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CORRELATION ANALYZE OF BODY COMPONENTS AND SPEED PERFORMANCE OF YOUNG FOOTBALLERS

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ABSTRACT

Aim: the study of the relationship of physical tests with bioimpedance analysis and as a result to obtain quantitative measures of these relationships in the form of pair correlation coefficients in order to search for effective means of developing speed qualities.

Methods: Analysis of morphological and functional parameters was measured by bioimpedance measurement. Evaluation of speed capabilities was determined by the Microgate Reystime 2 device, which ensured the measurement accuracy at the in-depth specialization stage. The processing was carried out by the computer mathematical and statistical program SPSS for parametric and non-parametric correlation, which allows us to determine a scientifically based search for effective means of developing speed abilities. Control exercises were used such as: “10m running”, “30m running”, Shuttle run 5 * 30m, Test “8”.

Results: According to the Pearson-Brava method, a 10-meter run does not correlate with all morphofunctional indicators, except for the body length indicator. According to the Kendel method, the 10-meter run correlates to an average degree with the growth rate (r = 0.556) and with the percentage of total fat and water in the body, to a weak degree, respectively, r = -0.327 and r = 0.266. According to the Spearman method, a 10-meter run correlates to an average degree with an indicator of body length (r = 0.590) and with percentages of total body fat in the body in the opposite direction and with a type of addition that is lower than an average degree, respectively = = 0.443 and r = 0.285.

Conclusion: A close relationship was found between the metabolic rate and% water (r = 0.92), muscle mass (r = 0.49) and a direct relationship between metabolic rate and muscle mass (r = 0.9). It is necessary in the process of training young football players at the stage of in-depth specialization to pay attention to exercises that contribute to the formation of athleticism.

Keywords: Kendal and Spearman correlation, SPSS computer program, Bioimpedancemetry method, standard “8” (“eight”), metabolic rate, bone mass density index.

I. INTRODUCTION

It is known that in the process of many years of preparation from stage to stage it does not always penetrate progressively and evenly; at one of the stages, there is a leap in the development of strength, age-related changes, an increase in preparedness. A growth spurt occurs at the age of 14-15, when there is all the prerequisite for this, an increase in physical strength, functional capabilities. That’s why its necessary to find out the dependence of speed qualities, with physiological indicators(1).

The study of dependencies by the methods of mathematical statistics and the theory of probability, in particular by correlation analysis, contributes to the establishment by researchers of previously unknown patterns. Obtaining accurate and timely information in the analysis of sports parameters, which have complex character. At the same time, for optimal planning of workloads, it is necessary to process measured data during training sessions, assessing the appraisal of a football player after exercise training is an invaluable tool in the arsenal of a researcher, especially at the stage of in-depth specialization(2).

Bioelectrical impedance analysis (BIA) equations can predict total body water (TBW) and extracellular water (ECW) in non-athletic healthy populations. This study aimed: a) to develop BIA-based models for TBW and ECW prediction based on dilution methods in a sample of national level athletes; and b) to validate the new models with a cross-validation approach in a separate cohort using dilution methods as criterion. Conclusions: The new equations can be considered valid, with no observed bias, thus affording practical means to quantify TBW and ECW in national level athletes(3). The bioelectrical parameters directly associated with cell integrity in athletes were ECW, PA, BIVA, Xc, R, and ECW/BCM ratio. Regarding the findings of cross-sectional studies, the parameters investigated (ECW, PA, BIVA, Z, BCM and ECW/BCM ratio) were directly associated with sex, age, sports performance level, modality, and game position(4). The present investigation observed that none of the indices (BMI, BAI, ABSI, and BRI) were adequate proxies of adiposity in athletic populations and that they should not be used to replace other field methods such as bioimpedance or skinfold prediction models(5).

BIA measurements were taken using a BIA 450 Bioimpedance Analyzer (Biodynamics), which applies an alternating current of 800 mA at a single frequency of 50 kHz. To measure the whole-body bioelectrical impedance, electrodes were applied on the right wrist and ankle, with the participants in a supine position, in a thermo-neutral environment of 25°C. To avoid disturbances in fluid distribution, participants were instructed to abstain from foods and liquids for 4 h, not to drink alcohol for 48 h, and to refrain from caffeine intake and intense physical activity 24 h before the BIA analysis(6). Total physical activity was estimated using metabolic equivalent hours/week for the questionnaire and mean acceleration for the accelerometer. Time spent in moderate-and-vigorous physical activity (MVPA) was also assessed by questionnaire and accelerometer. Adiposity assessment included body mass index, waist circumference, and fat mass index. Fat mass index was calculated as fat mass/height2 (kg/m2), with fat mass estimated using bioimpedance(7).

