DIFFERENCES OF MORPHOLOGICAL CHARACTERISTICS AND MOTOR ABILITIES OF STUDENTS INVOLVED IN DIFFERENT KINESIOLOGICAL ACTIVITIES

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Abstract: *The study was conducted on a sample of 51 male respondents, members of school sports sections of athletes (N = 15), basketball players (N = 21) from Novi Sad elementary school "Zarko Zrenjanin" and students (N = 15) of the Novi Sad school who do not practice sports, ages 11-12. Measurement of morphological characteristics and motor abilities was performed on them. Using multivariate analysis of variance, it was found that there were statistically significant differences in morphological and motor space. Individual analyzes revealed differences in the medium circumference of forearm, standing long jum, backwardsobstacle course* and *wide legged seated forwardvariables. The results of the Bonferoni comparison confirmed the existence of significant differences in the medium circumference of forearm variable, between athlete and student in favor of athlete and basketball player and student in favor of basketball player, and that there are significant differences between athletes attending school sports sections and non-sports students in favor of groups of athletes and basketball players, and between the athletic and basketball section students, there are significant differences in the backwards obstacle course and wide legged seated forward variables in favor of the athletic group. Directed physical activity contributes to a greater degree of development of the motor skills of the students who practice them.*

Key words:*school sports section; students; extra activity; differences.*

Intoduction

In order to develop a healthy population, it is necessary to develop exercise habits.One of the possible solutions for improving the development of children is the inclusion in optionalextracurricular school (school sports sections) and extracurricular sports activities (sports societies and clubs), with physical and health education classes.It is well known that the way of life today is characterized by the lack of movement of young people, who now spend more time at the computer, that there are more activities related to sitting, which is why there is an intense need to involve as many children as possible in extracurricular sports activities(Zivicnjak, Zebec, Franke, Filler, Szirovica, Haffner, Querfeld, Ehrich &Rudan, 2001; Breslauer, Maršić i Mesarić, 2004).

For these reasons, it is necessary to gather as much information as possible about the effects of exercise on the health, motor and functional abilities of elementary school students.The aim of physical education teaching is to transform the dimensions of the anthropological status of the students, with the emphasis on the transformation of the dimensions of the morphological, motor and functional subsystems in the teaching

process.Extra sport activity in the form of school sports sections in extracurricular activities also contributes to the development of the child in the morphological, motor and functional space(Breslauer, 2002). Since natural forms of movement are less and less represented in everyday life, children need to be taught just that first, and regardless of the sport activity that the child is engaged in, the most important attention should be given to natural forms of movement, which is not given to different sports enough attention.They need to be more interested in school sections and sports games.

Studies of a similar type were conducted by Breslauer, Delija, Jelenić(2005)as well as Vrbik, Gruic, and Ohnjec(2010)with the aim of determining the existence of significant differences between the respondents of directed school sports activities and children not involved in similar activities and to determine the higher level of motor abilities of children directed physical activity.The results obtained showed that there were significant differences between the groups of subjects in some anthropometric variables (body weight and medium circumference of forearm).Based on previous research by foreign authors on the activities of children in extracurricular school sections, there is an interest of authors in similar work of this type in Novi Sad.

The problem was the analysis of differences in anthropometric characteristics and motor abilities of boys aged 11-12 years, with different physical activities.The subject of the paper was morphological characteristics and motor skills, while the aim of the study was to determine the possible differences in the morphological characteristics and motor abilities of students involved in various sports activities and children who do not practice sports from Novi Sad, aged 11-12 years.

Method

The sample of respondents for the purposes of this paper consisted of 51 subjects: 15 student members of the school athletic section, 21 students of collective sports (basketball sections) and 15 students who do not attend school sports sections and do not play sports, aged 11-12 from Novi Sad. At the time of measuring and testing, all respondents attended the elementary school "Zarko Zrenjanin", and athletics and basketball are the most represented sports in the school and there are school sports sections from these two sports, which is why they were selected.

Measurement of morphological characteristics that could determine the physical growth and development of children, youth and people implied the measurement of: 1) Body height (mm); 2) Body mass (0.1 kg) and 3) Medium circumference of forearm (mm).

