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DIFFERENTIATION OF SOMATIC AND MOTORIC DEVELOPMENT OF CHILDREN AND ADOLESCENTS IN VIEW OF ASSESSMENT OF LIVING CONDITIONS OF THEIR FAMILIES

Key words: somatic development, motor development, family, living conditions.

ABSTRACT

The objective of the study is to determine the relationship between the somatic structure and motor fitness of children and the assessment of living conditions of their families. The study was conducted on a group of 524 school students aged 8 to 16 years, including 277 boys and 274 girls. Measurements were made of the body height and weight and the thickness of three skinfolds (abdominal, subscapular, triceps). On this basis BMI and lean body mass (LBM) were calculated. Also motor fitness tests were performed to diagnose the level of speed of movement of the upper limbs, locomotion speed, explosive force of lower and upper limbs, body dynamic force and agility, and the maximum anaerobic work. Additionally, a diagnostic survey was made among the parents of the studied children using a life quality questionnaire. The results show that good living conditions ensured to children do not always serve the purpose of a full functional development although good living conditions usually have a positive impact on their somatic development.

INTRODUCTION

The morphofunctional development of the young generation is affected by endogenous (genetic and paragenetic), lifestyle and exogenous (bio-geographical, social and economic) factors. Results of numerous studies show that the social and economic status is of major importance to children's development [1, 8, 11]. It modifies their morphofunctional development indirectly in combination with elements of living conditions and lifestyle which affect the human body directly such as nourishment, contagious diseases, physical work, harmful habits and some types of psycho-nervous stresses [1].

The simplest way to assess the economic condition of households is the income per family member. However, in Poland it is difficult to obtain reliable information. This is due to economic reasons (some people work off the books), cultural reasons (unwillingness to discuss one's own financial condition) and legal reasons (regulations concerning personal data protection). As a result, the economic status of families was assessed in this study by way of evaluation of their living conditions by the parents of the studied children.

The problem of relations between social and economic factors and somatic and motor development has been often discussed in literature. Results of studies show further advancements of the morphological development of children with a higher social and economic status [16, 20, 21]. On the other hand, the relations of economic factors with functional development are much weaker and versatile. Some authors indicate a one-directional dependence between those factors [3, 17]. However,

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other researchers advocate a non-existent relationship or weak and general correlations between children's motor development and their families' economic status [6, 13].

Despite a large number of publications in the area, there is still insufficient knowledge of the economic conditions of young people's development, in particular, with reference to their functional characteristics. It should also be stressed that the factor of family living conditions is seldom included in similar studies.

The objective of the present study paper is to determine the relationship between the somatic structure and motor fitness of children and adolescents and the assessment of living conditions of their families. The study will verify the following research questions:

1. Does the assessment of living conditions made by the parents of studied children differentiate selected somatic components of their children?
2. To what extent do the living conditions of studied children determine the level of their motor fitness?

METHODS

The empirical material was collected by means of a survey carried out from September to December 2004 in the Primary School and Junior High School in Jedlina-Zdrój in Poland. Overall, the research sample consisted of 524 persons aged 8 to 16, including 277 boys and 247 girls, which accounted for 95% of all studied school students (Table 1). The proposed survey had been approved by a competent bioethics commission. All measurements were made at the same time of the day, before noon, on the school premises. The students wore sports outfits during the examination. They had been informed of the objectives and course of the survey and had provided their consent. Also the parents of the studied children consented to their participation and use of the results for scientific purposes.

Table 1. Number of subjects according to their sex and age

Sex	Age (years)								
	8	9	10	11	12	13	14	15	16
Boys	29	32	41	20	32	31	37	29	26
Girls	35	36	28	22	29	25	23	27	22
Total	64	68	69	42	61	56	60	56	48

When the empirical material was collected, the method of direct participating observation was applied. Anthropometry (measurement of somatic traits) and motor fitness diagnostics (sports and motor tests) were used as research techniques and tools to determine the subjects' level of somatic and motor development. Additionally, the method of diagnostic survey was applied with a life quality questionnaire. The research protocol covered:

1. Measurements of key somatic features:
   - body height – with the use of an anthropometer with accuracy of 0.1 cm,
   - body weight – with the use of medical scales with accuracy up to 0.1 kg,
   - thickness of skinfolds (abdominal, subscapular, triceps) – with a skin fold caliper with accuracy of 0.1 cm.

   On the basis of these direct measurements, the body mass index (BMI) and lean body mass (LBM) were calculated [23].
2. The measurement of the spine movement range and hip joints (morphofunctional feature) – sit and reach test.
3. Measurement of motor fitness [5]:
   – movement speed of the upper limb – plate tapping with the dominant hand,
   – motion speed – shuttle run 10 x 5 m,
   – explosive strength of the lower limbs – standing long jump,
   – dynamic strength of the trunk – sit up,
   – explosive strength of the upper limbs – medicine ball throw.

