowing the complexity of deriving variables from deriving technical elements of goal shooting and morphological characteristics. Due to certain fatigue during testing, we tried to achieve as little fatigue as possible, while gaining game efficiency in our research (Melchiorri, G. et al. 2020) and to prove that differences in the player playing time are significant for the occurrence of fatigue that automatically can affect the general motor preparation of the player and the development of the chest. This also depends on the coach's

strategy, and in most cases, preference is given to more experienced players who have fully developed their performances, which is not the case with younger players. Gardasevic, J. et al. (2020) proved in which case players have better statistics on subcutaneous adipose tissue: triceps skinfold, biceps skin fold, and thigh skin fold, showed a better result of the Montenegrin national team compared to the Croatian national team. Dopsaj, M. et al. (2018). have proven that morphological parameters (body height and body weight) are of great importance in the selection of U15 water polo players. Popo et al., (2018). In the research, it was stated that water polo can be successfully played by different morphological types/profiles of players, which means that perspective is not determined based on individual anthropometric measures, which can vary due to different biological processes, ie uneven growth rate and development of certain morphological dimensions in water polo players. According to specific positions, central strikers are players who show higher hand-grabbing values, but these differences only gain statistical significance when central strikers are compared to wings and goalkeepers (Ferragut, Abrales, Machado, & Vila, 2015). Concerning subcutaneous adipose tissue, it was determined that skin folds are significantly more prominent in water polo players who play in the center position, in contrast to water polo players who play in other positions (Lozovina, Đurović, Katić, 2009). Of course, indicators are not adequate without motor ability no matter how many morphological characteristics individually have a connection and impact. This research work shows us a guideline for determining the equation of specification of morphological characteristics, selection of water polo players, positions in water polo, etc. It is known that one can start with a water polo school from the age of 12, at which time one can roughly see the development of morphological characteristics only by the measurements of the parents. Probably, if the same research were done in another country that has a long tradition and better results, we would certainly get more accurate results.

CONCLUSION

The connection of the first pair of significant canonical dimensions suggests the conclusion that morphological characteristics have a negative impact on the performance of the technical elements of goal-scoring in a water polo game. Such statements can be supported primarily by reviewing the results of canonical correlation analysis of two sets of variables used, then by knowing the complexity of the structure of movement that undoubtedly has an impact here, further, by knowing the complexity of deriving variables from deriving technical elements of goal shooting and morphological characteristics. By engaging in the relations of the isolated canonical function and the variables of both spaces, and depending on the height of the mutual correlation (correlations with the canonical function), the following relations can be defined: The greatest correlation exists between the variables of

morphological characteristics, "Group with high correlation" (DUZRK, OBGRU, NBTRB, STLK, STDK, and STC) and with most of the shooting from the left-wing. Because from that position, shooting is done with a better right hand, and most of the younger water polo players are right-handed. Statistically, a slightly lower correlation exists between the variables of morphological characteristics in the second group "Group with significant correlation" (DUZNG, OBNDL, and NBTRB).

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AUTHOR(S) INFORMATION

Nermin Nurkovic
Patriotske lige 41, 71000 Sarajevo, Bosnia and Herzegovina, e-mail: nermin.nurkovic@fasto.unsa.ba

Dzenana Imamovic – Turkovic
Patriotske lige 41, 71000 Sarajevo, Bosnia and Herzegovina, e-mail:
dzenana.imamovic@fasto.unsa.ba

Edin Mirvic
Patriotske lige 41, 71000 Sarajevo, Bosnia and Herzegovina, e-mail: edinmirvic@gmail.com

REPRESENTATION AND ROLE OF WOMEN IN SPORTS IN THE HERZEGOVINA-NERETVA CANTON

Aida Kuštrić Leto

ABSTRACT: The research conducted for the purposes of this master's thesis was carried out in the period from May 2013 to August 2013, and is of a transversal nature. This research included women, members of the management structures of women's sports clubs from Herzegovina – Neretva Canton and from the management structures of sports from the cantonal, municipal and city levels.

Key words: *women, sports, discrimination, representation*

INTRODUCTION

Women took part in the sports competition for the first time after the First World War, while at the Olympic Games in Paris in 1990, only women appeared in certain sports, in lawn tennis and golf. Some countries have taken promotion measures and enacted legislation to provide women with more space in the world of sports in general, as players, directors and coaches. This process, seen in France as part of a further "positive discrimination" movement, as well as "positive action", involves a multitude of local and national initiatives. The key factor that determines the conditions for the involvement of men and women in sports is the amount of time they can organize according to their volition - and the fact is that the burden of work at home and in the family is still carried almost exclusively by women.

METHOD

This research included members of women's management sports clubs from the Herzegovina – Neretva canton and sports management structures from the cantonal, municipal and city levels, a total of 95 of them.

SUBJECT

The subject of this research is the current position of women in sports in the Herzegovina - Neretva Canton.

The problem of the research is to determine the level of development of women's sports in the Herzegovina - Neretva Canton.

RESULT ANALYSIS AND DISCUSSION

The survey questionnaire for female respondents consisted of 13 items (see the attached questionnaires), to which respondents responded voluntarily and at their discretion. All 13 questions have the character of closed ones, ie it was possible to answer them only by precisely filling in the required data. The results are presented through the following tables.

Looking at Table 1, which tells us about the validity of filling out our questionnaire, we can see that all

VARIABLE SAMPLE

In selecting the variables, the results of previous research were used. The following variables were used to collect data in the study:

- Socio-demographic characteristics of the respondents,
- Questionnaire for local governments,
- Questionnaire for the cantonal level,
- Questionnaire for sports clubs

DATA PROCESSING METHODS

All data processing was performed in the mathematical-statistical package SPSS 19. The data obtained by this measurement and hypotheses determined the methods that will be used for data processing. Data were, after measurement, entered into statistical matrices.

Since the research is about non-parametric statistics, there was no need to work on methods for examining the normality of the distribution of results.

Among the measures of descriptive statistics, ie measures of central tendency, the Mod method was used, which tells us about a phenomenon that is most often repeated in one statistical series.

In addition to the above mentioned method, a technique for reading frequency and estimates was used. Of course, in order to make the obtained tables easier to understand and to present in a better way, a graphical presentation of the results in the form of "columns" and "pie" was used, depending on the task

respondents gave an answer to four variables: "age", "level of education"

respondents ", " sports respondents ", " gender structure in mixed clubs ". Only one respondent did not answer the question "place of residence", "employment status" and "marital status of the respondents".

Table 1. Insight into the questionnaire responses

	Age	Education level	Place of residence	employment	marital status	Type of sport	Gender structure in mix clubs
Valid	95	95	94	94	94	95	95
absences	0	0	1	1	1	0	0

Table 2 tells us about the age of the respondents and by looking at it we can see that all respondents are placed in the age group of 16- over 36 years. Most respondents are aged 16-20, 22 of them, which is

23.2% of respondents. Their smallest number is in the age group over 36, which makes up 16.8% of respondents

Table 2. Age of respondents

		Frequency	Percent	Cumulative percentage
Valid	16 - 20	22	23,2%	23,2
	21 - 25	20	21,1%	44,2
	26 - 30	18	18,9%	63,2
	31 - 35	19	20,0%	83,2
	Preko 36	16	16,8%	100,0
	Ukupno	95	100,0%	

Insight into Table 3, which talks about the level of education of respondents, we can see the largest number of respondents have completed secondary

education, 37 of them, which is 38.9% of the total number of respondents. Only one respondent (1.1%) attends primary school.

Table 3. Education level of respondents

		Frequency	Percent	Cumulative percentage
Valid	Highschool students	9	9,5%	9,5
	University students	27	28,4%	37,9
	Primary school students	1	1,1%	38,9
	High school	37	38,9%	77,9
	Collage	16	16,8%	94,7
	University	5	5,3%	100,0
	Total	95	100,0%	

Table 4, which talks about the place of residence of the respondents, shows the results where 94 of them who answered these questions, 79 of them (83.2%) lived in the city, while the remaining 15 (15.8%) lived

in the village. One respondent did not answer this question, which is 1.1% of the total number of respondents.

Table 4. Place of residence of the respondents

		Frequency	Percent	Valid percent	Cumulative percentage
Valid	City	79	83,2%	84,0	84,0
	Village	15	15,8%	16,0	100,0
	Total	94	98,9%	100,0	
Absence		1	1,1%		
Total		95	100,0%		

By pointing out Table 5, which tells us about the employment status of respondents, we can see that out of a total of 94 respondents who answered this

question, 56 (58.9%) are employed, while 38 (40%) are unemployed. One respondent as in the previous case did not give an answer.

Table 5. Employment status

		Frequency	Percent	Valid percent	Cumulative percentage
Valid	YES	56	58,9%	59,6	59,6
	NO	38	40,0%	40,4	100,0
	TOTAL	94	98,9%	100,0	
Absence		1	1,1%		
TOTAL		95	100,0%		

Looking at Table 6, which tells us about the marital status of respondents, we can see that out of a total of 94 respondents who answered this question, 60 (63.2%) are not married, 32 (33.7%) are married,

while only 2 of them (2.1%) are in an extramarital union. One respondent, as in the previous two cases, did not answer this question.

Table 6. Marital status of respondents

		Frequency	Percent	Valid percent	Cumulative percentage
Valid	married	32	33,7%	34,0	34,0
	extramarital union	2	2,1%	2,1	36,2
	single	60	63,2%	63,8	100,0
	Total	94	98,9%	100,0	
Absence		1	1,1%		
Ukupno		95	100,0%		

By looking at Table 7, which tells us about the type of sport of the respondents, we can see that the largest number of respondents play handball (13 of them, which is 13.7% of respondents). Other sports by representation from volleyball, dance and kayaking 7.4% of them. At least the number of respondents gave the answer that they do some other sport that is not listed in the offered answers of our survey.

Table 7. Type of sport of the respondents

		Frequency	Percent	Cumulative percentage
Valid	Volleyball	7	7,4%	7,4
	Karate	5	5,3%	12,6
	Handball	13	13,7%	26,3
	Athletics	4	4,2%	30,5
	Basketball	3	3,2%	33,7
	Swimming	6	6,3%	40,0
	Dance	7	7,4%	47,4
	Football	5	5,3%	52,6
	Tennis	4	4,2%	56,8
	Table	5	5,3%	62,1
	Fitness	3	3,2%	65,3
	Kick box	5	5,3%	70,5
	Kayak	7	7,4%	77,9
	Mountaineering	4	4,2%	82,1
	Judo	3	3,2%	85,3
	Bowling	3	3,2%	88,4
	Bocce ball	3	3,2%	91,6
	Gymnastics	6	6,3%	97,9
Some other sport	2	2,1	100,0	
Total		95	100,0	

Bh inspecting Table 8 which tells us about the gender structure in mixed clubs we can see that in 45 of the 95 clubs taken into survey there is equal insight of

women and men. 26 of the 95 clubs have a higher proportion of men in the club while 24 of 95 have a higher proportion of women in the club

Table 8. Gender structure in mixed clubs

		Frequency	Percent	Cumulative percentage
Valid	More women	24	25,3	25,3
	More men	26	27,4	52,6
	Equal	45	47,4	100,0
	Total	95	100,0	

Table 9 tells us about the representation of women's, men's and mixed clubs in the Herzegovina – Neretva Canton. If we take the municipality with the largest number of clubs (the City of Mostar), we can see that there are 105 sports clubs in the city, of which 54 are men's, 42 are mixed and 9 are women's.

The second municipality in terms of the number of sports clubs is the municipality of Čitluk, where there

are 22 sports clubs, of which 16 are men's, 5 mixed and 1 women's club. The municipality of Čapljina is the one of the least sports clubs has 6 sports clubs, of which 4 men's, 1 is a women's and 1 mixed club.

In addition to the municipality of Čapljina, the municipality of Prozor has 6 sports clubs, of which 3 are men's, 2 are mixed and 1 is a women's club.

Table 9. Gender structure of clubs in the municipalities of the Herzegovina – Neretva Canton

Representation of women's, men's and mixed clubs				
Municipality	Women's	Men's	Mixed	Total
Mostar	9	54	42	105
Jablanica	3	12	1	16
Konjic	4	4	3	11
Čapljina	1	4	1	6
Stolac	2	4	2	8
Neum	2	2	3	7
Prozor	1	3	2	6
Čitluk	1	16	5	22

Table 10 also tells us about the amount of funds provided from municipal budgets from the year 2010 to the year 2014. The leading municipality in terms of allocating funds for the use of sports clubs is the municipality of Mostar, which allocates about 1.5 million KM.

More than a million of KM goes to financing men's sports clubs. Slightly more than 200,000 KM goes to the financing women's clubs, while almost 200,000 KM goes to the financing mixed clubs.

The second municipality in the order of allocating financial resources for the sports purposes is the municipality of Konjic, which allocates almost one million KM. Over 600,000 KM goes to financing men's clubs. Over 200,000 KM goes to the financing of mixed clubs, which makes a very good share of the

total financing of sports clubs. Slightly more than 80,000 KM is made available to women's clubs.

The municipality that allocates the least money for the development of sports clubs is the municipality of Prozor, just over 200,000 KM. Out of that, 160,000 KM goes to the financing of men's sports clubs, 70,000 KM to the financing of women's and a little more than 30,000 KM to the financing mixed sports clubs.

The second municipality with the least allocation of funds is the municipality of Stolac, which allocates almost 350,000 KM. Slightly more than 250,000 KM is set aside to financing men's sports clubs. About 60,000 KM to financing mixed sports clubs and 30,000 KM to financing women's sports club

Table 10. The amount of funds provided from municipal budgets from 2010-2014.

