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CORRELATION BETWEEN RESULTS OF EXPLOSIVE STRENGTH AND SPEED TESTS IN YOUNG FOOTBALL PLAYERS

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Abstract: The subject of this research are the motor skills of children of preschool, younger school and middle school age who train football. The aim of the study was to establish the level of correlation of the observed tests in different age categories, as well as the influence of morphological characteristics on motor test results in subjects of different age. To assess morphological characteristics: body height and body weight, and three variables - foot tapping for 15 seconds, standing long jump and 30m sprint tests were used. The study involved transversal research conducted on a sample of 40 boys of preschool, younger school and middle school age (6-13 years old), who actively played football in the "Jedinstvo" school of football from Gospodjinci. The training experience of the respondents ranges from 6 months to 5 years. The obtained results indicate that there is no statistically significant correlation between explosive strength and speed tests in preschool age, while in younger school age the statistical correlation is significant, and in middle school age the correlation is the greatest. The obtained results confirmed that the level of connection between motor tests changes depending on the age of the examinees. Body

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height and body weight were found to have a statistically significant effect on the results of the long jump and 30m sprint tests only in middle school age. This type of statistically significant influence of body height and body weight on the results of motor tests was not observed in preschool and younger school age.

Key words: *motor skills, morphological characteristics, young football players.*

INTRODUCTION

Football is a game that is actively played by over 240 million people in more than 200 countries around the world. The continuous growth and popularity of the football game is reflected in the growing number of organized football schools for the youngest football players, starting with boys and girls aged 3-4.

Modern play requires abilities that are manifested through extremely fast, strong and explosive movements and activities. By analyzing a football match, the researchers came to the conclusion that in modern football the intermittent structure of movement with a large number of high-intensity actions with and without the ball, between which are periods of low-intensity activities, prevails (Svensson & Drust, 2005). In accordance with these facts, those football students who will be able to meet the requirements of top football, and compete for top sports results, should be identified and evaluated.

To assess the state of motor skills and forecast the success of football players – for the youngest age, different tasks (tests) are used to assess speed abilities, certain types of strength in general and specific conditions, strength capacity through running with a change of direction (agility), specific skill tests and morphological characteristics of students. Testing motor skills is an effective tool in the assessment and monitoring of young football players and it serves for developing technical skills, tactical training, teamwork and cognitive abilities.

Motor skills are usually defined as indicators of the level of development of the basic motor dimensions of a person that condition the successful realization of movement, regardless of whether these abilities are acquired through training or not. One of the most cited models of latent human motor space is the model of Zaciorsky (1975). The mentioned author singled out seven essential physical properties of an athlete: strength, speed, endurance, coordination, balance, precision and flexibility, and within each motor skill he defined several forms of its manifestation.

If motor skills do not develop to a level that is objectively achievable given the genetic limitations, it is likely that such an individual will not be able to perform various daily tasks effectively and easily, nor will it encourage the development of other traits and abilities with which motor skills are related.

These motor skills do not have the same coefficients of innateness, which is why some are under less and some under more influence of the exercise process throughout lifetime. Speed, coordination, explosive power are much more innate than repetitive and static power, and even flexibility (Findak, 2003). In order to influence the abilities with a higher degree of innateness, it is necessary to start the process of transformation as early as possible, respecting the sensitive periods for the development of certain traits and abilities (Findak and Prskalo, 2004).

The subject of the research are the motor skills of children of preschool, younger and middle school age who train football. The general goal of the research is to define the connection between motor tests: standing long jump, foot tapping and 30m sprint. Partial research goals: to establish the level of correlation between observed tests in different age categories, to establish the influence of body height and body weight on the results of motor tests in subjects of different age.

METHOD

In this paper, a transfer study was conducted, which means that only one measurement was performed on a sample of 40 boys of preschool, younger and middle school age, aged 6 to 13, who actively train football at the football school "Jedinstvo" from Gospodjinac. There were 10 boys of preschool age, 11 of younger school age, and 19 of middle school age. The respondents had been in the training process for up to 5 years, and some of them started training sports less than 6 months prior to the research. All respondents were well acquainted with the battery of tests, motivated and encouraged to give their maximum when performing them.

The study used two variables to assess morphological characteristics: height and body weight, and three variables to assess motor skills: long jump, foot tapping, and 30m sprint. Anthropometric measurements were performed in accordance with the International Biological Program (IBP). Body height was measured with a Martin anthropometer with an accuracy of 0.1 cm. Body weight was measured using a digital scale that allows a measurement accuracy of 0.1 kg. Throughout testing, the order of the application of the motor tests depended on the energy and information requirements of the appropriate motor tasks. Therefore, the order of the tests was as follows: foot tapping, standing long jump, 30m sprint (Krneta, 2014).

