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RELATIONS OF MORPHOLOGICAL CHARACTERISTICS WITH AEROBIC FITNESS OF CHILDREN OF DIFFERENT GENDER AND AGE

ABSTRACT

The survey was conducted on a sample of 200 subjects, divided into two subgroups as follows: 99 boys and 101 girls of III, IV, V and VI grade of primary school, age 9 and 13 years from Belgrade. 17 anthropometric measures were measured and one test to assess the aerobic fitness. The aim of this paper was to determine the relation of morphological characteristics and aerobic fitness of children of different age and gender. The results indicate that the system of predictors had a statistically significant impact with the criterion in the boys of the third (R = 0.944, P = 0.054) and sixth grade (R = 0.973, P = 0.016). In the girls the system of predictors with the criterion had a statistically significant impact in the fourth grade (R = 0.970, P = 0.009). In other grades a statistically significant impact of the system of predictors with the criterion was not determined.

Key words: *anthropometry, aerobic fitness, younger school age, older school age.*

1. INTRODUCTION

In the basis of every kinesiology (motion) activity a large number of physiological and metabolic processesare ongoing, so this activity can have its side effects on the body of a child (Nikolić, 2003). A body involved in physical activity responds with changes in almost all physiological systems, primarily musculoskeletal, cardiovascular, respiratory, endocrine and immune system (Mikalački, 2005; Mišigoj-Duraković, 2006). For these reasons, in recent years in the field of kinesiology, of a major importance are studies that lead aerobic fitness in connection with other anthropological areas. The importance of morphological characteristics and functional capabilitiesin the realization of tests fromthe coordination space was determined (Cicović & Pelemis, 2011). This represents valuable knowledge for planning kinesiology treatmentswhose structure should be based on polystructural acyclic-cyclic forms of movement. Boys realize greater values in cardiovascular endurance, strength and

flexibility. This is confirmed by recent research by Tinazci & Emiroglu, (2009). The functional capabilities contribute significantly to the resultefficiency of agonology (competitive) directed activities (Bratić, Nurkić & Kasum, 2005). There is a determined positive correlation between the aerobic fitness, the mass of hippocampus (a part of the brain that has a particularly important role in long-term memory) and the memory ability (Chaddock, L., Erickson, KI, Prakash RS, Kim JS, Voss, MW, Vanpatter, M ., Pontifex, MB, Raine LB, Konkel A, Hillman CH, Cohen, NJ, & Kramer, AF, 2010). The results indicate that the children who have better aerobic fitness are distinguished by a greater mass of the hippocampus, which directly results in better long-term memory. This indicates the importance and necessity of programmed kinesiology activities in childhood, because it increases the impact to the changes in the brain structure and function, which can result in long-lasting positive effects on children's cognitive status.

The aim of this research was to determine the relationship between the morphological characteristics (as a system of predictor variables) and functional capability, manifested witha criterion variable to assess the aerobic fitness, in boys and girls of younger and older school age of 9 and 13 years.

2. METHOD

The sample of the subjects for this paper was derived from a population of children of younger and older school age from Belgrade with the nonprobabilistic samplingmethod, *Quota sample*, and was also used the *ex post facto* research design. The measurement of the morphological characteristics and assessments of the functional capabilitywere carried out on a sample of 200 subjects, divided into two subgroups as follows: 99 boys (25 subjects ofthird, 25 of fourth, 25 of fifth and 24 subjects ofsixth grade) and 101 girls (25 of third, 25 of fourth, 25 of fifth and 26 of sixth grade), aged 9 and 13 years from Belgrade. All of the subjects at the time of measurement attended the primary school "Kralj Petar I" in Belgrade. The parents were, before the beginning of the anthropometric measurements and assessments of the functional capability, required to give consent for research on their children (Declaration of Helsinki for biomedical research).

As a sample of measuring instruments were selected the following anthropometric measures:

I <u>For the assessment of longitudinal dimensionality of the skeleton:</u>

1) *Body height (0.1cm),*
2) *Leg length (0.1cm),*
3) *Foot length (0.1cm) and*
4) *Hand length (0.1cm).*

II <u>For the assessment of transversal dimensionality of the skeleton:</u>

1) *Shoulder width (0.1 cm),*
2) *Pelvic width (0.1 cm),*
3) *Hand width (0.1 cm),*
4) *Knee diameter (0.1 cm),*
5) *Ankle diameter (0.1 cm) and*
6) *Elbow diameter (0.1 cm)*

III <u>For the assessment of body volume and mass:</u>

1) *Body weight (0.1 kg),*
2) *Mean chest circumference (0.1 cm),*
3) *Mean stretched forearm circumference (0.1 cm) and*
4) *Mean stretched thigh circumference (0.1 cm)*

IV For the assessment of subcutaneous adipose tissue:

1) *Upper arm skinfold (0.1 cm),*
2) *Back skinfold (0.1 cm) and*
3) *Abdominal skinfold (0.1 cm)*

For the assessment of the functional capability was used the test of aerobic fitness.