   On the basis of results of the explosive strength test, the maximum anaerobic power (MAP) was also calculated [9].
4. Assessment of quality of life in families of the studied children and adolescents made by the parents. A random survey was applied which is characterised by the fact that the surveying person is in constant contact with the respondents and clarifies all issues when they arise. A modified questionnaire to measure quality of life was applied [19]. The reliability of the tool was verified during pilot studies, held among randomly selected parents of the children and adolescents from both schools. The reliability coefficient of the questionnaire was $r = 0.88$.

One of the analysed fragmentary variables of the quality of life was living conditions of the family. The respondents – mothers and fathers – had a choice of five responses concerning the assessment of their living conditions: very poor,

poor, satisfactory, good and very good. A small number of extreme responses was the reason why families were grouped into those who assessed their living conditions as very poor and poor (a group with poor living conditions) and good and very good (a group with good living conditions). As a result, further statistical analysis covered three groups of families – with poor, satisfactory and good living conditions.

The statistical analysis was carried out with the use of Statistica 6.0 (StatSoft) software package. The computations were performed at the Bio-kinetics and Statistics Research Unit of the University School of Physical Education in Wrocław. The individual results of the somatic and motor test results were normalised in the form of means and standard deviation separately for the groups of boys and girls. In order to assess the differentiation of somatic features and motor skills of the children and adolescents subject to their family living conditions, one-factor variance analysis (ANOVA) was applied as well as the least significant difference (LSD) post-hoc tests. The level of statistical significance was set at $p \leq 0.05$.

RESULTS

The assessment of living conditions made by the families provides for statistically significant differences among all the somatic traits of the boys under study. The lowest mean body height is characteristic for boys from families with poor living conditions, while the highest mean body height for boys from families with satisfactory living conditions. Differences between the groups of children whose parents assess their living conditions as poor and satisfactory as well as poor and good are statistically significant. Mean body mass, BMI, total skinfold thickness, and lean body mass of the studied boys increase along with improving living conditions of their families. Statistically significant differences were found between groups of boys from families with poor and good living conditions; with regard to BMI and subcutaneous fat, and also between groups of boys from families with satisfactory and good living conditions (Table 2).

Table 2. Comparison of values of normalised somatic parameters and motor test results of boys, between groups separated by their assessment of living conditions

Feature	ANOVA		Mean values of somatic parameters and motor test results			Post-hoc comparison		
	F	p	living conditions			poor - satisfactory	poor - good	satisfactory - good
			poor	satisfactory	good			
body height	5.43	0.005*	–0.248	0.256	0.165	0.003*	0.006*	0.541
body mass	6.84	0.001*	–0.246	0.041	0.323	0.098	0.000*	0.069
BMI	7.23	0.001*	–0.188	–0.114	0.352	0.678	0.001*	0.004*
∑ of skinfold thickness	6.99	0.001*	–0.213	–0.191	0.322	0.907	0.002*	0.002*
LBM	4.61	0.011*	–0.234	0.049	0.265	0.119	0.003*	0.181
plate tapping	2.77	0.065	0.184	–0.022	–0.197	0.256	0.020*	0.280
shuttle run 10x5 m	1.19	0.307	0.102	–0.116	–0.136	0.228	0.143	0.901
standing long jump	1.58	0.208	–0.104	0.225	0.028	0.079	0.430	0.239
sit up	5.57	0.004*	–0.242	0.354	0.000	0.001*	0.136	0.029*
medicine ball throw	2.09	0.126	–0.158	0.145	0.171	0.108	0.053	0.880
MAP	5.71	0.004*	–0.258	0.160	0.271	0.019*	0.001*	0.484
sit and reach	1.43	0.241	–0.019	0.248	–0.003	0.148	0.925	0.127

*$p \leq 0.05$

As far as the boys' functional components were concerned, family living conditions differentiated significantly their dynamic strength of the trunk and maximum anaerobic power. Boys from families with satisfactory living conditions have the strongest trunks, while boys from families whose parents assess their living conditions as poor have the weakest trunks. The level of maximum anaerobic power increased in a monotonous manner along with improving living standards of their families. Statistically significant differences were noted between groups of boys from families that assessed their living conditions as poor and satisfactory as well as poor and good (Table 2).

In terms of the girls' somatic components, living conditions differentiated significantly their body height and weight as well as lean body mass. The highest mean body height and body mass are characteristic of girls from families with satisfactory living conditions, while the lowest values are characteristic of girls from families with poor living conditions. Statistically significant differences were recorded between the mean values of body height and body mass in girls from families with poor and satisfactory as well as poor and good living conditions. The skinfold thickness in girls under study increased monotonously along with improving living conditions of their families. Statistically significant differences were noted between groups with poor and satisfactory living conditions and with poor and good living conditions (Table 3).

Assessment of living conditions also differentiated significantly the explosive strength of the legs of the girls under study. The highest level of this motor feature is typical for girls with satisfactory family living conditions while the lowest level is characteristic for girls from families with poor living conditions. Statistically significant differences were also found between groups of girls with poor and satisfactory living conditions and those with satisfactory and good living conditions. The results of F-test and post-hoc analysis also suggest that the mean values of maximum anaerobic power in studied girls increased along with improving living standards of their families. There are clear differences between the maximum anaerobic power of girls from families with poor and satisfactory living conditions and those assessing their living conditions as poor and good (Table 3).