Phase angle (PA) is derived from resistance and reactance determined by bioimpedance analysis (BIA) and it appears to relate to cellular stability and integrity. Interpretation of PA values could be complemented by bioelectrical impedance vector analysis (BIVA), which relates to body hydration and structure. Body composi- tion, age, sex, and nutrients are known to stabilize cell membranes, such as zinc, have been related to PA although information is scarce in adolescent athletes(8).

As the participations of the study, n=15 youth footballers of the RBSOR (Republican boarding school of the Olympic reserve) aged U16 were selected. The subject of the research is the study of the correlation between morpho-functional parameters and speed qualities, such as the percentage of total fat, the percentage of water in body weight, muscle mass, metabolic rate, bone density index, running to 10m and 30m, shuttle run 5 * 30m and test "eight".

II. METHODS

To achieve the aim, had been used the SPSS software package for mathematical statistics, which includes a software procedure that implements the parametric and nonparametric method of correlation analysis.

Physiological indicators of athletes were eight characteristics: body length, body weight, percent of total fat and water in the body, muscle mass, type of constitution, metabolic rate and bone density index. The indicators were taken using the equipment Tanita MS-980 (made in Japan) and by the bioimpedance analyze (BIA) method (Fig. 1).

Figure 1. Bioimpedance analyze (BIA). Device “Tanita MS-980”.

The research activities were carried out in July 2019 at the Republican Olympic Reserve Boarding School with 12 football players in 4 age groups. Using the Microgate Raisttime 2 measuring device (Fig. 2), 3 normative tests were applied.

The first normative test – is “30 meter run”. at the start of a run from a high start, speed measuring devices are installed at the distances “Start”, “10 meters from the start” and on the “Finish” line. In the standard run for 30 meters, the speed of overcoming distances of 10 meters and 30 meters is determined simultaneously.

The second normative test – is a shuttle run 5x30m. Measuring devices of speed Microgate Racetime 2 are installed at the intersection of the lines "Start" and "Finish", where the time is recorded only when the player completely crosses these lines. This method determines the completeness of the intersection of the start and finish lines by footballers (Fig. 3).

The third normative test – is test "8". The 4 cones are placed on the four sides in the shape of a quadrangle and one cone is placed in the center. The distance between the cones is 10 meters. The footballer must carry out a high-speed dribble from the cones in the corner to the cone in the center. In this case, the microgate speed measuring device is installed on the “Start” and “Finish” lines.

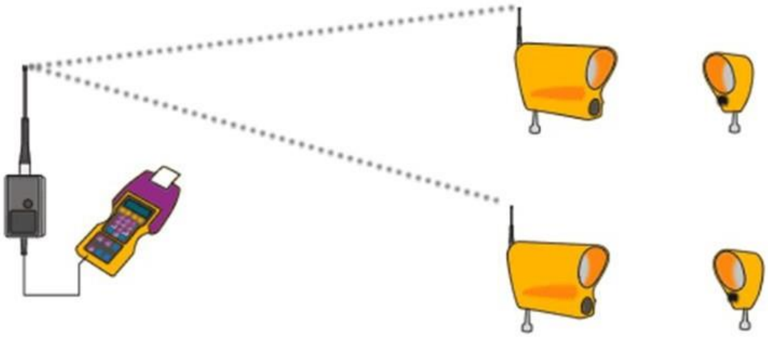

Figure 2 –Microgate Racetimer 2 device
Source : http://www.microgate.it/Timing/Products/Kit-Racetime2-Light-Radio/Description

Figure 3. Evaluation of speed measuring device “Microgate Racetime 2”

III. RESULTS AND DISCUSSION

Correlation analysis is used to determine the degree of closeness of the relationship between two random variables X and Y. The correlation coefficient is used as a measure of the relationship. The correlation coefficient is estimated from a sample of the volume of n connected pairs of observations (x, y) from the joint population of X and Y. There are several types of correlation coefficients, the application of which depends on the assumptions about the joint distribution of X and Y.

On the basis of the aforementioned speed and physiological indicators of athletes, we formed a sample in the Excel file format, consisting of eight observations (rows) and twelve indicators (columns), a copy of which was then used as the initial data for the correlation analysis program. Due to the fact that the processed file has a smaller number of observations, in addition to the parametric method (calculation of the correlation coefficient by the Pearson-Bravais method), nonparametric methods (methods of Kendal and Spearman rank correlations) were used to calculate the correlation coefficients.

Before starting the calculations, descriptive statistics and exploratory analysis programs were performed to determine the main statistical characteristics and check the distribution of the initial data for normality (Table 1**)**.