Data processing was performed using the statistical package SPSS 20.0. To obtain the final results, measures of central tendency and measures of the form of distribution were used: arithmetic mean (AS), standard deviation (SD), minimum result (MIN), maximum result (MAX), skewness (S), kurtosis (K), as well as the

Kolmogorov-Smirnov test to assess the normality of the distribution. Pearson's correlation was applied to determine the relationship between the examined variables, while regression analysis was used to determine the influence of body height and body weight on the results of explosive power and speed tests.

RESULTS

The results of the research are presented in 4 tables. The analysis of the measures of central tendency and the measures of the form of distribution of entered variables is presented in Table 1; the analysis of statistically significant correlation between the results of explosive power and speed tests of children of preschool, younger and middle school age is presented in Table 2; the impact of body height and body weight on explosive power and speed test results of children of preschool, younger and middle school age is presented in Tables 3 and 4.

Based on the insight into the results from Table 1, it can be concluded that in football players from preschool to middle school age, the results improve in all variables and that their development has an increasing trend. Skewness and kurtosis values in motor tests range from 0 to 1, and from 0 to -1 which indicates that the data distribution is normal.

Table 1. *Analysis of measures of central tendency and measures of form of distribution of entered variables in football players of preschool, younger and middle school age*

Variable	Age	AS	SD	MIN	MAX	S	K
Body height (cm)	Preschool	123,20	5,67	118	138	2,24	6,06
	Younger school age	138,73	13,85	120	147,4	0,87	1,66
	Middle school age	157,05	7,74	141	171	0,08	0,02
Body weight (kg)	Preschool	23,82	5,88	18,9	39,2	2,37	6,04
	Younger school age	31,15	7,61	22,6	38,2	1,16	1,40
	Middle school age	46,68	13,22	33,3	76,1	1,15	0,53
Long jump (cm)	Preschool	135,90	11,11	122	156	0,47	-0,43
	Younger school age	161,68	21,76	130	200	0,19	-0,82
	Middle school age	184,89	18,36	159	226	0,69	0,03

Foot tapping	Preschool	16,80	1,62	14	19	-0,97	0,43
	Younger school age	19,64	2,33	16	24	0,02	0,43
	Middle school age	21,53	2,50	18	26	0,34	-1,25
30m sprint (s)	Preschool	6,45	0,56	7,03	5,49	-0,64	-1,03
	Younger school age	6,01	0,47	6,76	5,32	-0,17	-1,07
	Middle school age	5,25	0,38	5,93	4,55	-0,41	-0,13

Legend: AS - Arithmetic mean, SD - Standard deviation, MIN - Minimum values, MAX - Maximum values, S- Skewness, K- Kurtosis.

"Pearson's linear correlation" was used to check the connection between explosive power and speed tests. The following data were obtained, which can be seen in Table 2.

Table 2. *Results of connection between explosive power and speed tests in football players of preschool, younger and middle school age.*

Variable	Age	r	p
Long jump 30 m sprint	Preschool	-0,464	0,176
	Younger school age	-0,856	0,001
	Middle school age	-0,847	0,000
Long jump Foot tapping	Preschool	0,555	0,096
	Younger school age	0,801	0,003
	Middle school age	0,849	0,000
30m sprint Foot tapping	Preschool	-0,727	0,017
	Younger school age	-0,818	0,002
	Middle school age	-0,756	0,000

Legend: r - Correlation coefficient; p - statistically significant correlation at the level of 0.05.

The data in Table 2 show that there is a statistically significant correlation between the results of the long jump and 30m sprint tests in the younger school and middle school age, while in the preschool age there is no statistically significant correlation between these tests. It is important to

note that the value of the correlation coefficient is negative (-), which further indicates that it is an inverse metric. This means that an increase in the results in one variable is accompanied by a decrease in the results in the other variable and vice versa.

Regarding the correlation between the results of the long jump and foot tapping tests, you can see that as in the previous case, a statistically significant correlation is present in the younger school and middle school age, while there is no statistically significant correlation in case of preschool age. In this case, the values of the correlation coefficient are positive, which further shows that with an increase in the value of the results in one variable, there is an increase in the results in the other variable, and vice versa.

In checking the correlation between the results of the 30m sprint tests and foot tapping, it can be seen that for the first time a statistically significant correlation occurs in all age categories and that the value of the correlation coefficient is negative, which again speaks of the inverse metric.

Determining the influence of body height and body weight on the results of motor tests was conducted through "linear regression", and the obtained results justified the theoretical assumptions, confirming that the impact of body height and body weight is statistically significant only in middle school age, in the 30m sprint and long jump tests. On the other hand, the frequency of movement measured by the foot tapping test does not change significantly depending on body height and body weight.