Financing of sports clubs with municipal budgets (2010 - 2014)				
Municipality	Women's clubs	Men's clubs	Mixed clubs	TOTAL
Mostar	245,603.78	1,087,654.6	195,767.65	1,529,025.9
Jablanica	156 585,00	704 700,00	27 520,00	888 805,00
Konjic	83 466,00	632,314,00	238,548,00	954,328,00
Čapljina	95 635,00	462,794,00	197,955,00	756,387,00
Stolac	30,500	257,763,00	59,473,00	347,736,00
Neum	84,678	231,624,00	48,438,00	364,740,00
Prozor	70,300	160,370,00	33,089,00	263,759,00
Čitluk	35.000,00	402.922,00	91.000,00	493.922,00

Table 11 tells us about the possibilities of choosing different sports in different municipalities that women and men can play. We can see that in the seven municipalities where the survey was conducted, women can mostly play sports such as karate, volleyball and handball, while chess, judo, vartepol, weightlifting and hiking have the least choice.

Of all the 7 municipalities mentioned, men have the largest choice of playing sports in football and basketball. Men have the smallest choice from the sports of water polo, boxing, table tennis, diving and badminton.

Table 11. The possibility of choosing different sports

Different sports offer		
Municipality	Sports that women can play	Sports that men can play
Mostar	Basketball, handball, volleyball, karate, football, hiking	Basketball, handball, football, karate, judo, boxing, hiking
Konjic	Karate, volleyball, handball, weightlifting	Karate, volleyball, handball, basketball, football, weightlifting
Jablanica	Handball, volleyball, karate	Football, basketball, weightlifting, table tennis, hiking, diving, badminton
Čapljina	Basketball, volleyball, football, karate	Basketball, football, volleyball, karate, chess
Stolac	Handball, karate, volleyball	Football, basketball, volleyball
Neum	Water polo, volleyball, handball, judo	Water polo, football, basketball, judo, karate, handball
Prozor	chess, karate, handball	Football, chess, basketball, karate

By the insight into Table 12, which tells us about the distribution of funds for sports in the municipality or the city, we see that sports clubs from four municipalities: Mostar, Čapljina, Stolac and Čitluk are founded at the suggestion of the city sports federation. Funding according to the plan made by the professional services of the municipality/ the city

sports clubs from three municipalities: from the municipalities of Jablanica, Neum and Prozor are financed. The specific situation is with the clubs of the municipality of Konjic, which are financed in both of these ways - at the suggestion of the city sports association and according to the plan made by the professional services of the city.

Table 12. Distribution of funds for sports in the municipality / city

Distribution of funds for sports in the municipality / city		
Municipality	At the suggestion of the City Sports Federation	According to the plan made by the professional services of the municipality / city
Mostar	yes	
Jablanica		yes
Konjic	yes	yes
Čapljina	yes	
Stolac	yes	
Neum		yes
Prozor		yes
Čitluk	yes	

CONCLUSION

Exploring the subject and the problem of this master's thesis, only at a glance on the research results we can conclude that we can clearly identify the underrepresentation of women in sports in our canton, which in some segments takes the form of discrimination. The results of the research and the information from the field tell us that men's and women's clubs within the same sport, which are in the same rank of the competition, receive different financial resources from the local budgets, as a rule at the expense of women's clubs. Due to the unequal distribution of budget funds, women's sport is put in a quandary, and becomes unprofitable and uninteresting to other potential sources of funding (donors and sponsors). Except for the Sports Association of the City of Mostar, which has an equal number of men and women in its structure of employees, there are almost no women in municipal bodies that make decisions on the financing of sports clubs.

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AUTHORS INFORMATION

mr Aida Kuštrić Leto
 IV Elementary school Mostar
 aidamostarka@hotmail.com

DIFFERENCES IN STUDENTS' ATTITUDES TO PHYSICAL ACTIVITY AND SATISFACTION WITH HEALTH STATUS

Amna Vefić, Denis Čaušević, Edin Kukavica, Indira Mahmutović, Dženana Imamović-Turković

ABSTRACT: The research aimed to identify the differences between physical activity, the health status of University students, sports and physical education in the Federation of Bosnia and Herzegovina. Methods: The research design was based on a descriptive research design model. This research sample consisted of 624 respondents, aged 19 to 30 years. Data have been collected since June 2020. Differences in student attitudes (ANOVA) were analyzed, using SPSS 22.0. Respondents completed questionnaires about their physical activity, health status. Results: Differences were found in most of the treated particles in the questionnaire and satisfaction with the health status of students and physical activity. Conclusion: Based on the results of this research, targeted programs are needed to increase sufficient physical activity in students to improve their health status and increase physical performance.

Keywords: differences, attitudes, physical activity, satisfaction, health status, student

INTRODUCTION

The period of studying at the faculty represents an important period of life for the formation of habits and attitudes of students as young people and their adoption (Park & Kim, 2013; Pengpid & Peltzer, 2019). The state of physical, psychological, and social well-being implies constant improvement of the conditions of personal and social characteristics in which the individual develops, to achieve a better and more successful quality of life (Hawker, 2012; Jafari et al., 2010). The level of physical activity decreases and a sedentary lifestyle begins to dominate, leading to an increased risk of developing obesity (Bouchard, Blair, & Haskell, 2012). Movement as optimal physical activity is a condition for preserving human health and the normal functioning of organs, systems of the human body as a whole (Angulo, El Assar, Álvarez-Bustos, & Rodríguez-Mañas, 2020). The lack of optimal physical activity can best and most easily be compensated through appropriate content of physical activities. Health is one of the most significant and subjectively and objectively recognized factors of an individual's well-being (Bouchard et al., 2012).

METHOD

Going to college is an important period in the life of every young person. Changing the living environment often results in changing living and health habits. There is a reduction in physical activity as well as a reduction in the intake of fruits and vegetables, while at the same time increasing the intake of fast food and alcohol. This paper aims to analyze what kind of physical activities students have and what their students' satisfaction with their health status is. The population, from which the sample of respondents was defined, consists of students of the University of FBiH, namely: the University of Sarajevo, the University "Džemal Bijedić" in Mostar, the University of Tuzla, and the University of Travnik. A total of 624 respondents, aged 19 to 30, were included in the study. To conduct the research, a questionnaire was created which covers the following areas: health status SF-36 (health status - 11 particles; physical activity -4

particles). Data were collected online by filling out a questionnaire. When accessing the online questionnaire, participants received instructions in which the purpose of the research was explained, the principle of anonymity, voluntariness, consent to participate in the research was explained. The survey was conducted in July 2020. The collected data were processed with the help of the SPSS 22 software package. To determine the differences in the attitudes of male and female students, we used Anova for each particle.

RESULTS

The share of students by gender is shown in Table 1. In the total sample, there were 268 and 42.9% - men, while women were 356 or 57.1%.

To determine the differences between students in the attitudes of students about health status (Table 2), all survey questions showed a statistically significant difference between the attitudes of students except for the activities of particles "The following questions relate to activities that you may be engaged during one typical day. Does your health currently limit you in performing these activities (SF03a, SF03b)", and for particles: Have you had any of the following problems in your work or other regular daily activities in the past 4 weeks due to your physical health (SF04a, SF04b).

Table 1. Frequencies and percentage of students by gender

		GENDER			
		Freq.	Percent	Valid Percent	Cumulative Percent
Valid	Male	268	42.9	42.9	42.9
	Female	356	57.1	57.1	100.0
	Total	624	100.0	100.0	

Table 2. Differences in students' attitudes about health status

ANOVA						
Particles	Code	Sum of Squares	df	Mean Square	F	Sig.
In general, would you say it is your health	SF01	26.287	1	26.287	37.686	.000
Compared to last year, to assess your health now	SF02	4.624	1	4.624	5.460	.020
Physically strenuous activities, such as running, lifting heavy objects, participating in strenuous sports	SF03a	1.169	1	1.169	2.297	.130
Moderately strenuous activities, such as moving the table, cycling, bowling, etc.	SF03b	.453	1	.453	.935	.334
Lifting or carrying a grocery bag	SF03c	2.486	1	2.486	1.654	.236
Climbing stairs (several floors)	SF03d	1.338	1	1.338	2.185	.140
Climbing stairs (one floor)	SF03e	.193	1	.193	.350	.554
Bending, kneeling, or bending	SF_03f	.259	1	.259	.414	.520
Walking more than 1 kilometer	SF03g	.034	1	.034	.058	.810
Walking about half a kilometer	SF03h	.548	1	.548	.844	.359
Walking 100 meters	SF03i	.047	1	.047	.063	.801
Bathing or dressing	SF03j	.088	1	.088	.115	.734
You have shortened the time spent in work or other activities	SF04a	.223	1	.223	1.348	.246
You did less than you wanted to	SF04b	.077	1	.077	.407	.523
You could not perform any jobs or other activities	SF04c	.829	1	.829	5.231	.023
You had difficulty doing work or other activities (eg you had to put in the extra effort)	SF04d	1.101	1	1.101	6.804	.009
You have shortened the time spent in work or other activities	SF05a	4.974	1	4.974	26.909	.000
You did less than you wanted to	SF05b	8.561	1	8.561	42.303	.000
You have not done work or other activities as carefully as usual	SF05c	11.467	1	11.467	63.050	.000
To what extent in the past 4 weeks has your physical health or emotional problems affected your usual social activities in the family, with friends, neighbors, or other people	SF06	59.537	1	59.537	58.243	.000
What physical pain have you had in the past 4 weeks	SF07	39.335	1	39.335	30.664	.000
To what extent have these pains interfered with your normal work in the past 4 weeks, including working outside the home and housework?	SF08	16.969	1	16.969	24.032	.000
How much time have you felt full of life in the past 4 weeks	SF09a	97.428	1	97.428	83.524	.000
How long have you been very nervous in the past 4 weeks	SF09b	64.801	1	64.801	43.057	.000
How much time in the past 4 weeks have you felt so depressed that nothing could cheer you up	SF09c	48.343	1	48.343	24.761	.000
How much time have you felt calm and peaceful in the past 4 weeks	SF09d	9.254	1	9.254	6.787	.009

How long have you been full of energy in the past 4 weeks	SF09e	106.878	1	106.878	88.633	.000
How long have you felt discouraged and sad for the past 4 weeks	SF09f	66.650	1	66.650	36.840	.000
How long have you felt exhausted in the past 4 weeks	SF09g	30.838	1	30.838	20.497	.000
How long have you been happy in the past 4 weeks	SF09h	55.280	1	55.280	45.915	.000
How much time have you felt tired in the past 4 weeks	SF09i	28.203	1	28.203	18.360	.000
How much time in the past 4 weeks have your physical health or emotional problems interfered with your social activities?	SF10	32.863	1	32.863	36.006	.000
It seems to me that I get sick easier than other people	SF11a	9.489	1	9.489	7.119	.008
I am as healthy as anyone I know	SF11b	3.288	1	3.288	3.974	.047
I think my health will get worse	SF11c	33.041	1	33.041	27.378	.000
My health is excellent	SF11d	26.725	1	26.725	39.394	.000

To determine the differences between male and female students in their attitudes about physical activity among female students (Table 3), it can be seen that the particles "How physically strenuous is your study (PH02), (sig. = .000), often physically active in your free time for at least 30 minutes so that you are at least moderately clogged or sweaty (hiking, running, cycling, gym, swimming, working in and around the house/cottage, etc.) (PH03) (sig. =

.000), "Has anyone advised you to increase your physical activity in the past year - family members. (PH04C) (sig. = .000) I Have you been advised to increase your physical activity in the past year - someone else (PH04d) (PH04d) (sig. = .000) are statistically significantly different while other particles are not seen the significant statistical difference between male and female students.

