UDC: 796.012.13-057.874(497.721)
Professional paper

RELATIONSHIP AND INFLUENCE OF BODY COMPOSITION AND SOME SKIN FOLDS ON SPEED AND AGILITY PERFORMANCE

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Abstract

Purpose: In this paper, the correlation and influence of the body composition and some skin folds in the success of speed and agility performance have been investigated. The purpose of this paper is to establish the correlation and influence between body composition and skin folds as a predictive system and speed and agility performance as a criterion system.
Methods: The survey was conducted in a sample of 170 male entities aged 14 years ± 6 months, primary school students at "Bajram Shabani" and "Naim Frasheri" – Kumanovo. A total of 10 variables were used in the research, including 4 variables for evaluating body composition, 4 variables for evaluating skin folds and 2 variables for assessing speed and agility performance. Variables for evaluation of body composition are 4 as follows: 1) body height (BH), 2) body weight (BW), 3) body mass index (BMI) and 4) body fat (BF), variables for evaluation of skin folds are 4 as follows: 5) Arm skin folds (ASF), 6) thigh skin folds (THSF), 7) pulp skin folds (PSK), and abdominal skin folds (ABSF), and variables for evaluation speed and agility performance are 2 as follows: 9) running 100 meters (RU100m) and 10) Agility 10x5 Shuttle run (A10X5Sh).
Results: Based on the results obtained from the correlation analysis we can conclude that, we have significant level correlations between the variables: RU100m and ASF, with a positive value of .445 ** and A10X5Sh and PSF, with a positive value of .314 **, while we have low level correlations between the variables: RU100m and BF, with positive value .221 ** and A10X5Sh and BH, with negative value -.165 *. Based on the results obtained from the regression analysis, we can conclude that: between the predictive system and the criterion variables RU100m and A10X5Sh, there is a linkage of statistical significance, at a confidence level of 0,000. From the whole predictor system, the individual impact on criterion variable RU100m has the variables: BH, with a beta coefficient of -.893 and a confidence level of 0,02, and BF, with a beta coefficient of -.280 and confidence level of 0,043. While from the whole predictive system, individual variables in the criterion variable A10X5Sh have the variables: PY, with beta coefficient values of -.453 and confidence level of 0.005 and LT, with beta coefficient values of -.918 and confidence level 0.042.
Conclusion: Based on the results obtained in this study, we can conclude that in order to have good results in speed and agility performance we need to have the lowest possible fat percentage in the body and also lower or average body height.

Keywords: body composition, skin folds, speed, agility, correlation, regression, students

1. Introduction

Physical growth and maturation are dynamic processes involving a wide range of cellular and somatic changes. Children of the same age can vary in the rate of physical growth. Physical growth, like other aspects of development, results from a complex interaction between genetic and environmental factors (Manna, 2014). Sports scientists, doctors and physical educators should be familiar with the normal growth and development patterns of the child and adolescent, as well as knowledge about the correlations between anthropological characteristics (Iseni, 2014). Motor abilities are those anthropological dimensions that are manifested in movement in a way that depends on the type of movement, human potential, and its development in the current moment and conditions (Bala, 2010). Basic motor skills are those that most people possess, and specific ones are those that are created or developed over time, which is most evident in athletes (Nićin, 2000). Motor abilities can be affected by many factors, such as genetic predisposition, body composition, socio-economic conditions, and the like. By body composition we refer to the composition of the human organism represented by the size and grouping of the existing measurable segments of which it consists of (Ugarković, 2001). The level of general motor skills is lower in obese children than in normal-weight and overweight peers (d'Hondt, 2009). Many trials reported a negative correlation between motor skills and overweight / obesity in children and adolescents, the correlation between age, gender and weight status is still questionable (Battaglia, 2021).

