



STUDY OF THE RELATIONSHIP BETWEEN PHYSICAL DEVELOPMENT AND MOTOR ABILITIES OF PRESCHOOLERS

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ABSTRACT

The genetic, structural, and functional characteristics of the human body are of particular importance for the manifestation of motor abilities.

The aim of the survey was to reveal the character and the degree of the relationship between the basic anthropometric parameters and the main motor abilities in preschoolers. 208 boys and girls were studied.

Methods: theoretical analysis, anthropometry, pedagogical testing, statistical methods. **Results:** height, weight and chest circumference have a positive, moderate, and significant influence only on the static strength of both hands and trunk and the explosive strength of the upper extremities. The correlation with other motor abilities is very low and statistically insignificant. **Conclusion:** Positive, moderate to significant correlation between structural characteristics and the static and explosive strength of the upper extremities and static back strength of the studied children was found. Probably motor abilities depend more on functional prerequisites and on other exogenous factors which are not an object of our study. However, in that age period, the role of structural factors should not be neglected when interpreting the results of motor tests.

Key words: correlations, anthropometric indicators, motor abilities, 5–6-year-olds

INTRODUCTION

Motor abilities are the basic structural elements of physical fitness. They are manifested in the motor activity of man simultaneously or with the dominance of one or another motor ability, depending on specific motor task (1-3).

For the manifestation of the main motor abilities - speed, strength, endurance, agility and flexibility, components of physical fitness a number of prerequisites with endo – and exogenous character are required. The genetic (hereditary), structural and functional characteristics of the organism are of particular importance.

However, in the process of assessing them, a problem occurred concerning the differentiation

of structural and functional prerequisites contributing to the achievement of one or another result of motor tests. Very often the emphasis is put on the functional prerequisites and the interpretation of the results does not take into account the structural factors. However, such an approach leads to an inaccurate and unrealistic assessment of the indicators we are interested in (4).

A number of scientific studies suggest that there is a certain correlation between the functional and structural elements of the organism as the structural prerequisites play some role in the development of better physical fitness. So, they should not be overlooked when assessing a person's motor abilities (5-7). For example, T. Yordanova (2020) found that 'The maximum power in all types of jumps increases with increasing indicators of height, weight, length of the lower limbs, chest circumference and shoulder width in figure players' (7).

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Most scientific studies are aimed at examining the influence only of certain body sizes (body weight, ATM, adipose tissue (on certain motor abilities) mainly strength and aerobic endurance (4). Despite the publications in that field there are some questions which are not solved yet. Researches are fragmented, and in many cases the impact of age is not taken into account, especially in children and adolescents where research is very scarce - and the results obtained are quite contradictory (4, 5, 8).

The aim of the survey was to reveal the character and the degree of the relationship between the basic anthropometric parameters and the main motor abilities in preschoolers.

METHODS

A total of 208 children (113 boys and 95 girls) from two age groups – 5 and 6 year olds attending and training in two kindergartens and in one preparatory group for school in Sofia were examined. The kindergartens and the school were randomly selected in order to eliminate more external factors that would impact the results of the performed motor tests.

In 2015/2016 school year, a pedagogical experiment was conducted with children on the territory of the two kindergartens and the school in order to establish the effect of the application of enriched educational content in physical culture pedagogical situations (3). They were tested twice – at the beginning and at the end of the experimental period. A test battery developed by the author (described in the dissertation work) was used. A number of morpho-functional indicators were measured, and in our study we included only the anthropometric ones – height, body weight and chest circumference. The following motor tests were carried out in order to measure the level of the motor abilities – ‘hand grip of the left and the right hand’, ‘trunk strength dynamometry’, ‘40 m run’, ‘standing broad jump’, ‘throwing a medicine ball 1 kg with two hands above the head and underneath’, ‘throwing a small dense ball as far as possible’, ‘throwing a small dense ball towards horizontal and vertical marker’, ‘maximum number of squats for 20 seconds’, ‘200 m run’, ‘sit and reach’.