The following standard motor tests were used to evaluate motor skills:I To evaluate movement structuring factors: 1) Standing long jump - evaluation of the explosive power of the legs;;2) backwards obstacle course - assessment of whole body coordination.II To evaluate the synergistic tuning of the tone: 3) wide legged seated forward - evaluation of the flexibility of the posterior lobe of the thigh.

After obtaining the consent of the principal and the consent of the parents, a complete survey was conducted on the population of children in the fifth and sixth grades of the "Nikola Tesla" elementary school in Novi Sad.The survey was conducted in the classes of physical education and school sports sections in June 2016.The measurements were made in the sports hall of the mentioned elementary school in Novi Sad.

Statistical data processing meant calculating descriptive statistics of anthropometric and specific-motor variables: arithmetic mean (AM), standard deviations (S), minimum values (MIN) and maximum values of the measurement results (MAX),Skewness (measure of horizontal deviation from normal distribution) and Kurtosis (measure of vertical deviation of distribution from normal) of elongation of distribution.Multivariate analysis of variance (MANOVA), univariate (ANOVA) analysis of variance and Bonferoni comparison with

significance level p≤0.0167 were used to determine the existence of statistically significant differences between groups of subjects in anthropometric and motor variables.In order to determine the existence of statistically significant differences between the groups of subjects in the anthropometric and motor variables, we used the multivariable analysis of variance (MANOVA), the univariate analysis (ANOVA) of the variation and the Bonferoni comparison with the significance level p≤0.0167.

Results

The results of the descriptive statistics of the morphological and motor variables (table 1) indicated a similar level of growth of the body in all the three groups of subjects observed through all the three variables analyzed to evaluate both the length of the skeleton (the height of the body) and the volume and body weight (body weight and medial circumference of the forearm).Given that we are dealing with an initial selection of children, at the school level, it can be concluded that it is satisfactory at least in terms of morphological characteristics.Taking into account the average values, it is concluded that the respondents of the basketball section are the highest on average, while the students who do not play sports are on average the hardest, and the students of the athletics school section stand out with the highest average values of the forearm circumference.

For motor variables, regarding the homogeneity of the sample, the same conclusions can be drawn: the subjects of the different groups formed are at a similar level of development of explosive leg strength, coordination and body flexibility as seen within their groups. Skewness and Kurtosis values indicate that the analyzed distributions do not deviate significantly from the normal distribution.

Table 1. DESCRIPTIVE STATISTICS OF MORPHOLOGICAL AND MOTOR VARIABLES

Variable	Group	AM	S	MIN	MAX	Sk	Kurt
Body height (0,1 mm)	Athletes	1576,47	65,11	1489	1671	0,27	-1,27
	Basketball	1620,24	61,07	1505	1735	-0,09	-0,03
	Students	1586,73	69,68	1486	1771	1,10	2,53
Body mass (0,1 kg)	Athletes	445,40	56,80	345	526	-0,14	-1,04
	Basketball	476,81	50,05	353	541	-0,57	0,11
	Students	484,20	84,32	387	635	0,64	-0,95
Medium circumference of forearm (0,1 mm)	Athletes	219,13	10,53	195	230	-1,26	1,12
	Basketball	211,62	10,31	195	235	0,17	-0,17
	Students	199,60	8,38	185	214	0,11	-0,25
Standing long jump (0,1 cm)	Athletes	180,47	14,45	162	210	0,52	-0,63
	Basketball	178,81	10,91	154	200	-0,25	0,45
	Students	163,77	11,06	148	183	0,34	-1,00
backwards obstacle course (0,1 s)	Athletes	147,73	12,78	130	175	0,58	-0,23
	Basketball	176,71	17,31	150	215	0,39	-0,37
	Students	182,93	13,40	150	201	-0,76	-0,28
Wide legged seated forward (0,1 cm)	Athletes	47,67	7,11	37	57	-0,26	-1,26
	Basketball	43,24	4,19	36	49	-0,01	-1,25
	Students	37,67	5,14	29	47	-0,06	-0,76

Legend: MIN - minimum values of the measurement results; MAX-maximum values of the measurement results;Sk – Skewness (inclination) / Kurt – Kurtosis(distribution elongation).