2. Methods

Sample of participants

In accordance with the set goal, a sample of respondents consisting of eighth grade pupils of the "Bajram Shabani" and "Naim Frasheri" elementary school from Kumanovo was selected for this research. The sample included 170 participants (boys), aged 14 years ± 6 months, with all the respondents being clinically healthy and at the time of measurement displaying no obstructions of the locomotors apparatus that would limit or interfere with the performance. Parents gave their consent for the testing to be performed, and all the examinees voluntarily participated in the testing.

Sample of measuring instruments

Measuring instruments were used in the research to assess body composition, agility and speed. The characteristics of the sample were assessed: height (BH) was measured with a ruler with an accuracy of 0.1 cm; body weight (BW), body mass index (BMI) and body fat (BF) and were measured with the Body Composition Monitor TANITA. To assess skin folds, we used these tests: skin folds of the triceps (ASFT), skin folds of the thigh (ASFTH), skin folds of the pulp (ASFP) and skin folds of the abdomen (ASFA). To assess speed and agility, we used these tests: 10X5 Shuttle run (10X5) and running 100 meter (RU100m).

Data processing

The processing of data obtained by this research was performed using the statistical program SPSS version 26. For all data obtained by the measurement, the basic central and distribution parameters of descriptive statistics were calculated. Correlation analysis (Pearson's degree of correlation) was used to determine whether there was a relationship between body composition parameters and agility and speed of children aged 14 years. While regression analysis (as multivariate analysis) was used to determine the impact of body composition and skin folds on speed and agility performance.

3. Results

Table 1. Basic statistical parameters

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
BH	170	148.00	183.00	169.4035	7.72154	-.610	.186	.271	.370
BW	170	34.00	96.00	59.8353	11.28014	.602	.186	.359	.370
BMI	170	14.70	30.50	20.8024	3.44868	.871	.186	.311	.370
BF	169	8.40	26.60	15.0107	3.57130	.826	.187	.214	.371
ASFT	170	4.00	21.60	10.0782	4.60995	1.000	.186	-.035	.370
ASFTH	170	5.30	31.20	12.0994	4.55127	.964	.186	.988	.370

ASFP	170	3.20	32.80	11.2082	4.67041	1.098	.186	1.748	.370
ASFA	170	3.30	25.40	10.2035	4.51050	1.041	.186	.600	.370
RU100м	170	12.36	19.76	15.0972	1.60200	.407	.186	-.565	.370
A10X5	170	15.47	27.40	19.9941	2.06854	.512	.186	.659	.370
Valid N (listwise)	169								

Table 2. Correlation analysis (Pearson's correlation coefficient)

Correlations

	BH	BW	BMI	BF	ASFT	ASFTH	ASFP	ASFA	RU100м	A10X5
BH	1									
BW	.483**	1								
BMI	.019	.881**	1							
BF	-.017	.762**	.890**	1						
ASFT	-.068	.647**	.776**	.709**	1					
ASFTH	-.072	.549**	.671**	.596**	.839**	1				
ASFP	-.115	.559**	.706**	.618**	.796**	.803**	1			
ASFA	-.034	.592**	.709**	.647**	.833**	.768**	.720**	1		
RU100м	-.419**	.066	.293**	.221**	.445**	.432**	.430**	.368**	1	
A10X5	-.165*	.105	.199**	.080	.222**	.278**	.314**	.247**	.601**	1

***. Correlation is significant at the 0.01 level (2-tailed).*

**. Correlation is significant at the 0.05 level (2-tailed).*

Table 3. Regressive correlation between body composition and skin folds with the criteria variable running in 100m

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.633a	.401	.371	1.27306	.401	13.373	8	160	.000

a. Predictors: (Constant), ASFA, BH, BF, ASFP, ASFTH, ASFT, BMI, BW

Tabela 4. Regression analysis of the variable RU100m - Coefficients (a)

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	44.811	13.582		3.299	.001
	BH	-.186	.080	-.893	-2.312	.022
	BW	.152	.116	1.072	1.309	.192
	BMI	-.364	.348	-.784	-1.046	.297
	BF	-.126	.062	-.280	-2.042	.043
	ASFT	.095	.053	.275	1.802	.073
	ASFTH	.048	.044	.137	1.092	.276