Table 3. Differences in students' attitudes about physical activities

ANOVA						
Particles	Code	Sum of Squares	df	Mean Square	F	Sig.
How do you go to college (add up time to college and back)	PH01	2.579	1	2.579	2.255	.134
How physically strenuous is your study that you are attending	PH02	59.138	1	59.138	53.977	.000
How often are you physically active in your free time for at least 30 minutes so that you are at least moderately stuffy or sweaty (hiking, running, cycling, gym, swimming, working in and around the house/cottage, etc.)	PH03	162.717	1	162.717	92.280	.000
Has anyone advised you to increase your physical activity in the past year - doctor?	PH04a	.159	1	.159	1.552	.213
In the past year, has anyone advised you to increase your physical activity - other health professionals?	PH04b	.140	1	.140	1.564	.211
Has anyone advised you to increase your physical activity in the past year - family members?	PH04c	3.930	1	3.930	16.799	.000
In the past year, has anyone advised you to increase your physical activity - someone else?	PH04d	3.225	1	3.225	14.290	.000

DISCUSSION

Student physical activity is an important factor for every person belonging to this group. Students who are more physically active feel more fulfilled in life, and thus are in better health. The most important positive effects of physical activity and physical exercise affect the psychophysical balance of students, and its role in socialization and about the natural environment are classified as deserved for the general condition of the student, and thus for health (Aşçı, 2003; Skurikhina, Kudryavtsev, Kuzmin, & Yermakov, 2016). The differences that show us

about the subjective feelings of students, although almost 80% of them feel great and very good, they exist. Also, when it comes to health assessment compared to last year, there are differences where about 36% of students said that they feel a little better than a year ago. Particles where physical activity activities, such as running, lifting heavy objects, participation in strenuous sports, were tested, also showed differences, and that 53.5% of students were not restricted by their health in these activities, while 33% It is stated that they have a small influence and 13.5% that their health status

has a lot of influence on the performance of these activities. From other particles of physical activities to conclude that over 50% of surveyed students of these activities is not a problem of their health. It is worrying that on average 15% and more students state that these activities are problems, it can be concluded that they do not have physical activities or are physically inactive, which is a reflection of modern society, the so-called. homosadens (seat society). How many students in the past 4 weeks in their work or other regular daily activities had some problems due to their physical health, shows us that about 80% of students did not have in their regular activities due to health, while about 20% they had which led to differences in them. Only 70% of students do not feel anxious or depressed when performing daily tasks in the previous 4 weeks before the survey. The percentage of 30% on average to the mentioned questions that they had emotional problems due to which their actions were reduced indicates caution and a more detailed analysis of this problem. Achieved differences in the particles of study difficulty, although attending sports and physical education studies, to conclude that 42.3% of surveyed students said that their physically very easy (mostly sitting) study they attend, 26.0% moderately difficult, 18, 9% light, 12.8% hard physical work. Having in mind the study, it turned out that 30.8% of the surveyed students stated that they were physically active for at least 30 minutes four to six times a week, 26.3% two to three times a week, 17.3% two to three times a month, 15.7% once a week, 6.4% several times a year, 3.5% are not physically active. Recommendations or advice to increase their physical activity can be achieved by the percentage of statements per parcel where 39.7% of surveyed students said that oh family members advised increasing their physical activity, 35.9% said it was someone else, 11, 5% that it is a doctor and 9.9% that it is other health professionals. Since the research is aimed at students who are in the transition period from adolescence to young adulthood, which is marked by specific life changes, it is possible to adopt undesirable behaviors, including a reduction in physical activity (Seefeldt, Malina, & Clark, 2002). Given that the student period is the last step in the educational process that provides great opportunities for systemic influence on the adoption of healthy living habits, and taking into account the evidence of previous research on many benefits of physical activity, it is necessary to act to increase students' physical activity. Findings on the positive effects of physical activity on student health and its contribution to explaining the health quality of life of students support the positive health benefits of physical activity of the student population (Snedden et al., 2019; Tyson, Wilson, Crone, Brailsford, & Laws, 2010). Since dissatisfaction with physical appearance can cause serious health problems such as depression, obesity, and eating disorders, the knowledge of the positive relationship between physical activity and satisfaction with physical appearance can increase physical activity, which can contribute to a more positive perception

of physical appearance. to better health (Jun & Choi, 2014; Kamaria, Vikram, & Ayiesah, 2016; Regis, Ramos-Cerqueira, Lima, & Torres, 2018).

CONCLUSION

After the presented results, the following can be concluded: In most of the analyzed characteristics, the results obtained by this research are by the existing knowledge about the healthy lifestyles of students. Students from the analyzed sample most often spend their free time in their own space and at the faculty, most often dealing with computer work and listening to music. The results on student health indicate the need for further research in this area to determine significant correlates of results and design programs (perhaps within existing study programs, eg strengthening subjects or introducing compulsory sports and physical education) that would be aimed at improving the physical and mental health of the student.

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AUTHORS INFORMATION

Amna Vefić
Healthy Life Association, Sarajevo, Bosnia and Herzegovina
amna.mahmutovic96@gmail.com

Denis Čaušević
Faculty of Sports and Physical Education, University of Sarajevo, Bosnia and Herzegovina
denis.causevic@fasto.unsa.ba

Edin Kukavica
Faculty of Political Science, University of Sarajevo, Bosnia and Herzegovina
edinurjankukavica@gmail.com

Indira Mahmutović
Faculty of Education Science, University of Sarajevo, Bosnia and Herzegovina
imahmutovic@pf.unsa.ba

Dženana Imamović-Turković
Faculty of Sports and Physical Education, University of Sarajevo, Bosnia and Herzegovina
dzenan.imamovic@fasto.unas.ba

EFFICACY OF COMBINATION THERAPY IN REHABILITATION OF ANKLE INJURIES

Davor Arslanagić

ABSTRACT: The ankle joint is among the most complex anatomical functional structures of the locomotor system. The most recent research on lower leg injuries reveals that the ankle joint sprains show the highest incidence rate of 206 injuries per 100 000 people annually, while the injuries most commonly occur among children and adolescents. The most frequent ankle joint injuries in sports are sprains (15%), followed by lesions and contusions. The study aims to determine the statistical analysis of the successful application of combination therapy (kinesitherapy and physical therapy) compared to the use of a single therapy for the treatment of ankle injuries. A prospective analysis of the period February 2012 - November 2014, on 60 subjects of the statistical treatment of the results, in order to compare performance of administration of the combination therapy (kinesitherapy and physical therapy) compared to the use of only one of these therapies in the treatment of ankle joint. The research results obtained show a significant, significant differences between the groups. By analyzing the results, the duration of rehabilitation is the most commonly from 11 to 20 days in both groups, while the use of ultrasound to 81.8% were most frequently used therapy in the groups. The VAS pain scale we have insufficient physical activity gave results that "no pain" was 36.7% of respondents to the end of the study, while the control group this number was 28.3%. The test group at the end of therapy has 5% of the copies of the dorsal flexion of 26 to 30° and the control group was 0%, while the embodiment plantarflexion equal result. In the embodiment of pronation, the majority of subjects at the end of therapy can work pronation 26 to 30° (33.3%) in both groups, with the study group but the control had better 15% of those with 26 to 30°. At the end of treatment in the embodiment of supination 43.3% of both groups could take over supination 30°. After the therapeutic treatment of condition marks respondents score "5" yielded 73.3% of the test group, and 63.3% of the controls. Research has shown better progress in the treatment in patients on combination therapy that fits into the world of research with which we compared our results.

Keywords: *Ankle joint, physical medicine, kinesitherapy, rehabilitation.*

INTRODUCTION

Ankle injuries are injuries to the distal tibia or fibula. During the last decades, the number of ankle injuries has increased significantly and they occur at all ages (Chirvi et al., 2017). A large randomized study conducted in the United States in 2010 registered 2,000,000 ankle injuries in one year, and the treatment and care of these individuals cost 2 trillion US dollars, which was imperative to find an adequate protocol in the diagnosis and treatment of these patients (Gottschalk & Andrich, 2011). In athletes, the most common injuries are the ankle, then the knees and lower legs. The most common type of ankle injury is sprains and bruises (Fong, Hong, Chan, Yung, & Chan, 2007). Distortion is a set of injuries to the ligaments, joint capsule, and attachment of the tendons of the muscles in the area of the joint caused by the action of gross motor force (Whiting & Zernicke, 2008). Distortion manifests itself when the amplitude of movement exceeds the physiological limit (Radulović, Mihajlović, Šolaja, & Pavlović, 2019). Inversion of the foot is cited as a mechanism of an ankle injury. The lateral side of the joint is most often injured, namely the ligament. collateral lateral consisting of three parts: lig. calcaneofibulare i lig. talofibulare anterius et posterius (Gross & Liu, 2003; Ivins, 2006). Numerous protocols and functional tests are used in the literature for the examination of ankle injuries, but none of them gave answers to all questions and did not give satisfactory results. and physiatrist. Only timely adequate diagnostics and early complex physical therapy, which can sometimes be long-term,

return the injured person to the previous functional level. (Polzer et al., 2012).

METHOD

This study aims to compare the results of treatment and rehabilitation of ankle injuries using combination therapy (kinesitherapy and physical therapy) with the application of only treatment and rehabilitation with kinesitherapy or physical therapy, to determine the effectiveness of combination therapy (kinesitherapy and physical therapy) in treatment and rehabilitation. The research was conducted in the Institute of Sports Medicine of Sarajevo Canton in the period from February 2020. until November 2021. The study included 60 subjects aged 15 to 30 years, who according to the criteria for inclusion in the study were divided into two equal groups: the study (n = 30) and control (n = 30). The study group consisted of subjects treated with combination therapy (kinesitherapy and physical therapy) and in the control group were subjects treated only with kinesitherapy or physical therapy. The research is prospective, comparative, to compare two methods of treatment: the use of kinesitherapy and physical therapy in the treatment of ankle injuries and the use of only one of these therapies in the treatment. At the end of all treatment protocols, a statistical analysis was performed to determine whether one protocol was more successful than the other. We used the Mann - Whitney U test to process the data.

Research instruments

Instruments used in both study groups:

- a) Visual analog pain scale (VAS). VAS is a centimeter strip 0-10 cm long, where "0" indicates a pain-free condition and "10" indicates the most severe pain condition,
- b) Measuring the function of the movement with a protractor,
- c) Length of treatment expressed in days for both study groups,
- d) Assessment of clinical condition after completion of therapy: 1-5
 - grade "1" means unchanged condition (without treatment results);
 - grade "2" indicates minimal improvement;
 - grade "3" indicates satisfactory functional improvement;
 - grade "4" indicates good improvement;
 - a grade of "5" indicates improvement without injury or illness.

All of the above instruments were used in the study and control groups of subjects during the first examination, control examination, and at the end of therapy. Questionnaires were filled out for each subject of the examined and control group with detailed generalizations and assessment of the clinical condition. Upon completion of treatment, a questionnaire was completed with a final assessment of the clinical condition.

RESULTS

The analysis of the gender structure of the examinees of the examined groups established that the same number of examinees was from both groups of males, 36.7% in the examined and 36.7% in the control group, while 13.3% were female and 13.3% in the control group. Insight into Table 1 can be seen that the examined groups are the same in the number of males and females where it can be concluded that there are no differences in the examined groups when it comes to gender.

Table 1. Gender structure of respondents in the surveyed groups

sex * group Crosstabulation					
		Group			Total
		examined	control		
sex	female	Number	8	8	16
		%	13.3%	13.3%	26.6%
	male	Number	22	22	44
		%	36.7%	36.7%	73.4%
Total	Number	30	30	60	
	%	50.0%	50.0%	100.0%	

Table 2. shows the frequency of the first injuries, which is 35.0% in the examined group and 26.7% in the control group. The percentage of recurrent injuries in the examined group is 15% and in the control group 23.3%. Overall, it can be seen that the first injuries were 61.7% and repeated injuries 38.3% of respondents. Analysis of the differences in injuries (first / repeated) of the examined groups (Table 3) showed that there is no statistically significant difference between the examined and control groups of subjects (sig = .188).

Table 2. Injury (first / repeated) of the examined groups

Injuries		Group		Total
		examined	control	
First injury	Number	21	16	37
	%	35.0%	26.7%	61.7%
Repeated injury	Number	9	14	23
	%	15.0%	23.3%	38.3%
Total	Number	30	30	60
	%	50.0%	50.0%	100.0%

Table 3. The difference in injuries (first / repeated) of the examined groups

Test Statistics ^a	
	Injuries
Mann-Whitney U	375.000
Wilcoxon W	840.000
Z	-1.317
Asymp. Sig. (2-tailed)	.188

Analyzing the types of injuries in the examined groups (Table 4), we can see that in the control group there were no injuries of the type: fissure, fracture, rupture.

Table 4. Types of injuries in the examined groups

		Group		Total	
		examined	control		
Duration rehabilitation	do 10 days	Number	4	13	17
		%	6.7%	21.7%	28.4%
	11-20 days	Number	18	17	35
		%	30.0%	28.3%	58.3%
	preko 20 days	Number	8	0	8
		%	13.3%	0.0%	13.3%
Total		Number	30	30	60
		%	50.0%	50.0%	100.0%

Table 5 using the Mann-Whitney U test shows the differences in the type of injury in the examined groups that are statistically significant sig = .000

Table 5. Differences in the type of injury in the examined groups

Test Statistics ^a	
	Incidence of injuries
Mann-Whitney U	240.000
Wilcoxon W	705.000
Z	-3.719
Asymp. Sig. (2-tailed)	.000

Table 6 shows the results on the duration of rehabilitation in the examined groups. Most of the respondents in both groups had rehabilitation that lasted from 11 to 20 days.

Table 6. Duration of rehabilitation in the examined groups

		Group		Total	
		examined	control		
Duration rehabilitation	do 10 days	Number	4	13	17
		%	6.7%	21.7%	28.4%
	11-20 days	Number	18	17	35
		%	30.0%	28.3%	58.3%
	preko 20 days	Number	8	0	8
		%	13.3%	0.0%	13.3%
Total		Number	30	30	60
		%	50.0%	50.0%	100.0%

Mann-Whitney results The test shows statistically significant differences in the duration of

rehabilitation in the examined groups sig = .001 (Table 7).

Table 7. Differences in the duration of rehabilitation in the examined groups

Test Statistics ^a	
	Rehabilitation duration
Mann-Whitney U	247.000
Wilcoxon W	712.000
Z	-3.406
Asymp. Sig. (2-tailed)	.001

The results in Table 8 show the results of the VAS pain scale - score at the beginning of therapy in the examined groups. It is noticeable that at the beginning of therapy in both study groups, the highest percentage is in the assessment of pain level "5".