The table shows the name, means, standard deviations and the number of all studied indicators.

Table 1

Descriptive statistics table

№	Indicators	Average	Standard deviation
1	2	3	4
1	10m running	1,8825	,17990
2	Running 30 meters	4,5375	,20070
3	Shuttle run 5 * 30m	31,8638	1,09520
4	Test "eight"	15,4075	,55633
5	Body length (cm)	170,7500	4,43203
6	Body weight (kg)	61,2125	5,62810
7	% total fat	2,0875	9,72220
8	% water	65,8750	3,00464
9	muscles. weight (kg)	52,9625	3,51281
10	Folding type	6,6250	1,40789
11	Metabolism speed	1665,3750	107,59705
12	Density index masses	2,8250	,17525

We had to use a nonparametric method for calculating the pair correlation coefficients based on the rank correlation methods of Kendel (Table 2) and Spearman (Table 3).

According to the Kendel rank method (Table 3), running to 10m indicator correlates moderately with the body length (r = 0.556) and with the indicators of the percentage of total fat and %water in the body, to a weak extent, respectively r = - 0.327 and r = 0.266

Running on 30 meters according to this method had a correlation only with the indicator of the percentage of total fat in the opposite direction with the value of the correlation coefficient equal to r = - 0.327, and the running on 30 meters did not correlate with other physiological indicators.

The indicator shuttle run 5 * 30 m according to Kendal's rank correlation method had the same weak closeness of connection with two physiological indicators: muscle mass and metabolic rate (r = 0.286). This indicator also weakly correlated with the bone mass index (r = 0.355), and did not correlate with the rest of the physiological indicators.

The Test "eight" correlated with only three indicators, but weakly. These indicators are height, body weight and percentage of water in the body with the corresponding correlation coefficients r = 0.327, r = 0.367 and r = -0.286.

The correlation between the "eight" test with other physiological indicators was very weak.

Table 2

Kendall pair correlation table

Kendalls' correlation	Run to 10m	Run to 30m	Shuttle run 5 * 30m	Test «8»	Body length (cm)	Body weight (kg)	% fat total	% water of the body	Muscle mass (kg)	Type of addition	Metabolism speed
Run to 30m	,667*										
Shuttle run 5 * 30m	,473	,618*									
Test «8»	,327	,473	,571*								
Body length (cm)	,556	,222	,182	,327							
Body weight (kg)	-,182	-,036	,214	,357	,255						
% fat total	-,327	-,327	-,214	-,071	-,036	,429					
% water of the body	,255	,109	-,143	-,286	-,182	-,929**	-,500				
Muscle mass (kg)	-,109	-,109	,286	,143	,327	,786**	,357	-,857**			
Type of addition	,252	,168	,041	-,206	-,084	-,536	-,866**	,536	-,371		
Metabolism speed	-,109	-,109	,286	,143	,327	,786**	,357	-,857**	1,000**	-,371	
Bone density index	,000	,000	,355	,197	,401	,749*	,197	-,749*	,906**	-,273	,906**

According to Spearman's rank method (Table 3), the running to 10m indicator correlates moderately with the body length indicator (r = 0.590) and with the percentage of total body fat in the opposite direction and with the type of addition, to a lower than average degree, respectively. r = - 0.443 and r = 0.285.

Table 3

Spearman pair correlation table

Корреляция по Спирману	Run to 10m	Run to 30m	Shuttle run 5 * 30m	Test «8»	Body length (cm)	Body weight (kg)	% fat total	% water of the body	Muscle mass (kg)	Type of addition	Metabolism speed
Run to 30m	,777*										
Shuttle run 5 * 30m	,587	,766*									
Test «8»	,407	,611	,690								
Body length (cm)	,590	,271	,299	,503							
Body weight (kg)	-,060	,000	,405	,476	,395						
% fat total	-,443	-,419	-,310	-,024	-,060	,619					
% water of the body	,228	,168	-,262	-,333	-,275	-,976**	-,667				
Muscle mass (kg)	-,144	-,132	,333	,214	,359	,905**	,429	-,929**			

Type of addition	**,285**	**,158**	**,126**	**-,252**	**-,095**	**-,693**	**-,945****	**,693**	**-,441**		
Metabolism speed	**-,144**	**-,132**	**,333**	**,214**	**,359**	**,905****	**,429**	**-,929****	**1,000****	**-,441**	
Индекс плот. костный массы	**,037**	**,037**	**,408**	**,284**	**,510**	**,840****	**,259**	**-,840****	**,964****	**-,327**	**,964****

Running 30 m in the mentioned method correlates very weakly with the physical indicator of Body length (r = 0.271) but with the indicator of the percentage of total body fat in the medium and in the opposite direction with the value of the correlation coefficient equal to r = - 0.419, and with others no physiological correlation was observed. It is important to note that with an increase in metabolic rate, body weight (r = -0.84), lean body mass (r = 1.0) and% of water decreases (r = -8.4). Hence, in the integral training of football players, it is necessary to use the means aimed at the development of muscle mass.