Table 3. Comparison of values of normalised somatic parameters and motor test results of girls, between groups separated by their assessment of living conditions

Feature	ANOVA		Mean values of somatic parameters and motor test results			Post-hoc comparison		
	F	p	living conditions			poor-satisfactory	poor-good	satisfactory-good
			poor	satisfactory	good			
body height	7.12	0.001*	–0.430	0.180	0.136	0.002*	0.001*	0.800
body weight	4.55	0.012*	–0.362	0.152	0.069	0.008*	0.010*	0.629
BMI	1.01	0.368	–0.185	0.066	0.008	0.192	0.244	0.738
∑ of skinfold thickness	1.97	0.142	–0.241	0.141	–0.020	0.051	0.189	0.357
LBM	4.90	0.008*	–0.386	0.107	0.124	0.015*	0.003*	0.925
plate tapping	0.75	0.475	0.153	–0.052	–0.029	0.291	0.277	0.895
shuttle run 10x5 m	1.27	0.283	–0.094	0.157	–0.110	0.202	0.923	0.130
standing long jump	1.53	0.218	–0.172	–0.004	0.117	0.381	0.082	0.482
sit ups	1.50	0.225	–0.125	0.203	–0.045	0.100	0.642	0.164
medicine ball throw	3.47	0.033*	–0.184	0.296	–0.061	0.012*	0.456	0.037*
MAP	6.26	0.002*	–0.409	0.113	0.141	0.006*	0.001*	0.869
sit and reach	1.12	0.328	–0.103	0.039	0.147	0.467	0.137	0.533

*$p \leq 0.05$

DISCUSSION

Individual differences in biological development result from both individual genetic predispositions with respect to the speed and final level of development as well as from different living conditions during childhood and adolescence. There are various important interactions and interrelations between the genotype and the environment [1]. As a result of such interactions, the genotype determines standard reactions of the body to specific environmental conditions, while the environment decides to what extent a standard reaction may be used by each genotype. Thus, if all environmental factors are favorable, an individual may fully draw on his/her genetic potential, also with regard to somatic features or motor predispositions [11]. Indirectly, the development processes of young people are also affected by social and economic factors which in this study were analysed in the context of assessment of family living conditions.

Living conditions were a differentiating factor of the level of the majority of the analysed morphological features (with the exception of BMI and skinfold thickness in girls). The lowest level of somatic development was characteristic of children from families with the worst living conditions, while the highest level was characteristic of those whose parents assessed their living conditions as satisfactory or good. This is evidence that satisfactory living conditions positively affect children's biological development, which is confirmed by test results of other authors [11]. The social and economic status of families had a stronger impact on somatic features of boys than girls, which confirms the higher eco-sensitivity of males to the changing environmental conditions [10]. The indirect impact of living conditions on morphological development processes in children under study consists in combining the economic status with the living conditions that the parents can provide to their children. A good financial condition of the family makes the children better nourished, provides them with better access to health services and various forms of physical recreation. There is also a potential relationship between the parents' economic status and their education. The level of education is related to a hierarchy of needs and to the awareness of the significance of such lifestyle elements in child's development as rational nourishment, active leisure or adherence to hygiene rules [2]. Research results of other authors [1, 4, 11] confirm that children from families with a high social and economic status are taller, mature faster physiologically and enter the phase of pubertal growth spurt earlier than their peers from less well off families.

A relationship of the motor sphere of the tested children with assessment of their living conditions is not as clear with respect to somatic features. In the studied population, statistically significant correlations were noted only with respect to maximum anaerobic powers in both sex groups, and the trunk functional strength in boys and explosive strength of the legs in girls. This is most likely due to the complex conditions of physical fitness which is subject to genetic, somatic, motor and behavioural components [18]. Mutual relationships between those features in combination with the impact of environmental factors and lifestyle, imply less obvious relationships of children's motor development with the social and economic status of their families. This fact was also confirmed in studies of other researchers [14, 22]. The few examples of relationships of motor development with economic status are indirect. Physical activity is a factor that directly affects the level of physical fitness. A possible higher level of physical activity of children from well off families is due to the fact that their parents can afford sports and recreational services, sports equipment and transportation costs. The correlations of maximum anaerobic power with the economic status that were observed are most probably due to the fact that the body mass measurement was applied to calculate MAP, which in the children under study was related to the assessment of living conditions. The more advanced somatic development of the children from better off families was probably the reason why they attained better results in tests of trunk functional strength and explosive strength of the legs. Positive correlations of somatic and motor development, in particular with reference to fitness capacity, confirm the results of numerous surveys [7, 12, 15, 16].

In conclusion, the analysis showed that good living conditions ensured to children do not always serve the purpose of a full functional development, although they usually have a positive impact on their somatic development.

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