Based on the Wilks' lambda F report (Table 2), it can be concluded that there is a statistically significant difference between the subjects of the different groups in terms of their morphological characteristics at F = 6.75.By the individual analysis of each morphological variable, it is concluded that there are statistically significant variations in the variable (table 2) *The average forearm circumference.*

Table 2. DIFFERENCES IN MORPHOLOGICAL VARIABLES

Variable	Group	F	p	F	P
Body height	Athletes	2,29	0,11	6,75	0,00
	Basketball				
	Students				
Body mass	Athletes	1,61	0,21		
	Basketball				
	Students				
The average circumference of forearm	Athletes	15,05	0,00		
	Basketball				
	Students				

Legend: F - univariate f test; p - level of statistical significance of f test; F - multivariate Wilkson F test; P - statistical significance of multivariate F test.

Considering the multiple correction procedure of Bonferoni, it can be concluded that there is a statistically significant difference in the variable for estimating the volume of the skeleton, the average volume of the forearm, between: athlete and student (p = 0.000) in favor of the athlete and the basketball player and of the student (p = 0.002) in favor of the basketball player.In the remaining two analyzed variables, no statistically significant differences were observed between the groups of subjects (p> 0.017).

Table 3. BONFERONI'S COMPARISON OF MORPHOLOGICAL VARIABLES

Variable	Group	Group	The difference of the AM	p
Body height	Athletes	Basketball	-43,77	0,155
		Students	-10,27	0,981
	Basketball	Students	33,50	0,400
Body mass	Athletes	Basketball	-31,41	0,455
		Students	-38,80	0,306
	Basketball	Students	-7,39	0,980
Medium circumference of forearm	Athletes	Basketball	7,51	0,086
		Students	**19,53**	**0,000**
	Basketball	Students	**12,01**	**0,002**

Legend: p - the level of statistical significance of the Bonferoni comparison.

Based on the Wilks' lambda values (Table 4), it can be concluded that there is a statistically significant difference between subjects of different ages in terms of their motor

skills at F = 13.23.By analyzing each motor variable individually, it is concluded that there are statistically significant differences in all three analyzed variables (Table 4): Standing long jump, backwards obstacle course wide legged seated forward

Table 4. DIFFERENCES IN MOTOR VARIABLES

Variable	Group	F	P	F	P
Long jump on the spot	Athletes	9,86	**0,00**	**13,23**	**0,00**
	Basketball				
	Students				
Back polygon	Athletes	21,71	**0,00**		
	Basketball				
	Students				
Wide legged seated forward	Athletes	12,67	**0,00**		
	Basketball				
	Students				

Legend: F - univariate f test; p - level of statistical significance of f test; F - multivariate Wilkson F test; p - statistical significance of multivariate F test.

Considering the procedure for correcting Bonferoni's multiple comparisons, it can be concluded that there is a statistically significant difference in the variable for the estimation of the structuring factor of the Jump motion in length from the spot, between: athletes and students (p = 0.001) for the benefit of athletes; basketball players and students (p = 0.001) for the benefit of the basketball players.In the back polygon variable, between: athlete and basketball player (p = 0.000) in favor of the athlete, then athlete and student (p = 0.000) in favor of the athlete.In a variable to evaluate the synergistic regulation of tone wide legged seated forwardbetween: athlete and student (p = 0.000) in favor of athlete and basketball player and student (p = 0.012) in favor of basketball player.

Table 5. BONFERONI COMPARISON OF MOTOR VARIABLES

Variable	Group	Group	The difference of the AM	p
Long jump on the spot	Athletes	Basketball	1,66	0,985
		Students	17,40	**0,001**
	Basketball	Students	15,74	**0,001**
Back polygon	Athletes	Basketball	-28,98	**0,000**
		Students	-35,20	**0,000**
	Basketball	Students	15,74	0,754
Wide legged seated forward	Athletes	Basketball	4,43	0,061
		Students	10,00	**0,000**
	Basketball	Students	5,57	**0,012**

Legend: p - the level of statistical significance of the Bonferoni comparison.