Table 8. VAS pain scale - score at the beginning of therapy in the examined groups

		Group		Total		
		examined	control			
VAS pain scale Rating at the beginning of therapy	pain 3	Number	1	2	3	
		%	1.7%	3.4%	5.1%	
	pain 4	Number	4	7	11	
		%	6.6%	11.7%	18.3%	
	pain 5	Number	12	12	24	
		%	20.0%	20.0%	40.0%	
	pain 6	Number	7	4	11	
		%	11.7%	6.6%	18.3%	
	pain 7	Number	4	4	8	
		%	6.6%	6.6%	13.2%	
	pain 8	Number	1	0	1	
		%	1.7%	0.0%	1.7%	
	pain 9	Number	1	1	2	
		%	1.7%	1.7%	3.4%	
	Total		Number	30	30	60
			%	50.0%	50.0%	100.0%

Using the Mann-Whitney U test, it was found that there are no statistically significant differences in the VAS pain scale - score at the beginning of therapy in the examined groups sig. = .215 (Table 9)

Table 9. Differences - VAS pain scale - score at the beginning of therapy in the examined groups

Test Statistics ^a	
	VAS pain scale Rating at the beginning of therapy
Mann-Whitney U	369.500
Wilcoxon W	834.500
Z	-1.240
Asymp. Sig. (2-tailed)	.215

VAS pain scale - the assessment at the end of therapy in the examined groups in Table 10 shows that in the examined group 36.6% of the respondents had "no pain", while in the control group this percentage is 28.3%.

Table 10. VAS pain scale - evaluation at the end of therapy in the examined groups

		Group		Total	
		examined	control		
VAS pain scale Rating at the end of therapy	no pain	Number	22	17	39
		%	36.6%	28.3%	64.9%
	pain 1	Number	7	12	19
		%	11.7%	20.0%	31.7%
	pain 2	Number	1	1	2
		%	1.7%	1.7%	3.4%
Total		Number	30	30	60
		%	50.0%	50.0%	100.0%

No statistically significant differences in the VAS pain scale were obtained using the Mann-Whitney U test - score at the end of therapy in the examined groups sig. = .198 (Table 11).

Table 11. Differences - VAS pain scale - evaluation at the end of therapy in the examined groups

Test Statistics ^a	
	VAS pain scale Rating at the end of therapy
Mann-Whitney U	377.500
Wilcoxon W	842.500
Z	-1.287
Asymp. Sig. (2-tailed)	.198

After the treatment of the condition of the subjects, we can see from Table 12 that the grade "5" was 73.3% of the subjects of the study group, and 63.3% of the subjects of the control group. Grade "4" was given to 26.7% of respondents in the study group, and 36.7% of respondents in the control group.

Table 12. Assessment of the condition of the subjects after the treatment

	1-5	Number / Percentage	Group	
			examined	control
Grades	5	Number	22	19
		Percentage	73,3%	63,3%
	4	Number	8	11
		Percentage	26,7%	36,7%
Total		Number	30	30
		Percentage	100%	100%

DISCUSSION

Ankle injuries are one of the most common injuries. They occur as a result of twisting the feet. They can occur when walking on uneven surfaces, while running, when stumbling, when athletes land on someone else's foot, slip, etc. The most common ankle injuries are distortion (sprain), luxation (dislocation), and fracture (fractures), (Banović, 2006). The goal of rehabilitation is to reduce pain, improve range of motion, and it is equally important to restore strength and proprioception (Singer, Jones, & Taillon, 1995). Meta-analysis has shown

that neuromuscular rehabilitation results in faster improvement in function (de Vries, Krips, Sierveelt, Blankevoort, & Van Dijk, 2011). We compared the results we obtained with the results of research by other authors. The results of our study agree with the study (Pavlović A, 2011), with the proviso that our study shows that a higher percentage of subjects were on combination therapy without pain at the end of treatment. The results of performing dorsal flexion in subjects at the beginning of therapy in the examined groups show that in the control group we have the same percentage when it comes to dorsal flexion up to 5 ° and from 6 ° to 10 ° (23.3%). In our study, subjects were involved in the treatment of physical and kinesitherapy as well as in the treatment of only one of the therapies. At the beginning of treatment, dorsiflexion was at most 15 ° in the total number of subjects, and at the end of treatment 55% of subjects had over 15 °, also, in plantar flexion at the beginning of treatment no subject had over 50 °, and at the end of the study in 30 % of subjects, PF was over 50 °. The treatment lasted an average of 3 weeks and as with the author (Kim & Jeon, 2016) who researched soccer players with recurrent ankle injuries who underwent functional exercises to strengthen joint muscle strength in combination with balance. The rehabilitation program lasted 12 weeks to improve muscle strength and dynamic coordination of the lower extremity. Muscle strength and dynamic coordination were assessed using the Y balance test and isokinetic exercises where they measured dorsal and plantar flexion, inversion, and eversion, before and after 12 weeks. After 12 weeks of rehabilitation, there was a statistically significant improvement in performing dorsal and plantar flexion, inversion, and eversion on the ankle. The results of performing dorsiflexion at the end of treatment are smaller compared to the study they performed (Biškupić G, 2011) where only 5% of subjects were up to 30 °, while the results of performing plantar flexion at the end of treatment showed significantly better results in our study, 30% of subjects over 50 °. The use of combined muscle strengthening and proprioceptive exercises for those who have functional joint instability is more successful than the use of only muscle strengthening exercises. Research (Urguden et al., 2010; Willems, Witvrouw, Verstuyft, Vaes, & De Clercq, 2002) has shown that the use of combined muscle strengthening and proprioceptive exercises for individuals with functional joint instability is more successful than the use of only muscle strengthening exercises. The results of our study at the end of treatment showed that the performance of plantar flexion, dorsiflexion, inversion, and eversion in the study and control groups were equal, but subjects on combination therapy achieved better results faster. In our study, 46.7% of subjects at the beginning of therapy could perform supination over 30 °, while at the end of the study this number was 86.7% taking into account the total number of subjects, while in (Eils & Rosenbaum, 2001; Refshauge, Kilbreath, & Raymond, 2000; Wennerberg, 1991), after an exercise program, there was a significant (almost

60%) reduction in the frequency of ankle inversion. Comparing the study (Bleakley, McDonough, & MacAuley, 2008) with ours, it is concluded that the results of our study contradict these results. Our research showed significant progress in joint mobility in subjects who were on the combination, as well as on the use of only one of the therapies. This especially refers to the performance of dorsal flexion, which is 51.7% of subjects was up to 5 ° at the beginning of the study, and in the end, only 1.7% performed dorsal flexion of 5 °, while other subjects had visible progress.

CONCLUSION

The program of rehabilitation therapy for ankle injuries should be started as early as possible, it must be individually conceived and include a combination of physical therapy and kinesiotherapy. Prevention of ankle injuries consists of adequate warm-up before sports activities, adequate sports shoes, and improvement of fitness, balance, and proprioception.

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AUTHORS INFORMATION:

Davor Arslanagić
Department of Sports Medicine, Sarajevo, Bosnia and Herzegovina
dacho.a@hotmail.com

PREVALENCE OF SPINE DEFORMITIES AND RELATIONSHIP WITH BODY COMPOSITION IN ELEVEN AND TWELVE YEAR OLD STUDENTS

Natalija Kurtović, Nijaz Skender, Ekrem Čolakhodžić, Ifet Mahmutović, Sulejman Kendić, Samir Porić

ABSTRACT: On the sample of 110 students aged 11 and 12, a study was carried out to determine the prevalence of spine deformity and relationship with the body composition. Two methods for determining bodily deformities were applied. The method of Wolanski and the method on the CONTEMPLAS and Tanitu apparatus for body composition. In two variables Sag. Distance cervical spine sacrum results represent the distance of the cervical spine from the projection of the vertical line of sacrum, and the distance of the lumbar spine from the projection of the vertical line of the sacrum show that 85 and 99 subjects had this body posture deformity. These subjects have increased flexion in cervical spine. In one variable Sag. Distance of the cervical spine sacrum, the results in 47 subjects were negative. The result indicates an enlarged extension of the chest part of the spinal column. These results were reflected in the scoliotic posture measured by the Wolanski method. The predictive value of the variables that define the body composition measured by Tanita scale with respect to the criterion defining the variables of scoliotic posture by the Wolanski method, multiple correlation is .440. The complete predictor system has given a statistically significant contribution to the explanation of the criterion variable of scoliotics at a significance level of 0.01%. The largest single contribution was given by the fatproc variable (mass percentage and fat mass. (total weight of fat) There are results in all variables that significantly deviate from the normal body posture and are considered a poor body posture. In some variables, as many as 80-90% of students deviate from good posture. Based on the results, we can conclude that bodily deformities and bad postures are very pronounced in 11 and 12 year olds.

Keywords: *incidence, body deformities, scoliotic posture, body composition*

INTRODUCTION

Physical posture implies proper alignment of body segments and their balance, which is achieved with the investment of minimum strength with maximum mechanical efficiency (Garrison and Read, 1980). So far, many studies have addressed the problem of assessing posture, selecting the best indicators, and assessing the reliability of these procedures (Adar, B.Z. 2004, Stefanović i suradnici, 1972; Tribastone, 1994; Watson, Mac Donncha, 2000; Skender, 2001; Skender, Kendić, 2002; Paušić, 2005; McEvoy i Grimmer, 2005; Demeši, Č. 2007). All these studies were conducted with the aim of detecting irregularities in the posture of children and adults. Lack of movement reduces the ability to regulate the vegetative system, on which largely depends the ability to adapt, resistance and health. (Kosinac, 1994). Sedentary lifestyle leads to an increase in various diseases, especially spinal deformities, which are related to reduced physical activity. Hypokinesia is an insufficient amount of physical activities that the body needs to function normally.

The population of students of all ages is affected by hypokinesia regardless of the place of residence, resulting from a sedentary lifestyle, which, with abundant food most often unconfirmed origins and increased intellectual and emotional activity (Nagyová & Ramacsay, 1999), is a multiplied problem. Today's population of children and young people is burdened by nervous tension, locomotor system disorders and diseases of the cardiovascular and respiratory systems. There is a growing disproportion between meeting biotic needs and the so-called civilisational needs or, more precisely, genetically conditioned and civilisationally imposed demands, and this, of course, to the detriment of the

former (Prskalo, I., et.al. 2010., Kurtović, N. et al 2020).

AIM AND METHODS

The aim of this paper is to determine the frequency of physical deformities in students aged 11 and 12 years and their relationship with the structure and composition of the body.

The aim of this paper is to determine the frequency (prevalence) of spine deformities by students 11 and 12 year olds and relationships with the composition and body structure.

Sample of respondents

The sample of respondents in this study is 110 female and male students aged 11 and 12, citizens of Bosnia and Herzegovina, who are clinically healthy. These are the students of the Elementary School "Gornje Prekounje" in Bihać. The main reason for choosing this population is contained in the observation of the professor of physical education and health, the frequency of spinal deformities and the sudden increase in obese children in this population.

Sample variables

The sample of variables for the assessment of physical deformities (Skender, 2001; Skender, 2004; Skender et al. 2018., Wolanski, 2005) The entire assessment procedure VODRGL - head posture, VORGK - chest posture, VDRLO - shoulder blades posture, VOSKO - scoliotic posture, VODRTR - front abdominal wall posture, and VOBO - leg posture. Evaluation of posture according to the method of Napoleon Wolanski. In order to obtain some assessment of body posture or assessment of

posture for one component, the following scoring is performed: 0 POINTS - if the component is within the given criteria and such condition is considered normal. 1 POINT - the first degree of impaired posture deformity is observed. 2 POINTS - second degree, i.e., marked deviation. This system is good because it gives us the opportunity for a more detailed assessment of certain minor deviations in individual posture elements. It is also possible to evaluate the posture of the body as a whole based on the sum of negative points. Based on these indicators, we determined the prevalence of poor posture and spinal deformities. We formed two groups so that subjects who had up to 8 points were treated as the first group and we characterised them as subjects with good posture, and subjects who had 9 to 16 points were treated as the second group who had poor posture and spine deformities. 0 POINTS - excellent posture. 1-4 POINTS - very good posture, 5-8 POINTS - good posture, 9-12 POINTS - poor posture, and 13-16 POINTS - very poor posture. The second group of variables for the assessment of physical deformities of the back using the measuring instrument Contemplast, professional motion analysis software, (Kovač & al., 2014), a modern tool for the diagnosis of postural disorders. We used a total of 11 variables in this study.

Shoulder rotation

Variable expressed in degrees indicates the rotation in longitudinal axis (transversal plane) of the left/right shoulder. If the results are positive it indicates a rotation of the upper body in which case the right shoulder is placed forward, while negative results indicate a rotation of the upper body in which case the left shoulder is placed forward.

Pelvic rotation

Variable expressed in degrees indicates rotation in longitudinal axis (transversal plane) of the left/right pelvic side. If the results are positive it indicates the rotation in which case the right side of the pelvis is placed forward, while in negative results the rotation of the left side of the pelvis is placed forward.

Trochanter rotation

Variable expressed in degrees indicates rotation of the left/right trochanter in longitudinal axis (transversal plane). If the result is positive it indicates the rotation of the lower body in which case the right side of pelvis is rotated towards front, while the negative results indicate the front rotation of the left side of pelvis.

Condylus rotation

Variable expressed in degrees indicates the knee rotation in longitudinal axis (transversal plane). If the results are positive, it indicates the front rotation of lateral condylus of the right leg, while the negative results indicate the front rotation of the left lateral condylus.

Sag. Distance cervical spine – sacrum*

Variable expressed in centimetres indicates the distance of the most protruded cervical (neck)

vertebra in regards to the vertical line projection of the sacrum (bone at the bottom of the spine) in the sagittal plane. Positive result indicates the increased flexion of the cervical spine, while the negative results indicate the increased extension of the cervical spine.