To achieve the goal of the survey the following scientific methods were used: theoretical analysis of the informational resources, pedagogical testing, anthropometric research method, statistical methods – variation, correlation analysis, graphical analysis.

In order to establish the strength and degree of the relationship between the anthropometric parameters and motor abilities a correlation analysis was carried out using the results from the first measurement (3). In connection with the aim set, the statistical method used was applied to the results of all children of both age and sex groups, whether they belonged to the control or to the experimental group. Coefficients of ordinary linear correlation by Pearson – (r) was calculated. For statistically significant, were accepted those values of the coefficient - r , which are greater than or equal to the theoretically calculated (in our case $r = 0.11$) (9). The statistical significance was selected at the level of $p < 0.05$.

RESULTS

The results of the correlation analysis are presented in **Tables 1 and 2**.

As most of the correlation coefficients calculated have low and statistically insignificant values. They will not be an object of our discussion in that report (3).

The relationship between the anthropometric characteristics and the test results will be analysed separately for any of the three structural elements. The anthropometric parameters are accepted as independent variables while the motor abilities as dependent ones.

Height is one of the main anthropometric parameters of the human body. In the age 5-6/7 years it increases significantly under the influence of natural processes of growth and development. It should be noted that this indicator is hereditary determined and more conservative in comparison to the other anthropometric parameters.

Table 1. Correlation coefficients between the anthropometric parameters and motor abilities in 5 years old boys and girls

BOYS				GIRLS		
TESTS AND PARAMETERS	Height	Weight	Chest circumference	Height	Weight	Chest circumference
1. Hand grip - right hand	,524**	,372*	,453**	,499**	,596**	0,304
2. Hand grip- left hand	,395**	,356*	,329*	,439**	,601**	0,229
3. Trunk strength dynamometry	,411**	,397**	,367*	,393*	,398*	-,317*
4. Throwing medicine ball 1 kg above head	,430**	0,267	,443**	,569**	,544**	0,003
5. Throwing medicine ball 1 kg underneath	,438**	0,268	,421**	,568**	,508**	0,095
6. Throwing small ball as far as possible	,346**	0,259	0,288	,459**	,396*	0,184
7. Towards horizontal and vertical mark	0,109	-0,07	0,087	0,154	,329*	0,018
8. 40 m run	-0,05	0,217	0,073	-0,205	-0,037	,468**
9. Sit and reach	-0,022	-0,113	-0,123	,453**	0,136	-0,054
10. 200 m run	-0,157	0,095	0,026	-0,017	-0,003	0,167
11. Standing broad jump	0,171	-0,121	0,057	,333*	0,268	-0,193
12. Max squats for 20 sec	0,166	-0,235	-0,081	0,033	0,278	0,018

Table 2. Correlation coefficients between the anthropometric parameters and motor abilities in 6 years old boys and girls

BOYS				GIRLS		
TESTS AND PARAMETERS	Height	Weight	Chest circumference	Height	Weight	Chest circumference
1. hand grip - right hand	,531**	,372*	,436**	,343*	,467**	,528**
2. Hand grip - left hand	,363**	,287*	,451**	,373**	,407**	,410**
3. Trunk strength dynamometry	,287*	,319**	,391**	0,096	0,058	0,199
4. Throwing medicine ball 1 kg above head	,374**	,402**	,553**	,390**	,338*	,376**
5. Throwing medicine ball 1 kg underneath	,388**	,294*	,430**	,490**	,482**	,338*
6. Throwing small ball as far as possible	0,164	0,2	,250*	,381**	0,227	0,223
7. Towards horizontal and vertical mark	0,173	0,107	0,094	0,033	0,011	0,061
8. 40 m run	-0,013	0,146	-0,052	-0,212	-0,022	-0,009
9. Sit and reach	0,127	0,147	0,21	0,15	0,059	0,033
10. 200 m run	-0,025	0,092	-0,021	-0,158	-0,059	-0,074
11. Standing broad jump	-0,159	-0,22	-0,033	,319*	0,244	0,051
12. Max squats for 20 sec	-0,227	-0,227	-0,153	0,043	-0,031	-0,096