The indicator shuttle run 5 * 30 m according to Spearman's rank correlation method had a lower average degree of closeness of relationships with the following physiological indicators: height, body weight, percentage of total fat, muscle mass, metabolic rate and bone density index with the corresponding values of the correlation coefficients 0.299, 0.405 , -0.310, 0.333, 0.333, 0.408.

The "eight" test was moderately correlated with two physiological indicators. These indicators - body length (r = 0.503) and body weight (r = 0.476), and with two more indicators - the percentage of water in the body and the bone density index, correlated weakly with the corresponding correlation coefficients r = -0.333 and r = 0.284

IV. CONCLUSIONS

When preparing young football players at the stage of in-depth training, for effective management, along with the parameters of physical fitness, it is necessary to fix the percentage of water in the body, muscle mass.

1. It was determined that with an increase in the running speed by 10 m, the running speed by 30 m, shuttle run 5 * 30 m and the figure eight test also increase.

2. With a decrease in the running time by 10m and 30m, the time of the shuttle run test 5 * 30m and the figure eight test also decreases.

3. A close relationship was found between the metabolic rate and% water (r = -0.92), muscle mass (r = 0.49) and a direct relationship between the metabolic rate and muscle mass (r = 0.1). It is necessary in the process of training young football players at the stage of in-depth specialization, pays attention to exercises that contribute to the formation of athleticism.

References

1. Sampaio JE, Lago C, Gonçalves B, Maçãs VM, Leite N. Effects of pacing, status and unbalance in time motion variables, heart rate and tactical behaviour when playing 5-a-side football small-sided games. J Sci Med Sport. 2014;17(2):229–33.
2. Haugen T, Seiler S. Physical and Physiological Testing of Soccer Players: Why, What and How should we Measure? Sport Norway Email Rev Martin Buchheit. 2015;19:10–26.
3. Matias CN, Santos DA, Júdice PB, Magalhães JP, Minderico CS, Fields DA, et al. Estimation of total body water and extracellular water with bioimpedance in athletes: A need for athlete-specific prediction models. Clin Nutr [Internet]. 2016 Apr 1 [cited 2020 Mar 29];35(2):468–74. Available from: https://www.sciencedirect.com/science/article/pii/S0261561415000886
4. Martins PC, Moraes MS, Silva DAS. Cell integrity indicators assessed by bioelectrical impedance: A systematic review of studies involving athletes. J Bodyw Mov Ther [Internet]. 2020 Jan 1 [cited 2020 Mar 29];24(1):154–64. Available from: https://www.sciencedirect.com/science/article/pii/S1360859219301913
5. Santos DA, Silva AM, Matias CN, Magalhães JP, Minderico CS, Thomas DM, et al. Utility of novel body indices in predicting fat mass in elite athletes. Nutrition [Internet]. 2015 Jul 1 [cited 2020 Mar 29];31(7–8):948–54. Available from: https://www.sciencedirect.com/science/article/pii/S0899900715000714
6. Koury JC, Ribeiro MA, Massarani FA, Vieira F, Marini E. Fat-free mass in adolescent athletes: Accuracy of bioimpedance equations and identification of new predictive equations. Nutrition [Internet]. 2019 Apr 1 [cited 2020 Mar 29];60:59–65. Available from: https://www.sciencedirect.com/science/article/pii/S0899900718306956
7. Sabia S, Cogranne P, van Hees VT, Bell JA, Elbaz A, Kivimaki M, et al. Physical Activity and Adiposity Markers at Older Ages: Accelerometer Vs Questionnaire Data. J Am Med Dir Assoc [Internet]. 2015 May 1 [cited 2020 Mar 29];16(5):438.e7-438.e13. Available from: https://www.sciencedirect.com/science/article/pii/S1525861015000936
8. Koury JC, de Oliveira-Junior AV, Portugal MRC, de Oliveira K de JF, Donangelo CM. Bioimpedance parameters in adolescent athletes in relation to bone maturity and biochemical zinc indices. J Trace Elem Med Biol [Internet]. 2018 Mar 1 [cited 2020 Mar 29];46:26–31. Available from: https://www.sciencedirect.com/science/article/pii/S0946672X17307216