Sag. Distance thoracic spine - sacrum*

Variable expressed in centimetres indicates the distance of the thoracic spine in regards to vertical line projections of the sacrum (bone at the bottom of the spine) in sagittal plane. Positive results indicate an increase of flexion in thoracic spine, while the negative results indicate an increase in other extension of the thoracic spine .

*Higher values in the positive and negative offset do not apply for the variables "Sag. distance cervical, thoracic, lumbar – sacrum"

Sag. Distance lumbar spine - sacrum*

Variable expressed in centimetres indicates the distance of the lumbar (lower) spine in regards to the vertical line projection of sacrum (bone at the bottom of the spine) in sagittal plane. Positive result indicates an increase in lumbar spine flexion, while negative results indicate increase in the lumbar spine extension.

Varus/Valgus left Variable expressed in degrees indicates the Varus-Valgus alignment angle of the left leg (medial/lateral) at the knee joint.

Varus/Valgus right Variable expressed in degrees indicates the Varus/Valgus alignment angle of the right leg (medial/lateral) at the knee joint.

Flexion/Extension left

Variable expressed in degrees indicates the hyperextension and flexion of the left leg at the knee joint (sagittal plane). Positive result indicates the left leg flexion, while negative result indicates hyperextension of the left leg.

Flexion/Extension right

Variable expressed in degrees indicates the hyperextension or the flexion of the right leg at knee joint (sagittal plane). Positive result indicates the right leg flexion, while the negative result indicates the hyperextension of the right leg.

A sample of variables to assess body composition BIA was measured using a TANITA body composition parameter analyser (the model of TANITA body composition analyser BF-350) in relation to the body composition and age of the subjects. This body composition assessment set includes the following nine variables: HEIGHT - body height, WEIGHT - body mass, BMI - Body Mass Index, BMR - the value of basal metabolism, IMPEDANCE RESISTANCE - bioelectrical resistance of the body, FATPROC - percentage of fat, FATMAS - total weight of fat mass (in kg, lb) in the body, FFM - total lean body mass, TBW - the percentage of water in the body. All formulas and settings used are factory default.

(Musulin J, Baretić M, Šimegi - Đekić V. 2017, Kurtović, N. et al. 2020).

RESULTS AND DISCUSSION

Frequency of physical deformities-poor posture in students aged 11 and 12) based on the method of Napoleon Wolanski

Of the five groups of respondents, table no. 1. The first three groups of respondents who had a total of up to 8 points were treated as respondents with good posture, and respondents who had from 9 to 16 points were treated as respondents with poor

posture. Based on these studies, we found that a total of 66 of the 110 respondents had poor posture. This shows us that more than 50% of respondents in this population had poor posture, which tells us about the increased number of poor posture in students aged 11 and 12 years.

This state of incidence of poor posture (scoliotic, kyphotic and lordotic posture) in primary school students indicates a condition that warns and indicates the need for systematic examinations in schools in order to take preventive measures and develop corrective exercise programs.

Table 1. Frequency of body deformities divided into two groups

Ordinal number	Number of points	Posture	No	groups	total	
1.	0 points	excellent posture	2	1	44	40%
2.	1-4 points	very good posture	10	1		
3.	5-8 points	good posture	32	1		
4.	9-12 points	poor posture	43	2	66	60%
5.	13-16 points	very poor posture	23	2		
Total:			110		110	

Frequency of physical deformities - poor posture in students aged 11 and 12 years) based on the device Contemplast

By applying the most modern equipment, the measuring instrument Contemplast (professional motion analysis software), we obtained significant descriptive and numerical indicators in the deviation from the correct posture. We have applied the logic

based on previous research that when it comes to rotation in variables measured degrees above + 5 and below - 5 is considered poor posture and when it comes to variables where displacement deviation from good posture is considered above + 2 and below -2. The following Table 2 shows the results of a study of the prevalence of poor posture scores for all variables.

Table 2. Incidence of poor posture and spinal deformities

R.Br.	Name of variable	u +	u-
1.	Shoulder rotation	29	14
2.	Pelvic rotation	15	18
3.	Trochanter rotation	7	27
4.	Condylus rotation	14	6
5.	Sag.Distance cervical spine sacrum	85	0
6.	Sag.Distance lumbar spine sacrum	14	47
7.	Sag.Distance cervical spine sacrum	99	0
8.	Varus/Valgus lef	10	2
9.	Varus/Valgus right	10	5
10.	Flexion/extension left	57	3
11.	Flexion/extension right	11	38

Analyzing the above table, we see that in almost all variables there is an increasing number of deviations from proper posture. In the first variable Shoulder rotation where the result is expressed in degrees, and gives us information about the rotation along the

longitudinal axis of the left and right shoulder, we found that 29 subjects rotated the upper torso where the right shoulder is moved forward, and 14 the subject is also a rotation of the upper torso where the left shoulder is facing forward. Therefore, only in

this variable there is a pronounced deviation in 43 subjects. The second variable we analyzed was Pelvic rotation. The results we obtained also tell us about the rotation along the longitudinal axis of the pelvis, a positive result tells about the rotation of the right side of the pelvis, and a negative result about the rotation of the left side of the pelvis forward. A total of 15 subjects had a rotation of the right side forward, and 18 subjects had a deviation of the rotation of the left side of the pelvis forward, which totals 33 subjects.

The third variable analyzed in this study is Trochanter rotation which gives us information about the rotation of the left / right femoral rotator along the longitudinal axis in the transverse plane. In a total of 7 subjects, the rotation of the right side of the pelvis forward was determined, and in 27 subjects it was a rotation of the left side forward.

Analysis of the first variable Sag.Distance cervical spine sacrum which gives us information about the distance of the most protruding cervical (cervical) vertebra from the projection of the vertical line of the sacrum (sacral) bone seen in the sagittal plane, and expressed in centimeters 85 subjects had increased flexion in the cervical spine. Analysis of the second variable Sag.Distance cervical spine sacrum which tells us about the distance of the thoracic (thoracic) spine from the projection of the vertical line of the sacrum observed in the sagittal plane from the results shows that increased flexion in the thoracic spine was obtained in 14 subjects, while enlarged extension thoracic spine we have in 47 subjects. Further analysis of the third variable Sag.Distance cervical spine sacrum which tells us about the distance of the lumbar spine from the projection of the vertical line of the sacrum seen in the sagittal plane indicating increased flexion in the lumbar spine was observed in 99 subjects.

The next variable we analyzed is Flexion / extension left which speaks of hyperextension of the left leg and knee joint in the sagittal plane. A positive result indicates left leg flexion while a negative result indicates left leg hyperextension. In a total of 57 subjects, deviation from normal posture was noted. In the variable Flexion / extension of the right leg, hyperextension of the right leg was noted in 38 subjects, while flexion of the right leg was noted in 11 subjects.

The results of the research show that one of the causes of kyphotic poor posture is probably poor

posture (bending the head towards the sternum) (Simov et al., 2011), and one of the growing problems of our time is excessive computer work. Some research suggests that increased sitting time at the computer leads to an increase in cases of lumbar lordosis, and the reason is improper sitting and looking up, which leads to stretching the torso to keep the view towards the monitor straight (Straker, O'Sullivan, Smith and Perry, 2007). Inactivity leads to weakening and loss of muscle tone, and thus the strength of the back muscles, which causes improper sitting, which can lead to spinal deformities, or the appearance of poor posture. (Kovač, et al 2014,)

From the above results we can conclude that almost all variables have results that deviate significantly from normal body posture, and as such in this paper are considered as poor posture. In some variables, as many as 80-90% of students have a pronounced disagreement with good posture. Analyzing the results of both methods of determining physical deformities, we can say with certainty that the frequency of physical deformities in students aged 11 and 12 years is expressed in a very large volume. Since this is the age where students reach puberty, which is a sensitive period in the development of children and a sensitive period for the emergence of poor posture due to the rapid growth and development that occurs in this period, which we have proven with this paper. The main reason for poor posture is immobility and poor physical activity, which are one of the main external causes of deformities.

Influence of body composition on scoliotic posture (VOSKO)

By regression analysis, we wanted to determine the predictive value of variables that define body composition in relation to the criterion that defines the variable scoliotic posture. By analyzing the table number 3, which shows the regression analysis with the criterion of scoliotic posture, we can conclude that the multiple correlation is high and amounts to .440 and the coefficient of determination .194. The complete predictor system made a statistically significant contribution to the explanation of the criterion variable scoliotic posture at a significance level of 0.01%. Further analysis of the same table shows the individual contribution of each predictor variable to the explanation of the criterion variable scoliotic posture in our subjects.

Table 3. Regression analysis of body composition and scoliotic posture (anova, coefficients)

Model		R	R Square	Adjusted R Square	Std. Error of the Estimate	
1		,440(a)	,194	,138	,55470	
		Sum of Squares	df	Mean Square	F	Sig.
	Regression	Regressi	7,533	7	1,0768	3,498
	Residual	Residual	31,385	102	,308	
	Total	Total	38,918	109		
		Unstandardized Coefficients	Standardized Coefficients	t	Sig.	
		B	Std. Error	Beta	B	Std. Err
	(Constant)	-,841	2,440		-,345	,731
	bmi	,028	,077	,171	,367	,714
	fatproc	-,084	,028	-1,279	-2,978	,004
	fatmas	-,118	,040	-1,344	2,951	,004
	ffmas	-,353	,199	-2,991	-1,772	,079
	tbw	,451	,267	2,804	1,691	,094
	totpor	,003	,002	,270	1,124	,264
	bmr	,000	,000	,239	1,070	,287

Dependent variable: vosko

Predictor variables: bmi, fatproc, fatmas, ffmas, tbw, , totpor, bmi,

The largest single contribution was made by the variable fatproc and fat mass. Fatmass has some significance, but not statistical significance in the explanation of this our model. It is quite understandable that the variable percentage of fat and fat mass is a ballast and an aggravating factor for normal functioning in children. An increase in these two parameters inevitably affected scoliotic posture. All this speaks in favor of the structure of the body, especially from the point of view of fat deposits that accumulate for several reasons, and the most important factor is inactivity and improper diet. Based on these results, we can conclude that obesity affects poor posture in children and especially scoliotic poor posture. (Kurtović, N. et al. 2020). It is very important that in the period of growth and development of physical activity we influence the reduction of subcutaneous fat, which has been proven in this paper as a very important factor in the occurrence of poor posture and deformities.

CONCLUSION

We conclude there are results in all variables that significantly deviate from the normal body posture and are considered a poor body posture. In some variables, as many as 80-90% of students deviate from good posture. Based on the results, we can conclude that bodily deformities and bad postures are very pronounced in 11 and 12 year olds.

The complete predictor system has given a statistically significant contribution to the explanation of the criterion variable of scoliotics at a significance level of 0.01%. The largest single contribution was given by the fatproc variable mass percentage and fat mass. (total weight of fat).

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AUTHORS INFORMATION

Natalija Kurtovi,
Faculty of Education University „Dzemaal Bijedi“ Mostar
natalijakurtovic@yahoo.com
Ifet Mahmutovi
Faculty of Sport and Physical Educaton University of Sarajevo

Sulejman Kendi
Faculty of Health Studies University of Biha

Samir Pori
Faculty of Health Studies University of Biha.
Faculty of Pedagogy University of Biha

Nijaz Skender
Faculty of Pedagogy University of Biha
nijazs@yahoo.com

INFLUENCE OF MORPHOLOGICAL CHARACTERISTICS ON THE FREQUENCY OF BODY DEFORMITIES IN CHILDREN AGED 11 AND 12

Nijaz Skender, Natalija Kurtović, Rijad Novaković, Ernest Šabić, Naim Ćeleš

ABSTRACT: The main aim of this study was to determine the relationship between spinal deformities and morphological characteristics in students aged 11 and 12 years. In the area of morphological characteristics, seven variables were used to measure body volume and circumference, and in the assessment of body posture, the standard method for measuring body deformities according to Napoleon Wolanski was applied, where the assessment is performed by visual method. They performed the assessment by three evaluators. We determined the connection of the entire predictor set with individual variables of criteria. The results showed that within the intercorrelation matrix there is a large correlation between the entire morphological space and three body posture variables, namely the scoliotic posture variable (WAXWORK), the abdominal posture variable (VODRTR) and the leg shape variable (VOOBN). By regression analysis, we determined a significant influence of the predictor system on two body posture variables. We see the influence of morphological characteristics on the variable scoliotic posture through a multiple correlation of 427, and a coefficient of determination of 182, and the statistical significance of the entire system is 0.013, which indicates a significant influence of the entire system on this variable. We did not have a single impact of any variable on the system criterion system. The same is the case with the variable abdominal posture where the multiple correlation was, 419 and the coefficient of determination, 176, which ultimately resulted in a significance level of 0, 018. Based on these results, we confirmed that there is a statistically significant correlation and influence of morphological characteristics as a predictor system with the frequency and level of poor posture and body deformities in the two variables, namely scoliotic posture and abdominal posture.