The data in **Table 1 and 2** show that the relationship and impact of height on motor abilities varies from moderate ($r = 0.3 - 0.5$) to significant ($r = 0.5 - 0.7$) degree. The moderate correlations dominate and most of them have a high degree of significance and a positive sign. That trend was observed in both age-sex groups. The highest are the correlation coefficients between the height and static strength of the right hand (0.531), measured by 'hand grip test' (6 old boys) and the explosive strength of the upper extremities measured by two tests – 'throwing a medical ball 1 kg with 2 hands above the head' and underneath (in 5-year-old boys: $r=0.430$, $r=0.438$), 6-year-old boys ($r=0.374$, $r=0.388$) and 5-year-old girls ($r=0.569$, $r=0.568$). An exception is observed in 6-year-old girls, where the correlation coefficients are in the moderate limits.

A moderate correlation is observed between the height and the static strength of the left hand (measured by 'hand grip test') and trunk static strength (test 'back strength dynamometry') and explosive strength of the upper extremities, measured by the tests 'throwing a medical ball 1 kg with 2 hands above the head and underneath' in all sex and age groups.

Moderate correlation between the height and the explosive strength of the lower extremities (test 'standing broad jump') and flexibility (test 'sit and reach') was found in 5-year-old girls.

Body weight is the other main anthropometric indicator of an individual's physical development. Unlike height, it is quite variable and changes, both as a result of natural processes of growth and development, as well as of a number of factors of the external environment.

The highest and significant in value are the correlation coefficients between body weight and static and explosive strength of both hands ($r = 0.508$, 0.601) in 5-year-old girls and with explosive strength of upper extremities ($r = 0.402$) in 6-year-old boys. In the other age-sex groups, body weight correlates moderately with the measured motor abilities (**Tables 1, 2**).

In this range, the highest coefficient of correlation between body weight and the explosive strength

of upper extremities in 6-year-old girls ($r = 0.482$), and the lowest one is found between the weight and static trunk strength in 6-year-old boys ($r = 0.319$). All correlation coefficients have a positive sign.

The third main anthropometric parameter is the **chest circumference in pause**. In the scientific literature no data exist about the impact of this indicator on the motor abilities of preschoolers.

In our study most correlation coefficients are positive and are in the range of moderate relationships ($r = 0.3 - 0.5$) in all age-sex groups. Significant correlations are also recorded, but they are few. The highest correlation coefficient is recorded between the chest circumference and the static strength of the right hand ($r = 0.553$) in 6-year-old boys, and the weakest one is the relationship with the static strength of the right hand in 5-year-old girls ($r = 0.304$). A moderate correlation between this anthropometric parameter and speed measured by the '40 m run' test was also found ($r = 0.468$) in 5-year-old girls. In the cases where the correlation coefficients are positive in nature and statistically significant a proportional relationship between the parameters presented in the study exists. It means that as one of them grows so will the other. But in our study the basic anthropometric parameters (independent variables) correlate positively in moderate and significant degree only with few motor tests results. The relationship with the rest parameters are very low and statistically insignificant. That means that some other factors have an impact on the growth of the dependent variables (motor abilities).

As mentioned above, functional prerequisites are one of the most important factors affecting the level of the different forms of motor abilities. Obviously in our case, they play a dominant role in achieving relevant results in the motor tests. It is obvious that most correlation coefficients between the studied basic anthropometric indicators and the motor abilities of children 5–6 years old are low. Relatively few positive in nature and moderate and significant correlations with the static and explosive strength of the upper extremities and trunk static strength were found.

CONCLUSION

As a result of the correlation analysis, we can make the conclusion that height, body weight and chest circumference (structural prerequisites). Affect only the static and explosive strength of the upper extremities and static trunk strength from a moderate to significant level in 5–6-year-olds, and the calculated correlated coefficients have a positive sign. Probably most motor abilities depend more on the functional prerequisites and probably on some other exogenous factors that are not the object of our study! Having in mind that the preschool age period the processes of growth and development are very intensive the role of structural factors should not be neglected when interpreting the results of motor tests.

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