I For the assessment of aerobic fitness:

1) *Running 300 meters(0.1 sec).*

The statistical processing of the data included calculation of the relationships between the anthropometric variables, which made the system of predictors and the variables for the assessment of the aerobic fitness (criteria) with Multiple regression analysis.

3. RESULTS

Table 1 shows the values of the Multiple regression analysis of the criteria for the boys of the third, fourth, fifth and sixth grade.

Table 1. MULTIPLE REGRESSION ANALYSIS *Running 300 meters* FOR BOYS

VARIABLES	Boys							
	III	grade	IV	grade	V	grade	VI	grade
	Beta	p	Beta	p	Beta	p	Beta	p
Body height	-.588	.111	1.443	.171	.946	.273	-.103	.665
Leg length	.010	.966	-.499	.596	-.173	.705	.075	.872
Foot length	.714	.099	-.470	.276	-1.054	.083	-.157	.496
Hand length	.249	.487	-.154	.782	.145	.731	.000	.998
Shoulder width	-.388	.103	.028	.943	.895	.019	-.148	.567
Pelvic width	-.741	.128	-.517	.275	-.256	.435	-.125	.777
Hand width	.309	.227	.484	.302	-.521	.300	.185	.429
Knee diameter	-.198	.509	.312	.588	-.465	.455	-.227	.343
Ankle diameter	-.159	.570	-.188	.506	.580	.263	-.031	.862
Elbow diameter	.316	.361	.013	.980	-.706	.126	.239	.353
Body weight	1.539	**.054**	-2.291	.229	-.993	**.005**	.691	.544
Chest circumf.	-.931	.075	.516	.650	-2.909	**.008**	-.178	.596
Forearm circumf.	-.219	.627	.962	.334	.198	.819	-.432	.237
Thigh circumf.	-.153	.551	1.050	.139	3.020	**.006**	-.150	.760
Upper arm skinf.	1.600	**.005**	-.790	.320	-.129	.838	.732	.059
Back skinfold	-.962	**.049**	.491	.350	1.582	**.017**	.633	.352
Abdominal skinf.	-.341	.366	.381	.643	-.690	.162	-.422	.571

R=0.944; R^2=0.628 R=0.888; R^2=0.278 R=0.930; R^2=0.534 R=0.973;R^2=0.796

F=3.383; P=**0.054** F=1.543; P=0.289 F=2.620; P=0.100 F=6.284; P=**0.016**

Legend: Beta-standardized regression coefficients; p-level of statistical significanceof standardized Beta coefficients; R-multiple correlation coefficient; R^2-coefficient of determination; F-testing of relations of multiple correlation; P-level of statistical significance of F relations.

Based on the multiple correlation coefficient, F relations and its statistical significance there can be concluded a statistically significant impact of the system of predictors with the criterion in boys of the third and sixth grade. Based on the adjusted coefficient of determination for the third grade boys it can be concluded that the system of predictors explains nearly 63% of the commonvariability with the criterion, while for the rest were responsible other characteristics and capabilities of the anthropological status of the boys. The standardized regression coefficients Beta have mathematically positive, but logically negative statisticallysignificant impact on the criterion in the variables: *Body weight* and *Upper arm skinfold*. Mathematically negative but logicallypositive impact was made by the variable *Back skinfold* since it is about the inverse metrics. In students of the fifth grade there was a statistically significant impact of the Beta coefficients, but since the systemof predictors is not statistically significant, any further statement would not make sense. The system of predictors of the sixth grade boys, on the basis of the multiple correlation coefficients, F relation and its significance, and the coefficient of determination, explains almost 80% of the common variability of the system of predictors with the criterion. In the sixth grade boys no variable has statistically significant impactfrom the system of predictors with the criterion.