Keywords: *morphological characteristics, scoliotic posture, abdominal posture*

INTRODUCTION

The growth and development of a child is well biologically programmed, regulated and directed towards genetic potential. The individual differences encountered during development are mainly genetic but also numerous external factors that affect the characteristics of individuals. Body posture implies balanced static and dynamic behavior of the body in space (Čolakhodžić, Vuk, Habul, Tanović and Vujica, 2017). Proper posture implies a relaxed upright posture when walking. Such a posture of the body is actually an appropriate position of the head with a view forward and straight, a slight pull of the shoulders backwards, the chest is pointed forward and the arms are stretched out along the body. The abdomen is retracted, the knees are stretched and the pelvis is set at an angle of 60 degrees. Poor posture is the initial breakdown of the biomechanical balance of the spine. Muscle groups that keep the spine in an upright position due to symmetrical or asymmetrical sagging cause curvature of the spine of the scoliotic or kyphotic type. This is the phase when there are no pronounced changes in the bony parts, so muscle weakness can be strengthened by appropriate exercises and brought to a state of muscle sufficiency with normal physiological curves of the spine (Kosinac, 1992, Skender, 2001.). The sedentary way of life is present in western countries and is spreading to developing countries. As a result, an increase in various diseases has been observed, which are associated with reduced physical activity. Decreased physical activity and immobility lead to hypokinesia. Hypokinesia is an insufficient amount of physical activities that the body needs for normal

functioning (Kurtović, 2017). This phenomenon affects the population of children in the period of growth and development. Disorders and diseases of today - overweight and nervous tension, are increasingly present in young people, and free time of children and adolescents is increasingly used for activities that require almost no muscular effort (Prskalo et al., 2010, Kurtović et al. 2017). The population of students of all ages is affected by hypokinesia regardless of place of residence, resulting from a sedentary lifestyle, which with abundant food most often unconfirmed origins and increased intellectual and emotional activity (Nagyová and Ramacsay, 1999) is a multiplied problem. Morphological characteristics represent the process of growth and ontogenetic development. Nešić, Šabić and Skender (2020) state in their research that the consequence of this is inappropriate attitude towards physical exercise as a measure of prevention from the occurrence of painful states of lumbar syndrome are noticeable. In light of these findings, it can be concluded that is a keyword (which can trigger positive shifts in terms of lifestyle change and thus prevention of LBP) refers to knowledge. That is, continuing education and informing about healthy lifestyles, especially active lifestyles. Morphological characteristics include:

- longitudinal dimensions of the skeleton - growth of bones in length
- transverse dimensionality of bone growth in width
- body weight and volume - total body weight and circumference

- subcutaneous fat - the total amount of fat in the body

Morphological status is determined by anthropometric measurements. Morphological anthropometry is a method that includes measuring the human body and processing and studying the obtained measures. It is applied in many areas: in sports and sports medicine, pediatrics and school medicine for monitoring the growth of children and youth, ergonomics and industry, within standard procedures in practice, for assessing nutritional status, for scientific research of body morphological characteristics during growth and development, correlation of body dimensions with other anthropological characteristics and in the analysis of population structure (Čolakhodžić, Rađo and Alić, 2016). The problem of assessing posture, selecting the best indicators, and assessing the reliability of these procedures has been addressed by many scientists with the aim of detecting irregularities in the posture of children and adults. (Tribastone, 1994; Palmer and Epler, 1998; Watson and Mac Donncha, 2000; Paušić, Skender, 2002; Skender et al, 2018; McEvoy and Grimmer, 2005). Abalkhail (2002) published a study on the incidence of obesity in girls and boys in Saudi Arabia, measured in 1994 on a sample of 2708 subjects and in 2000 on a sample of 2542 subjects. Measurements of morphological characteristics were assessed by measures of body height and body weight, and the BMI value was calculated from the obtained results. Between the two measurements in both sexes, there was an increase in BMI in percentages from 85 to 95 percent. The trend of increase in boys shows the largest increase between the ages of ten and sixteen. The sample of girls showed the smallest increase between the ages of fourteen and sixteen. Abalkhail believes that it would be very important to prepare preventive measures to reduce obesity in this population.

RESEARCH METHODOLOGY

Sample of respondents

The sample of respondents in this study is 110 female and male students aged 11 and 12, citizens of Bosnia and Herzegovina. These are the students of the Elementary School "Gornje Prekounje" in Bihać. The main reason for choosing this population is contained in the observation of physical education and health professors about the frequency of spinal deformities and the sudden increase in obese children in that population.

Sample variables

A sample of variables to assess morphological characteristics AOBGRU-chest circumference, AOBNAD-upper arm circumference, AOBTRB-abdominal circumference, AOBNAT-upper leg circumference, ANABTR-abdominal fold, ANABNAD-upper arm fold, ANABLE-back skin fold

Sample of variables for the assessment of physical deformities (N. Wolanski assessment) The entire assessment procedure (Skender, 2001) VODRGL - holding the head, VORGK - holding the chest, VDRLO - holding the shoulder blades, VOSKO - scoliotic holding, VODRTR - holding the front wall of the abdomen and VOBO - shape of the legs. Assessment of posture according to the method of Napoleon Wolanski.

In order to obtain some assessment of body posture or assessment of posture of one component, scoring is performed.

0 POINTS - if the component is within the given criteria and such condition is considered normal.

1 POINT - the first degree of impaired posture deformity is observed.

2 POINTS - second degree, ie marked deviation.

This system is good because it gives us the opportunity for a more detailed assessment of certain minor deviations in individual posture elements. It is also possible to evaluate the posture of the body as a whole based on the sum of negative points. Based on these indicators, we determined the prevalence of poor posture and spinal deformities. We formed two groups so that subjects who had up to 8 points were treated as the first group and we characterized them as subjects with good posture, and subjects who had 9 to 16 points were treated as the second group who had poor posture and spinal deformities.

0 POINTS - excellent posture
1-4 POINTS - very good posture
5-8 POINTS - good posture
9-12 POINTS - poor posture
13-16 POINTS - very poor posture

DATA PROCESSING METHODS

Data processing was realized in the software package SPSS 18. Manifest variables applied in this experiment were processed by standard descriptive procedures to determine their distribution and basic function parameters, as well as the differences between actually obtained and expected relevant cumulative frequencies.

In this way, it is possible to test hypotheses that the distribution of the obtained results is normal, which was done - tested by Kolomogorov - Smirnov procedure. The following parameters were calculated for the obtained results:

Arithmetic mean - Mean, Standard error - Error, Standard deviation-St. dev., Variance-Variance, Minimum value-Min, Maximum value - Max, Range, Rank, Coefficient of curvature-Skewness, Elongation coefficient - Kurtosis, Total - Sum.

The connection between the space of body deformities and morphological characteristics was examined by regression analysis.

RESULTS

Analysis of central dispersion parameters of applied variables for all subjects

Table 1. shows the central dispersive parameters of measuring instruments for all sets of variables (variables of body posture assessment and variables of morphological characteristics) in students aged 11 and 12 years. The values of minimum and maximum result, arithmetic mean, standard deviation, variance, skewness and kurtosis are presented. A good look at the table shows a good balance of descriptive statistics results. The results range within the normality of the distribution of the applied manifest variables. We can also notice this on the

basis of balanced results of the median and arithmetic mean which are very close (the values are close) which tells us about the correct distribution of the results and the normality of the distribution. The applied manifest variables based on the variability parameters indicate significant variability between the variables which is estimated based on the standard deviation and the variance of the applied variables. Based on kurtosis and skewness, we can assess the balance of the results, which shows the mesocourt distribution of these results. This was quite to be expected as the sample was taken from the natural population by the method of random sampling, and the number of 110 subjects is quite sufficient for normal distribution when it comes to the applied variables that we treated within the paper.

Table 1. Analysis of central dispersion parameters of applied variables for all subjects

Variables	N	Range	Min	Max	Sum	Mean		Std. Dev	Varian	Skewness		Kurtosis	
	Stat.	Stat.	Stat.	Stat.	Stat.	Stat.	Std. Err.	Stat.	Stat.	Stat.	St. Err	Stat.	Std. Err.
AGE	110	2,30	10,70	13,00	1285,10	11,68	,06	,65	,42	,21	,23	-1,34	,45
AMASTJ	110	56,5	27,50	84,00	5076,50	46,15	1,01	10,61	112,75	,69	,23	,64	,45
AVISTJ	110	43,0	132,00	175,00	16723,70	152,03	,78	8,19	67,18	,17	,23	-,24	,45
AOBNAD	110	13,0	17,50	30,50	2522,10	22,92	,28	2,96	8,81	,24	,23	-,61	,45
AOBGRU	110	51,4	43,20	94,60	8076,70	73,42	,86	9,05	81,94	-,26	,23	,53	,45
AOBRBTB	110	72,5	27,40	99,90	7766,80	70,60	,95	10,04	100,81	-,24	,23	2,47	,45
AOBNAT	110	33,1	32,30	65,40	4850,80	44,09	,55	5,81	33,77	,96	,23	2,35	,45
ANABNAD	110	4,30	,30	4,60	164,00	1,49	,08	,87	,76	1,07	,23	,76	,45
ANABLE	110	3,40	,10	3,50	122,30	1,11	,06	,63	,40	1,32	,23	1,57	,45
ANABTR	110	5,70	,10	5,80	194,30	1,76	,10	1,10	1,23	,89	,23	,56	,45
VODGL	110	3,00	,00	3,00	128,00	1,16	,07	,78	,61	-,18	,23	-1,10	,45
VODRRA	110	2,00	,00	2,00	131,00	1,19	,06	,67	,44	-,24	,23	-,77	,45
VORGK	110	2,00	,00	2,00	125,00	1,13	,05	,59	,35	-,05	,23	-,25	,45
VDRLO	110	2,00	,00	2,00	151,00	1,37	,05	,58	,34	-,31	,23	-,68	,45
VOSKO	110	2,00	,00	2,00	113,00	1,02	,05	,59	,35	-,00	,23	-,13	,45
VODRTR	110	2,00	,00	2,00	127,00	1,15	,05	,62	,38	-,11	,23	-,47	,45
VOOBNO	110	2,00	,00	2,00	102,00	,92	,06	,70	,49	,10	,23	-,93	,45
VOSVST	110	2,00	,00	2,00	140,00	1,27	,06	,72	,53	-,47	,23	-,98	,45

Analysis of the results of the correlation of morphological characteristics and body posture for all subjects

Table 2. shows the matrix of intercorrelations and correlations of morphological space and body posture for all subjects. A total of nine variables from morphological space and eight variables from body posture space were analyzed. Based on the results from the matrix of intercorrelations of morphological space, a very large coefficient of correlation between all variables within that space can be observed. Particularly significant are the associations of the body mass variable (AMASTJ) with the variables covering body volume. There is also a very large association with subcutaneous adipose tissue variables, and in particular the variables fold of the back (ANABLE) and fold of the abdomen (ANABTR). These correlations were to be expected because in previous studies, a great connection within the

morphological space was confirmed. Within the posture space, the level of intercorrelations is much lower in both volume and intensity. The variable head posture has a very high correlation with shoulder posture at 0.01% and chest posture at 0.01%, while with abdominal posture at 0.03%. This was to be expected as in upright posture and proper posture proper shoulder posture as well as abdominal posture is crucial in head posture and in the sagittal and frontal planes. The shoulder holding variable, in addition to the explained connection with head holding, has a very high coefficient of connection with shoulder holding, as it is known that the acromion (top of the scapula) connects and enters the shoulder joint, it is inevitable that the position of the shoulder blades This tells us a very high correlation coefficient at the significance level of 0.01. Chest posture also has a high coefficient of association with the head posture variable and the abdominal posture variable. These three variables

are very important in both the frontal and sagittal levels of postural status because they form one chain in maintaining proper posture. Another characteristic variable is the posture of the abdomen, which has correlations with the posture of the head and the posture of the chest, and the correct posture of the spinal column, the muscular wall of the abdomen and back is crucial for maintaining the correct position of the spine. The analysis of the cross-correlation matrix of body posture variables and morphological characteristics showed a statistically significant correlation between the scoliotic posture variable with body mass variables, body volume variables and subcutaneous adipose tissue variables. The variable posture of the abdomen also has statistically significant correlations with the same variables as the variable shape of the legs. This indicates that at the significance levels of 0.1 and 0.5%, there was an

association of these three variables with body mass space, body volume, and subcutaneous adipose tissue. Other variables have individual correlations and we will not single them out. Already at this level of research, it can be stated that there is a significant correlation between morphological space variables and body posture variables.

Within the cross-correlation table, it can be seen that there are statistically significant relationships between the variables scoliotic posture (wax), the variable posture of the abdomen (vodtr) and the variable shape of the legs (voob) with almost all variables of morphological characteristics. These relationships are very significant, which will probably confirm the influence of these morphological characteristics on these variables of poor posture in a later analysis.