	ASFP	.034	.040	.100	.869	.386
	ASFA	.015	.043	.043	.361	.719

a. Dependent Variable: RU100м

The relation of the predictive variables with the variable of the criterion running in 100 meters (RU100m), is expressed with the coefficient of multiple (multiple) which is with value R = .633 (table no. 3) and is considered as a value with statistical significance, respectively explains the common variability about 40.1% (R2 = 0.401), while the other 59.9% explanation of the common variability of the criterion variable running in 100 meters (RU100m) belongs to other anthropological characteristics which are not researched (such as other anthropometric variables, motor skills, functional, cognitive, conative, etc.). The table shows that the value of variability between groups (regression) is less than the value of variability within the group (residual). The value of the F test is 13,373, while the level of reliability p = 0.000 indicates that the value of variability between and within the group of multiple regression variance has a statistically significant difference which allows the commentary of predictive variables separately. As mentioned before the impact of independent variables (weighters) on the dependent variable (criteria) is estimated with the standardized beta coefficient. From table no. 4 it is clear that the best predictor is the variable body height (BH) with a negative value of the standardized beta -.893 coefficient and with a reliability level of .022. Another good predictor is the variable fat percentage (BF), with the value of the standardized beta -.280 coefficient and with a reliability level of .043.

Table 5. Regressive correlation between body composition and skin folds with the criteria variable 10x5 shuttle

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	F Change	df1	df2	Sig. F Change
1	.442a	.196	.155	1.90586	.196	4.863	8	160	.000

a. Predictors: (Constant), ASFA, BH, BF, ASFP, ASFTH, ASFT, BMI, BW

Tabela 6. Regression analysis of the variable 10x5Sh - Coefficients (a)

Coefficientsa

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	T	Sig.
1	(Constant)	58.817	20.334		2.893	.004
	BH	-.247	.120	-.918	-2.052	.042
	BW	.299	.174	1.632	1.719	.087
	BMI	-.616	.522	-1.025	-1.181	.239
	BF	-.263	.092	-.453	-2.857	.005
	ASFT	-.119	.079	-.266	-1.504	.134
	ASFTH	.065	.066	.142	.978	.329
	ASFP	.111	.059	.251	1.875	.063
	ASFA	.096	.064	.209	1.506	.134

a. Dependent Variable: A10X5

The relation of predictive variables with the criterion variable 10X5 Shuttle run (10X5SH), is expressed by the coefficient of multiple (multiple) which is with value R = .442 (table no. 5) and is considered as a value with statistical significance, respectively explains the common variability about 19.6% ($R2 = 0.196$), while the other 80.4% explanation of the common variability of the 10X5 Shuttle run criterion variable (10X5SH) belongs to other anthropological features which have not been studied (as other anthropometric variables, motor skills, functional, cognitive, conative etc.). The table shows that the value of variability between groups (regression) is less than the value of variability within the group (residual). The value of the F test is 4,863, while the level of reliability $p = 0.000$ indicates that the value of variability between and within the group of multiple regression variance has a statistically significant difference which allows the commentary of predictive variables separately. As mentioned before the impact of independent variables (weighters) on the dependent variable (criteria) is estimated with the standardized beta coefficient. From table no. 6 clearly shows how the best predictor is the variable percentage of body fats (BF) with negative value of the standardized beta coefficient -.453 and with a level of reliability .005. Another good predictor is the variable body height (BH), with the value of the standardized beta -.918 coefficient and with a reliability level of .042.