Table2. MULTIPLE REGRESSION ANALYSIS *Running 300 meters* FOR GIRLS

	Girls							
VARIABLES	III	grade	IV	grade	V	grade	VI	grade
	Beta	p	Beta	p	Beta	p	Beta	p
Body height	.611	.230	.510	.342	-.247	.538	-.406	.412
Leg length	-.979	.068	-.390	.282	-.841	.174	.343	.383
Foot length	-1.333	**.027**	-.090	.648	-.213	.749	.081	.788
Hand length	1.254	**.041**	-.319	.275	1.321	.056	.256	.531
Shoulder width	.100	.761	.166	.402	-.018	.970	.341	.310
Pelvic width	.336	.368	-.513	.106	.316	.506	.136	.793
Hand width	-1.761	.090	.026	.924	.015	.966	-.200	.528
Knee diameter	-.033	.947	.088	.811	-.471	.301	.103	.841
Ankle diameter	.636	.095	.151	.550	.947	.106	-.173	.670
Elbow diameter	.926	.063	.321	.153	-.967	.125	.009	.989
Body weight	1.462	.331	.425	.445	-.298	.869	-.680	.687
Chest circumf.	-.905	.131	-.901	.133	1.798	.135	-.006	.996
Forearm circumf.	1.725	.077	-.828	.088	.266	.765	-.570	.511
Thigh circumf.	-.866	.163	.374	.361	-.842	.491	1.014	.216
Upper arm skinf.	-1.817	.157	.025	.930	.482	.412	1.155	.173
Back skinfold	-.840	.173	.941	**.010**	-.426	.601	-.875	.465
Abdominal skinf.	1.276	.071	.571	.135	-.687	.328	.632	.552

R=0.935;R^2=0.571 R=0.970; R^2=0.794 R=0.855; R^2=0.080 R=0.920;R^2=0.522

F=2.879; P=0.080 F= 6.454; P=**0.009** F=1.122; P=0.465 F=2.609; P=0.085

Legend: Beta-standardized regression coefficients; p-level of statistical significance of standardized Beta coefficients; R-multiple correlation coefficient; R2-coefficient of determination; F-testing of relations of multiple correlation; P- level of statistical significance of F relations.

By reviewingthe Table 2 Multiple regression analysis of the criteria for girls, and based on the multiple correlation coefficient, F relation and its significance, there can be concluded a statistically significant relation between the system of predictorswith the criterionin fourth-grade girls. The adjusted coefficient of determination indicates that the entire system explains nearly 58% of the common variability with the criterion. The biggest mathematicallypositive, logically negative impact was made by the variable *Backskinfold*. In girls of the third grade there was a statistically significant impact of the standardized regression Beta coefficients in two variables, but since the system of predictorsis not statistically significant, it can be assumed that it happened accidentally or that other characteristics and capabilities of the anthropological status had a greater impact. The system of predictors of girls of the fifth and sixth grade also have no statistically significant impact on the criterion.

4. DISCUSSION

The statistically significant relations that were found between the morphological characteristics and functional capabilities in the boys of the third grade, and based on the standardized regression Beta coefficients, show that the lower the body weight valuesthe boys had, the lowerthe subcutaneous adipose tissue values assessed on the skinfold of stretched upper arm (*m. triceps*), and the higher the back skinfold values(*subscapularskinfold*),the better are the results theyachieved on the functional test. That is consistent with the findings of Molnar and Smajić (2008), based on a similar sample. This can be explained by noting that increased body weight acts as a disturbing factor in the manifestation of the aerobic fitness, the amount of the maximal oxygen uptake decreases with increasing body weight of a person. The largest annual increase in body weight in both genders can be seen in the fourteenth year from 6.68 to 7.73 kg (Kerić, 2010). The subcutaneous adipose tissue is especially contraindicated in the kinesiology activities that must "carry" the body weight, and which therefore require that the balancing mass is as small as possible because of the rational use of energy as well as the kinetic and kinematic motion efficiency (Ilić & Mrdaković, 2009).

The sixth-grade boys are in a similar state of growth and development and their relation to the aerobic fitness. It can also be noted with a regular inspection of the standardized regression coefficients Beta, considering that they did not achieve a statistically significant impact, and the system of predictorsas a whole did. This may also indicate a different number of anthropometric measures per one morphological factor (Bala, 2010). In order to achievereally correct results, the number of variables by a factor should be equable, especially when it comes to the factor, canonical correlation and regression analyses.

In the fourth-grade girls the system of predictorsindicateda statistically significant relation with the criterion. The greatest negative impact was made by the variable *Back skinfold*, so it can be concluded that the lower the subscapular skinfold values the girls in this age had the better were the results they achieved. It is obvious that the back subcutaneous fat in the girls influenced as a disturbing factor. That can be compared with similar findings of Babić, Blažević & Katović (2012), based on a similar sample of subjects.

5. CONCLUSION

The knowledge of the principles, which are most manifested in the form of the relations between the anthropological dimensions, is necessary because the efficiency of any motoric programs, with appropriate motoric skills, can be manifested only through the effectors that are represented by muscles, bones and joints. Attempts to define certain principles, or at least tendencies, are based on the fact that the individual differences among children aregenerators of different body constitutions, as well as types of functional capabilities.

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