Table 2. Analysis of the results of the correlation of morphological characteristics and body posture for all subjects

	VODGL	VODRRA	VORGK	VDRLO	VOSKO	VODRTR	VOOBNO	VOSVST	AMASTJ	AVISTJ	AOBNAD	AOBGRU	AOBRTB	AOBNAT	ANABNAD	ANABLE	ANABTR
VODGL	1	,673**	,559**	,543*	,460**	,529**	,323**	,323**	,054	,047	,039	-,020	,068	,129	,048	,128	,048
VODRRA	,67*	1	,415**	,609*	,376**	,390**	,343**	,249**	,090	,175	,077	,009	,080	,160	-,067	,044	-,057
VORGK	,559**	,415**	1	,454*	,349**	,386**	,221*	,251**	,087	,120	,061	,032	,076	,141	,041	,058	,004
VDRLO	,543**	,609**	,454**	1	,415**	,417**	,311**	,210*	,110	,088	,095	,034	,058	,010	-,061	,059	-,028
VOSKO	,460**	,376**	,349**	,415*	1	,407**	,443**	,299**	,268**	,127	,162	,100	,154	,235*	,281**	,336**	,208*
VODRTR	,529**	,390**	,386**	,417*	,407**	1	,257**	,129	,177	-,149	,237*	,129	,238*	,194*	,288**	,300**	,260**
VOOBNO	,323**	,343**	,221*	,311*	,443**	,257**	1	,507**	,212*	,066	,170	,206*	,068	,133	,250**	,321**	,269**
VOSVST	,323**	,249**	,251**	,210*	,299**	,129	,507**	1	,128	,067	,155	,126	,061	,204*	,156	,123	,145
AMASTJ	,054	,090	,087	,110	,268**	,177	,212*	,128	1	,587**	,825**	,766**	,739**	,669**	,490**	,667**	,651**
AVISTJ	,047	,175	,120	,088	,127	-,149	,066	,067	,587**	1	,328**	,406**	,379**	,341**	-,099	,089	,035
AOBNAD	,039	,077	,061	,095	,162	,237*	,170	,155	,825**	,328**	1	,657**	,669**	,662**	,524**	,612**	,645**
AOBGRU	-,020	,009	,032	,034	,100	,129	,206*	,126	,766**	,406**	,657**	1	,658**	,505**	,350**	,510**	,483**
AOBRTB	,068	,080	,076	,058	,154	,238*	,068	,061	,739**	,379**	,669**	,658**	1	,496**	,262**	,417**	,443**
AOBNAT	,129	,160	,141	,010	,235*	,194*	,133	,204*	,669**	,341**	,662**	,505**	,496**	1	,454**	,524**	,551**
ANABNAD	,048	-,067	,041	-,061	,281**	,288**	,250**	,156	,490**	-,099	,524**	,350**	,262**	,454**	1	,845**	,747**
ANABLE	,128	,044	,058	,059	,336**	,300**	,321**	,123	,667**	,089	,612**	,510**	,417**	,524**	,845**	1	,814**
ANABTR	,048	-,057	,004	-,028	,208*	,260**	,269**	,145	,651**	,035	,645**	,483**	,443**	,551**	,747**	,814**	1

Regression analysis of morphological characteristics and scoliotic posture (VOSKO)

Table 3 shows the results of regression analysis in which the relationship of one continuous dependent variable in this case scoliotic posture with a set of predictor variables in the area of morphological characteristics is shown. This regression analysis is based on the correlation processed in Table 2, but allows us to more accurately determine the interrelationships of a set of variables. In this case, it tells us how well a certain set of variables (morphological characteristics) predicts a concrete outcome. Given the size of the sample on which the research was conducted, we can talk about the ability to generalize, which means that the results obtained on this sample can be obtained on other samples. Since the two variables VOSKO and VODTR show a high correlation, the conditions for the

continuation of the multiple regression procedure have been met. The analysis showed that the relationship between the predictor set of variables and the criterion set of variables (VOSKO) was statistically significant. The prediction of the whole system of morphological characteristics with the variable scoliotic posture reflected through the multiple correlation coefficient is of medium height and is .427 which tells us how much of the variance of the dependent variable is explained by the model. This means that our model explains 43% of the variance of the scoliotic posture criterion variable. The model in this example reaches a statistical significance of .013 which is significant at the sig level. 0.03. The results of this table show that the overall model of predictor variables has a statistically significant effect on the criterion variable scoliotic posture.

Table 3. Regression analysis of morphological characteristics and scoliotic posture

Model		R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	1	,427	,182	,109	,56407	
		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7,101	9	,789	2,480	,013
	Residual	31,818	100	,318		
	Total	38,918	109			
		Unstandardized Coefficients	Standardized Coefficients	t	Sig.	
		B	Std. Error	Beta	B	Std. Err.
	(Constant)	1,424	1,680		,848	,399
	AMASTJ	,023	,017	,416	1,402	,164
	AVISTJ	-,001	,011	-,013	-,085	,933
	AOBNAD	-,049	,036	-,242	-1,349	,180
	AOBGRU	-,017	,010	-,252	-1,738	,085
	AOBRTB	,003	,009	,047	,323	,747
	AOBNAT	,013	,013	,123	,955	,342
	ANABNAD	,056	,127	,083	,442	,660
	ANABLE	,361	,203	,385	1,776	,079
	ANABTR	-,134	,095	-,248	-1,405	,163

Regression analysis of morphological characteristics and abdominal posture (VODTR)

Analysis of table number 4, which shows the results of multiple correlations, shows that the correlation is medium high and amounts to 0.419. The coefficient of determination is 0.17 and tells us how much of the variance of the dependent variable posture of the abdomen explains the model. The model in this example reaches a statistical significance of .013 which is significant at the sig level. 0.03. The results of this table show that the overall model of predictor

variables has a statistically significant effect on the criterion variable abdominal posture. Further analysis of the evaluation of each independent variable did not yield any statistically significant coefficient at the level of 0.05 of any single variable, although the variables body height and abdominal circumference are very close, but not statistically significant. This suggests that all variables as a group had a contribution in creating an impact on this criterion, but that none of the variables made an individual contribution.

Table 4. Regression analysis of morphological characteristics and abdominal posture

Model		R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	1	,419	,176	,102	,59098	
		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7,447	9	,827	2,369	,018
	Residual	34,926	100	,349		
	Total	42,373	109			
		Unstandardized Coefficients	Standardized Coefficients	t	Sig.	
		B	Std. Error	Beta	B	Std. Err
	(Constant)	2,951	1,760		1,677	,097
	AMASTJ	,002	,017	,038	,129	,898
	AVISTJ	-,022	,011	-,286	-1,8949	,061
	AOBNAD	,013	,038	,063	,344	,728
	AOBGRU	-,007	,010	-,108	-,745	,458
	AOBRTB	,016	,0094	,251	1,735	,086
	AOBNAT	,008	,014	,078	,604	,547
	ANABNAD	,017	,133	,023	,124	,901
	ANABLE	,239	,213	,244	1,122	,265
	ANABTR	-,064	,100	-,114	-,641	,523

DISCUSSION

The main aim and purpose of this research is the influence of morphological characteristics on the frequency of deformities that occur for various reasons and their connection with morphological characteristics. The results obtained on a sample of 110 respondents, students of the Elementary School "Gornje Prekounje" in Bihać, aged 11 and 12, were analyzed. The main reason for choosing this population is contained in previous research conducted in the wider region as well as empirical research and observations of school physicians as well as the observations of physical education teachers, the frequency of poor posture and spinal deformities and a sudden increase in obese children in that population. In the space of morphological characteristics, seven variables were applied, intended for measuring body volume and circumference. The basic central and dispersive parameters of the distribution of the achieved results of the applied tests, with an error of the level of 0.05%, enable the confirmation of the hypothesis about the existence of normal distribution of the expressed values.

Based on the results from the matrix of intercorrelations of the morphological space, we noticed a very large coefficient of correlation between all variables within that space. Particularly significant are the associations of the body mass variable (AMASTJ) with the variables covering body volume. There is also a very large association with subcutaneous adipose tissue variables, and in particular the variables fold of the back (ANABLE) and fold of the abdomen (ANABTR). These correlations were to be expected because in previous

studies, a great connection within the morphological space was confirmed. There are very characteristic and significant connections between the predictor and criterion system in the intercorrelation. A large and significant correlation was found between almost all variables of circumference and subcutaneous adipose tissue with the variables scoliotic Posture, Abdominal Posture and leg shape. Within the regression analysis, a positive relationship and influence of the entire predictor system (morphological characteristics on two body posture variables, namely scoliotic Posture and Abdominal Posture variable were determined. Since abdominal muscles are very important in maintaining proper posture and overall posture). In this period of growth and development of children, it is especially important to influence the improvement of morphological characteristics and especially the posture of the abdomen, because the abdominal muscles are very important in maintaining the complete posture of the body.

CONCLUSION

These results showed that morphological characteristics affected poor posture because in students who had increased measures in morphological characteristics in most cases there were certain anomalies in posture as in this case. Based on this research, we can conclude that the morphological characteristics of the team of body circumference, subcutaneous adipose tissue and body weight significantly influenced the development of poor posture and body deformities. It is proposed that schools develop physical skills as well as nutrition education through physical education and health education, which would significantly affect a

better approach to monitoring morphological characteristics.

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AUTHORS INFORMATION

Nijaz Skender,
University of Bihać,
Faculty of Pedagogy,
E-mail: nijazs@yahoo.com

PHYSICAL ACTIVITY OF PRIMARY AND SECONDARY SCHOOL STUDENTS IN THE CITY OF MOSTAR

Dženan Šuta, Adi Palić, Amel Jazvin

ABSTRACT: This research aimed to determine the level of physical activity of primary and secondary school students from the area of the city of Mostar. The research was conducted on a sample of $N = 1381$, aged 11 to 18, attending the fifth and ninth grades of primary school and the first and third grades of secondary school. The obtained data show that the students of the ninth grade of primary school are the most active, while the students of the third grade of secondary school are the least active in terms of engaging in physical activities in their free time. Regarding engaging in organized physical activity, the results showed that the greatest interest in engaging in organized physical activity was expressed by students in the fifth grade of primary school, while on the other hand, the least active students were in the third grade of secondary school. Regarding the frequency of organized physical activity on a weekly basis, we can conclude that it is more frequent among upper grade students, probably because higher grade students are at a more serious level of organized physical activity.

Keywords: Physical activity, sports, students

INTRODUCTION

In the modern age of technology, which has its advantages and disadvantages, more and more children and young people are striving for a sedentary lifestyle, which leads to reduced mobility, insufficient activity required by the body to maintain the necessary level for normal functioning and health - hypokinesia.

Insufficient movement of children and young people negatively affects the anthropological system and health in general. Numerous studies indicate that physical activity is one of the main means in the fight for a healthy and quality life.

For human health and well-being, in addition to a healthy diet and quality rest, regular physical activity is also necessary. However, despite the growing knowledge about the importance and necessity of physical activity, there seems to be no greater gap between what we know and what we do than when it comes to this behavior. This is clearly seen in our population, which seems to be physically inactive in all segments of life - at school and at work or during free time. We spend too much time in front of the screen comfortably reclining in an armchair and watching others play tennis or basketball, we go everywhere by car, and the bike collects dust in the basement - we haven't played sports or recreation for years. (Nutrition and physical activity - Guide to healthy living habits, 2017.) In the accelerated pace of modern life, especially in the city, there is more and more free time, but it is less and less used for their own needs (Andrijašević, 2000). Neglecting the need for exercise can lead to overall developmental disorders (Prskalo 2005).

The aim of this research was to investigate how physically active students are in the area of the City of Mostar, whether they practice a sport, how many times a week, and whether they ride bicycles in their free time. The respondents were students of the fifth and ninth grades of primary schools, and the first and third grades of secondary schools of the City of Mostar. A total of 1381 respondents participated.

METHODS

This research aimed to determine the differences in the level of free and organized physical activity among primary and secondary school students from the City of Mostar.

Sample of examinees

The research was conducted on a sample of $N = 1381$ primary and secondary school students, aged 11 to 18 years. Out of the total number of students, $N = 695$ were of primary school age, more precisely $N = 331$ of them were fifth grade students and $N = 364$ of them were ninth grade students. Out of the total number of high school students $N = 686$, $N = 343$ were first grade students, the rest of the respondents $N = 343$ were third grade students. The primary schools that were exposed to the research are: 6th elementary school, IV Elementary school, Mustafa Ejubović Šejh Jujo, elementary school Bijelo Polje, elementary school Blagaj, elementary school Blagaj, elementary school Cim, elementary school Petra Bakula, elementary school SS Kranjčević, elementary school Vrapčiči, Elementary school "Ivana Gundulića", Elementary school "Mujaga Komadina", Elementary school "Omer Maksumić", Elementary school Antun Branko Šimić, Elementary school Drežnica, Elementary school Ilija Jakovljević, Elementary school Zalik, elementary school "Marina Držića" Buna, elementary school Bartola Kašića, Gnojnice Elementary School, Ilići Elementary School, Third Elementary School. The high schools that were exposed to the research are: Second Gymnasium, Fr. Grga Martić Gymnasium, Mostar Gymnasium, Karađoz Bey's Madrasa, Ruđer Bošković Electrical Engineering School, Juraj Dalmatinac Construction School, Secondary School of Economics and Hospitality and Tourism, Secondary School of Civil Engineering, Secondary School of Mechanical Engineering, Medical High School, Sisters of Mercy Medical School, Traffic High School, "Faust Vrančić" High School of Mechanical Engineering, Gabrijel Jurkić High School of Fine Arts, Textile and Agricultural School, School of Tourism and Hospitality, United World College.

Variable sample

The results of the research were obtained on the basis of a survey sent to the management of the above-mentioned schools, and conducted in cooperation with their class teachers. Students' free activity was checked with the question "I ride a bicycle in my free time", while organized physical activity was examined with the questions "Do they play sports" and "How many times a week do they train"

Methods of data processing

The data were entered into the software package for social sciences (Statistical Package for Social Sciences - SPSS, Version 26.0) in which statistical data processing was performed. For all variables, frequency, percentage were calculated, and the value of mod was used as a measure of central tendency. Each of the expressed attitudes of the students is shown graphically for easier understanding.

RESULTS AND DISCUSSION

Insight into the first group of graphs (Graph 1 - Graph 4) which shows the descriptive parameters of assessing the level of leisure activities "I ride a bike in my spare time", we can see that in terms of leisure activities the highest level was achieved by ninth graders. Out of the total number of ninth grade respondents, 96 (28%) said that they should ride a bicycle for more than 60 minutes. per day, while 109 (32%) students stated that they ride a bicycle for 30-60 minutes.