Disccusion

The reason for the existence of statistically significant differences between athletes and basketball players in the space of movement structuring factors, manifested by the variables standing long jum and backwards obstacle course, can be attributed to the individual preferences of the physical education teachers, but also to the current requirements and opportunities for implementation. of the program for these groups of respondents.Also, it should be noted that in the structure of athletic training, especially in the introductory and final part of the training (for the school sports club - athletics section),more exercises are represented for developing flexibility through the use of static and dynamic stretching-tightening in relation to the lessons of the school sports club-basketball section.

In training process technology, the primary creation of an optimal situational training model (Bowerman, Freeman, Vern Gambetta & T.A.C., 1999).The situational model implies that exercises are used in the training process to develop those motor skills that are primary in a given discipline.As the school section was concerned and the respondents are not active athletic competitors, and their age is in the category of "beginners", the situational model is not aimed at just one selected discipline, but is comprehensive.This means that it is geared towards improving the motor skills that are primary in most athletic disciplines.Because explosive power is one of the determinants of success in all activities that require the exercise of maximum muscular strength in a unit of time as short as possible (Newton & Kreamer, 1994), it is an important factor in those activities where it is necessary to exercise grants a great acceleration to the body mass, the mass of some body parts or external object, which implies all the athletic disciplines.Therefore, in the basic training of athletics, more attention is paid to developing the strengths of the lower extremities, which are essential for achieving good results in all athletic disciplines, thus representing vertical, horizontal and combined vertical and horizontal jumps, which cause effects positive on explosive movements, balance and more efficient ability to repeat start accelerations (Ramírez-Campillo, Gallardo, Henriquez-Olguín, Meylan, Martínez, Álvarez, et al., 2015). In addition, maximum load is applied in athletic training very often, depending on the training plan and program, because such load is very effective in the process of developing physical abilities, since it simulates the expression of maximum load as well as during competition (Bondarchuk, 2010), but also as when testing.On the basis of the above, the result is that the athletes in the variable Jump away from the place achieved the best results, ahead of the basketball players.Basketball, on the other hand, requires the manifestation of certain types of power: repetitive and explosive.In the immediate game, specific abilities are manifested that are determined by a high percentage of power: jump, start speed, acceleration, stop and slow, and more.The goal is to perform complex basketball movements with as much muscle force as possible in as little time as possible, and that this can be repeated several times if necessary (Karalejić i Jakovljević 2008).As explosive power is defined as the ability of the neuro-muscular system to withstand relatively high external loads at high contraction rates (Sudarov, 2007), it is crucial in the so-called. explosive activities such as jumps and is an important feature for basketball players (Aşçi, & Açikada, 2007; Paiva Neto & César, 2005).In this study, it should be noted that the students were focused on the development of different motor skills, which were not examined in this research.However, basketball training technology also develops motor skills that are incorporated into the basketball game itself, such as speed, agility, strength - especially explosive power, etc.However, although in the training process it was very likely the development of the same motor skills, but with different percentages and different means of training, the students who trained the athletics obtained better results in the standing long jump variable compared to students who have coached basketball, although not at a statistically significant level.The reason is most likely that in basketball, the jump itself is performed in different directions, high jumping prevailed.Such a jump represents the ability to exert a large amount of muscular force

in a vertical direction, very quickly in a short time, so training was most likely to develop a vertical type jump, which is most commonly encountered in athletics.Although both studied groups showed a greater explosive force of the extensor muscles of the legs, compared to the students who do not practice any sport, the best results were obtained by the athletes, ie the group that in the training process applied exercises for developing the horizontal jump, which are much more similar to the test of standing long jump, which is equally horizontal.In line with the above, it is a logical explanation that the respondents who attend additional school sports sections are at a higher motor level in terms of explosive leg strength, because they have regular physical exercise (in physical education classes) and additional activities (in athletic and basketball school sections), they strengthen their leg muscles through various exercises applied to the adequate section.Research has shown that a complex training program influences better neuromuscular adaptation and maximum strength and speed of effort, but especially, the combination of concentric exercises, eccentric-concentric explosive exercises influences the rapid generation of muscle strength (Fatouros, Jamurtas, Leontsini, Taxildaris, Aggelousis, Kostopoulos et al., 2000; Jensen & Ebben, 2003; Kukrić, Karalejić, Petrović i Jakovljević, 2009). Regularly toning the muscles and increasing the stimuli in them, training leading to the inclusion of more motor units in the movement, there were also differences in the benefits of athletes and basketball compared to students who do not do sports, which could be expected.