Table 3. *Influence of body height on results of explosive strength and speed tests of football players of preschool, younger and middle school age*

Variable	Age	Beta	P
Body height 30m sprint	Preschool	-	-
	Younger school age	-	-
	Middle school age	-0,87	0,01
Body height Foot tapping	Preschool	-	-
	Younger school age	-	-
	Middle school age	-	-
Body height Long jump	Preschool	-	-
	Younger school age	-	-
	Middle school age	1,166	0,001

Legend: Beta - coefficient of influence of one variable on another; p - statistical significance at the level of 0.05

In Table 3, you can see that at middle school age, body height has an effect on running speed, the beta coefficient is negative, which means that with increasing body height in children, there is a decrease in the time required to run a section of 30m. With the influence of body height on standing long jump, the beta coefficient is positive and shows that older children at middle school age achieve better long jump results and vice versa.

Table 4. *Influence of body weight on results of tests of explosive power and speed of football players of preschool, younger and middle school age*

Variable	Age	Beta	p
Body weight 30m sprint	Preschool	-	-
	Younger school age	-	-
	Middle school age	-	-
Body weight Foot tapping	Preschool	-	-
	Younger school age	-	-
	Middle school age	-	-
Body weight Long jump	Preschool	-	-
	Younger school age	-	-
	Middle school age	-0,809	0,009

Legend: Beta - coefficient of influence of one variable on another; p - statistical significance at the level of 0.05

The effect of body weight on the results of explosive power and speed tests is noticeable only in long jump. The obtained value of the beta coefficient shows that with the increase of weight in children of middle school age, there is a decrease in the results in standing long jump, which is quite logical.

DISCUSSION

On a sample of 40 football players of preschool, younger and middle school age, it was examined whether there is a statistically significant correlation between the results on explosive power and speed tests.

Based on the results of statistical analyses, it was found that in the preschool age category there is no statistically significant correlation between the results of explosive power and speed tests. When it comes to younger school age, the correlation is positive and rather high, while in case of middle

school age the correlation is the highest because this age represents a phase of puberty and rapid growth, and in this way the theoretical views from the introductory part of the paper were confirmed. Fratrić (2006) obtained similar results, confirming that the explosive power of the lower extremities was statistically significantly related to both agility tests, i.e. that athletes who had better results in long jump, 20m running and high jump also achieved significantly better results in agility tests (t-test and zigzag test). Regarding the correlation between the results on the long jump and foot tapping tests, it can be seen that, as in the previous case, a statistically significant correlation is present at the younger school and middle school age, while there is no statistically significant correlation in case of preschool age. Regarding the results of the 30m sprint and foot tapping tests, it can be seen that for the first time a statistically significant association occurs in all age categories. Dragosavljević (2016) came to similar research results by investigating the relations of speed and explosive power with the agility of two groups football players divided by age (10-11 and 12-13 year-olds). A strong positive correlation was present between the results of the tests of the speed of the straight line sprint for 20m and 30m, and the results of the tests of agility and ball control. In both age groups and at both running distances, the correlations were approximate and very high.

In Table 4, it can be seen that at middle school age, body height has an effect on the sprint, the beta coefficient is negative, which means that with increasing height in children, there is a decrease in the time required to run a section of 30m. With the influence of height on the long jump from the place, the beta coefficient is positive and shows that older children in high school achieve better results in the long jump and vice versa. Many authors have dealt with success in the game of football (Mekić, 1985 and 1988; Jerković, 1986 and 1991 Zbiljski, 2000; Talović, 2001; Kapidžić, 2005). These authors' studies showed a negative impact of volume and body weight on the results of situational motor tests and a somewhat stronger influence of stenomorphy on the force of the blow on the ball.

The effect of body weight on the results of explosive power and speed tests is noticeable only in long jump. The obtained value of the beta coefficient shows that with the increase of weight in children of middle school age, there is a decrease in the results in standing long jump. The obtained results of our research are also confirmed by the results of Molnar et al. on a sample of 105 examinees, (boys who play football) aged 10, which indicate that in football school, those boys who achieved underperformed in all forms of kicking and ball driving, as well as running speeds with a change of direction were those who also had unfavorable morphological measures, lower body height and a larger amount of subcutaneous adipose tissue, that is, better results were achieved by boys who have better motor skills. The negative correlation

between the assessment of muscle and fat on the manifestation of speed-strong abilities was confirmed in his work by Djordjevic (2015), researching the influence of the same in young basketball players.

CONCLUSION

The subject of this research were the motor skills of children of preschool, younger school and middle school age who train football at the football school "Jedinstvo" from Gospodjinac. The obtained results of the research in the preschool age category showed that there is no statistically significant correlation between explosive power and speed tests, while at younger school age a statistically significant correlation was established that proved to be quite high, and at middle school age the correlation was the greatest. The obtained results confirmed that the level of connection between motor tests changes depending on the age of the examinees. Body height and body weight were found to have a statistically significant effect on the results of the long jump and 30m sprint tests only at middle school age. This type of statistically significant influence of body height and body weight on the results of motor tests was not observed in the preschool and younger school age categories.

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