In second place in terms of the level of free activity are fifth grade students with 88 students (28%) who said that more than 60 minutes. they ride bicycles daily, while 93 (30%) practice cycling for 30-60 minutes. Third in line are high school first graders. In the last place in terms of physical activity are the students of the third grade of high school. Only 45 (14%) ride a bike for more than 60 minutes. per day, while 74 (23%) ride a bike for 30 - 60 minutes per day. When it comes to engaging in organized physical activity, which was assessed by the variable "Do you practice any sport" (Graph 5 to Graph 8), we can see that with increasing age (age of students) there is less interest. We can see that the highest percentage of those who engage in physical activity among fifth grade students (Chart 5) is 185 (57%) students. When it comes to engaging in physical activity on a weekly basis (Graph 9), we see that most students train three times a week (71), 57 students train twice on a weekly basis, while 23 of them train four times a week. On the other hand, those who do not engage in organized physical activity, 138 of them (42%). In the second place in terms of organized physical activity are ninth grade students (Chart 6), 143 of them (39%). Based on the week (Graph 10), 37 students train three times a week, 29 students train four times a week, while 28 of them train twice a week. There are 212 (58%) of those who do not engage in physical activity. In third place are first-grade high school students (Chart 7), while in third

place are third-grade high school students (Chart 8) 78 (23%). On a weekly basis, 30 of them train three times, 28 of them five times, while 24 of them train four times a week (Graph 12). There are 260 (77%) of those who do not train in the third grade of high school.

A study (Petrović, 2020) conducted with high school students concluded that students who are more engaged in physical activity have a lower level of body mass index, which is directly related to the health status of the organism. Therefore, we can conclude that much more attention needs to be paid. According to data from the report (Inchley et al. 2016) Health Behavior in School-aged Children in the countries of the European Union the prevalence of insufficiently physically active adolescents ranges from 82 to 95% for girls and from 72 to 89% for boys. Data for Croatia (Ajman, 2016) show that at the age of 15, 88% of girls and 75% of boys do not spend at least one hour of physical activity at moderate to submaximal intensity per day. The data obtained in the research (Floričić, 2021) can determine that fewer and fewer students engage in physical activity in their free time, but most lower grade students still practice physical activity in accordance with the recommendations of the World Health Organization and the results obtained in our study. As the years increase, the minutes in which students are physically active due to various obligations decrease. (Klaričić and Vidranski 2021) They came to the conclusion that there is no difference in total physical activity between urban and rural areas, but students from urban areas show greater physical activity in Physical Education and Health classes and during physical activities in free time. Students who come from rural areas show greater physical activity in a variety of sports. Contrary to the results of the research (Klaričić, Vidranski and Cvitanović 2020), we obtained the result that lower grade students engage more in physical activity than higher grade students. In contrast to the research he conducted (Prskalo 2007) on a sample of 287 students from 1st to 4th grade of primary schools (ages 7 to 10). The research showed a worryingly low frequency of responses that put the subject of physical education and health in the first place in importance for future life (13%) while the preference of this subject is slightly higher (37%). (Badrić, Prskalo and Kvesić 2011) within the 20th Summer School of Kinesiology of the Republic of Croatia in 2011 wrote a professional paper on "The importance of kinesiological activity in the formation of children's free time." In their work, they say that many developed countries of the world are facing the problem of immobility of children and youth and are trying to stop it in various ways. One of the ways to try to achieve this is to implement intervention programs. The programs aim to increase the level of daily physical exercise of children, ie to create the habit of daily application of kinesiological content.

CONCLUSIONS

Minimum recommendations for older children and young people require a higher level of physical activity compared to adults. During the day, children and young people aged 6 to 17 should accumulate at least 60 minutes of physical activity each day, moderate to high intensity (Nutrition and physical activity - Guide to healthy living habits, 2017)

Children and adolescents should avoid prolonged periods of inactivity, ie rest for more than 2 hours a day, most often related to computer use, playing games, watching television (Diet and physical activity - Guide to healthy living habits, 2017).

Parents also play an important role in participation by supporting them or imitating their children. In addition to parents and family, school is also important because it should provide the bulk for the development of physical activity, including informing students and encouraging physical activity.

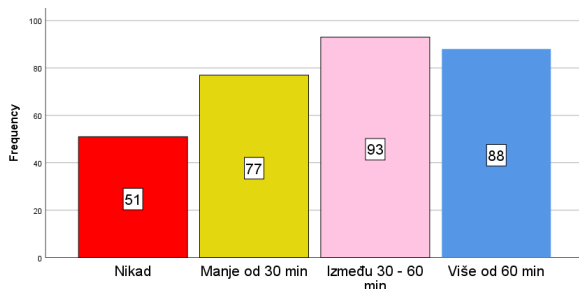
Rare are the human activities that can simultaneously influence as many human traits as possible through professionally designed kinesiological activities. If we accept the obvious fact that the need for movement is a basic biotic need and that the child voluntarily and completely surrenders to spontaneous play or some other form of physical activity, we conclude that from the point of view of "useful" leisure time kinesiological activity without alternative (Prskalo, 2005)

This result of training organized activities on a weekly basis is logical given that high school students are

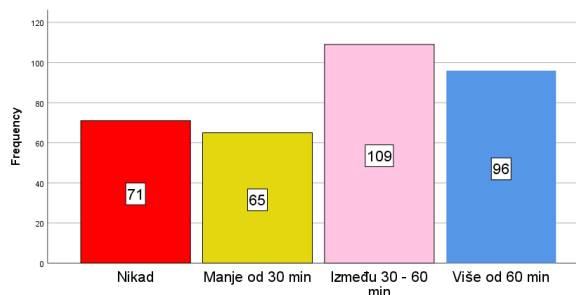
already specializing in selected sports activities, while on the other hand in primary schools it is still on an amateur basis. An alarmingly large number of primary school students stated that they do not train in any sport, 50.5% of them, and 70% of the secondary school age population. The biggest reason for this can be found in the poor organization of training sessions. It is assumed that they are usually in the evening, which in time does not suit children who come from the vicinity of Mostar or live a little further from school, and at that time do not have transportation to training. Also worrying is the fact that a larger number of respondents of secondary school age stop playing sports after primary school age. The reason for such results can be found in all major school obligations that are placed before the student. It is assumed that the solution could be a better organization of school schedules, where children would finish their school obligations earlier and could arrive for trainings. Also, one of the solutions is greater promotion of sports in the teaching of Physical Education in cooperation with sports clubs, and the affirmation of children in sports by showing them their affinities for some kind of sport.

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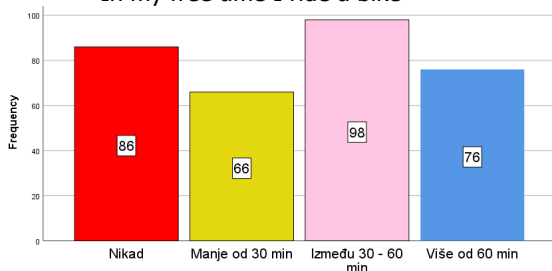
Graph 1. Fifth grade of elementary school
In my free time I ride a bike



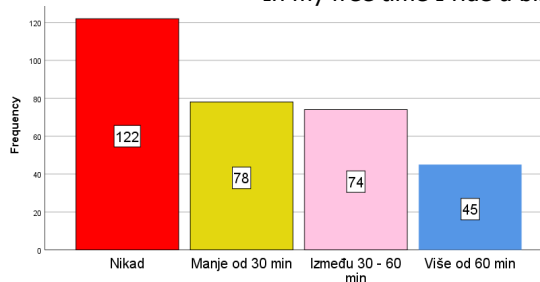
Graph 2. Ninth grade of elementary school
In my free time I ride a bike



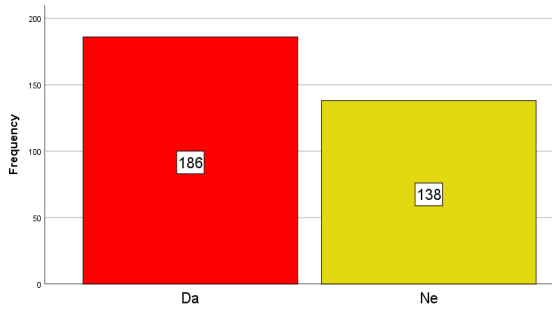
Graph 3. First grade of high school
In my free time I ride a bike



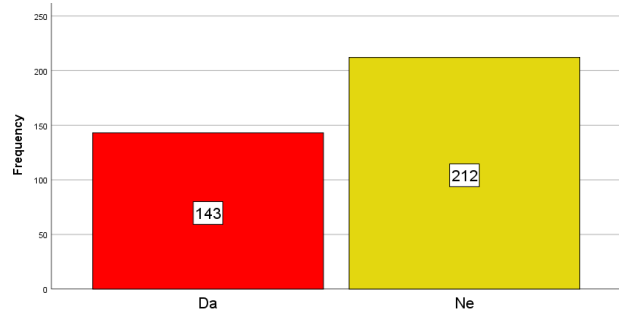
Graph 4. Third grade of high school
In my free time I ride a bike



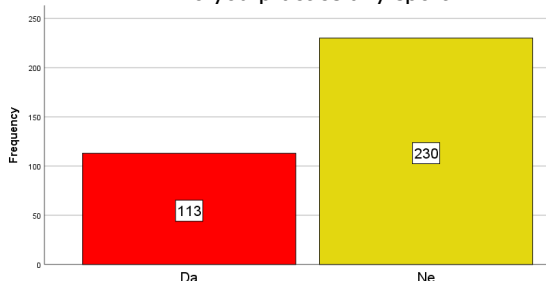
Graph 5. Fifth grade of elementary school
Do you practice any sport



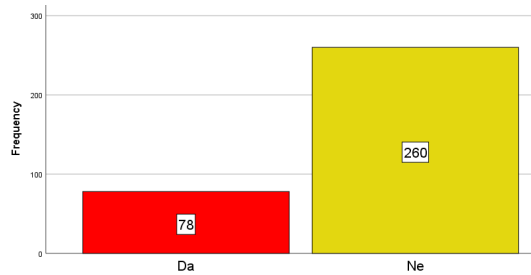
Graph 6. Ninth grade of elementary school
Do you practice any sport



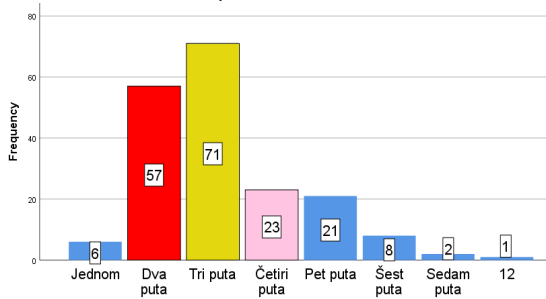
Graph 7. First grade of high school
Do you practice any sport



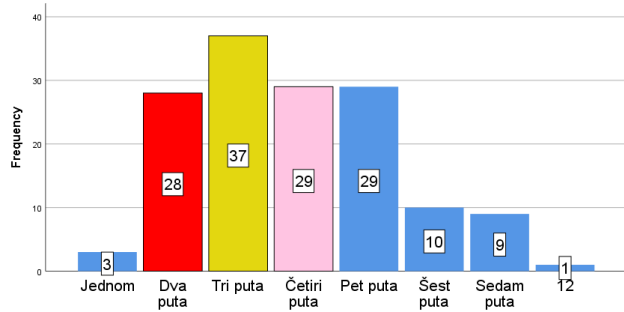
Graph 8. Third grade of high school
Do you practice any sport



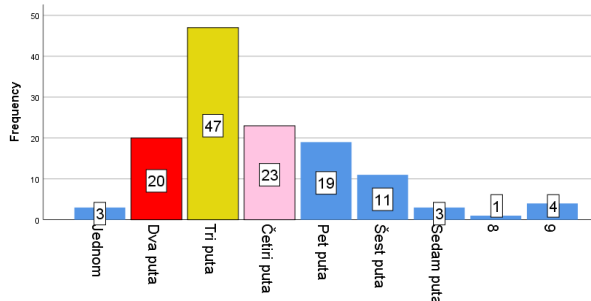
Graph 9. Fifth grade of elementary school
How many times a week you practice



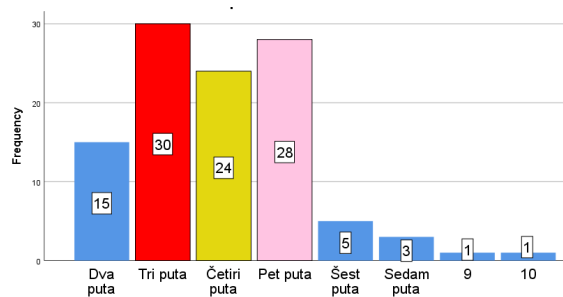
Graph 10. Ninth grade of elementary school
How many times a week you practice



Graph 11. First grade of high school
How many times a week you practice



Graph 12. Third grade of high school
How many times a week you practice



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AUTHORS INFORMATION

Dženan Šuta
Sport association of Mostar
Kinesiology Doctoral Degree Program at Džemal Bijedić University of Mostar
e-mail: dzenansuta@gmail.com

Adi Palić
Faculty of Education at the Džemal Bijedić University of Mostar
e-mail: adi.palic@unmo.ba

Amel Jazvin
Kinesiology Doctoral Degree Program at Džemal Bijedić University of Mostar
e-mail: amel_jazvin@live.com