In the second variable for estimating the structure factor of the backwards obstacle course movement, statistically significant differences were observed between the three groups tested in favor of athletes.They were at a higher level of coordination development than basketball players and non-sporting students.Previous experience gained in schoolsports section classes, higher power levels, richer motor experience have contributed to the fact that there are better results for more active groups of students (athletes and basketball players) than non-athletic students.The contents of the athletics program cover a large motor space. Research done on athletes and basketball players found a significant difference in motor skills.It should be mentioned, in order to plan the contents of the program in extracurricular activities, that athletes have a better expressed repetitive power factor, better mobility, balance and speed, while basketball players have good coordination, speed, mobility and all forms. of manifestation of power (Popović,Boli, Stanković, Ochiana, Savić, & Bojović, 2014).This information is especially useful for physical education teachers in schools that run sports departments.The students of the athletics section scored on average better results than the students of the basketball section, which may be due to a better coordination of this group of respondents of the same age and the fact that a greater longitudinality in the basketball players could have made it difficult to pass under the Swedish box in the group of respondents of the basketball school section.Also the fact that they were on average taller, had bigger problems when pushing through the frame of a Swedish crate and moving backwards over an obstacle.

From the earliest childhood, the child develops and acquires the proper sports habits in the years to come. The habit leads to the need for movement and if it is preserved throughout life, it will have optimal effect (O'Sullivan, 2004; Tappe & Burgeson, 2004). Through training, exercising and learning new movements, these two groups of subjects improved their motor skills, which were incorporated into basic motor skills, such as coordination.Greater motor experience and a wealth of movement have contributed to the significant differences between the group of non-sporting students.The result is consistent with the fact that athletes who besides physical education and other sports differ statistically significantly in terms of motor characteristics compared to their colleagues who do not practice any sport (Vuksanović, 1999).

The results of this study showed that there were significant differences between the groups of subjects in one anthropometric variable, Medium Scope of the Forearm, with regard to the type of school sports section in which the students were involved, in favor of groups engaged in athletics and basketball in extracurricular activities in relation to students who do

not practice sports.The mean circumference of the forearm, as a parameter that could indicate the condition and level of training (Breslauer, Maršić i Mesarić, 2004), was more pronounced in students attending sports school sections. Even athletes had higher values of this anthropometric variable than the students in the basketball section, so it can be stated that they are in a better level of morpho-motor status.Racing performance in athletics is influenced by body weight(Kenney & Hodgson, 1985), body mass index (Knechtle, Knechtle, &Rosemann, 2010;Hoffman, Lebus, Ganong, Casazza, &Van Loan, 2010; Sedeaud, Marc, Marck, Dor, Schipman, Dorsey, et al., 2014)and body fat percentage (Hoffman, 2008;Hetland, Haarbo, &Christiansen, 1998) other than skin folds and their sums, and the results are not surprising. It should not be overlooked that a large part of the respondents involved in school sports sections are engaged in the same sports in some of the sports clubs in Novi Sad, and that their dominance in motoring may have been a consequence of long sports.

The results of this research confirm the previous research of Breslauer, Delija and Jelenic (2005) and can be used in terms of better planning of the physical education process implemented in the system of education of elementary school students.Studies of the effects of additional physical education instruction within the school sports society for physical culture in primary school students indicate that the correct methodological shaping of training work results in significant positive transformational effects of anthropological characteristics (Cicović, 2010).

This paper could support anthropological disciplines, and it would be reflected in the analysis of the status of particular anthropological dimensions of elementary school-age children, who are included and who are not included in the kinesiological activity programs. In future studies of a similar type, it would be desirable to carry out longitudinal research on the same groups of subjects so that their further growth and development in the morphological and psychomotor domains could be monitored.

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Statement

The authors have equally contributed to the paper.

Conflict of interest

We declarate there is not conflict of interest between authors.

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