4. Discussion

In this study, the main goal was to determine the relations and influence between body composition and some skin folds with speed and agility performance in 14-year-old children in the city of Kumanovo. Examination of the results showed that body composition variables have a high correlation with the performance of speed and agility tests. Kodzoman et al. (2020) investigated the correlations between physical fitness skills and body composition in students. The research was conducted on a sample of 4051 students (2078 boys and 1973 girls) in the city of Skopje. The authors concluded that young adolescents of both sexes with medium and high BMI have higher blood pressure, lower muscle mass percentage, and achieve poorer scores on explosive strength, agility, coordination tests, and have lower aerobic capacity. Chowdhury and the authors investigated the association between body mass index (BMI) and motor competence in Santal children aged 5–12 years. A total of 816 Santal children were studied. Healthy weight (HW) children scored higher ($p < .05$) on several individual motor tests (in balance, speed, agility, and strength), compared with children underweight (UW) and overweight (OW). The results also showed that motor skills, but not fine ones, were poorer among children who were underweight and overweight compared to children with healthy weights. Kemp and Peineer (2013) explored the relationships between body composition and motor and physical competence in first graders living in the northwestern province of South Africa. Data were collected through a random procedure in a sample of 816 first grade students (419 boys, 397 girls) aged 6-7 years. The authors concluded that there are high correlations between body composition and most motor and physical competence tests in first graders. Dhapola and Verna (2017) investigated the relationships between height, weight, and body mass index (BMI) with agility and speed skills in some male university players. The research was conducted on a sample of 46 male players of Guru Ghasidas University - India, aged 20-25 years. The authors concluded that there is a significant correlation between weight and 10x5Sh agility test ($r = .670$, $p < 0.05$), weight and 50-yard run ($r = .543$, $p < 0.05$), BMI and test of 10x5SH agility ($r = .546$, $p < 0.05$) and BMI and 50 yard running ($r = .752$, $p < 0.05$). No significant correlation was found between height and agility and speed test. Larsen and the authors (2017) investigated whether physical fitness and body composition in Danish children aged 8–10 years are related to participation in sports clubs. The study included 423 students (209 girls and 214 boys) of whom 67% and 74% were active in sports clubs. Children who were active in sports clubs had better exercise skills and superior body composition compared to children who are not active in sports clubs. Kryeziu and the authors (2020) aimed to analyze the correlation of some subcutaneous adipose tissue with motor ability in 11-year-old girls. The research was conducted in a sample of 60 sixth grade entities in the municipality of Prishtina. The authors concluded that the correlation between subcutaneous adipose tissue and motor ability are relatively low and with negative signs. Iseni (2014) explored the canonical relationships between motor abilities and anthropometric characteristics in high school students. The research was conducted on a sample of 100 male subjects in the municipality of Kumanovo. The author concluded that students with lower longitidunal and transversal skeletal dimensions achieved poorer scores on motor tests taping with hand, podium rotation, and body lift in the Swedish crate, while students with larger body dimensions achieved much better results in motor tests. Amet et al. (2017) investigated the correlation and impact of body mass index and subcutaneous adipose tissue on the success of some motor skills. The research was conducted on a sample of 170 male subjects from primary schools in the municipality of Kumanovo. Based on the results obtained from the correlation analysis the authors came to the conclusion that the body mass index and subcutaneous adipose tissue have low correlations with motor skills. While statistically significant impact on motor variables have had subcutaneous adipose tissue of the arm and subcutaneous adipose tissue of the abdomen. Stankovic and authors (2020) analyzed the correlations between body composition and speed and agility in children aged 9-10 years. The research was conducted in a sample of 40 entities (29 males, 11 females). Based on the results obtained in this study, it can be concluded that there is a correlation between body composition and speed and agility. In addition to body composition, high correlations were also found between body height and jump performance, as well as basal metabolism and motor tests. Marmeleira and authors (2017) examined the relationships between motor skills and body composition in children aged 6-10 years. The research was conducted on a sample of 70 girls and 86 boys. Significant correlations were found for both sexes between body fat percentage and performance in each motor task. The authors concluded that motor skills have a negative association with body fat and children with normal weight show better motor skills than those who are overweight and obese. Based on the results obtained in this study, we can conclude that in order to have good results in speed and agility performance we need to have the lowest possible fat percentage in the body and also lower or average body height.

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