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Relationships Between Features of Somatic Development and Physical Fitness in 6-7 Year Old Lean and Obese Children

by

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The aim of the study was to determine the relationships between indices of physical development and physical fitness in 6-7 year old children from the extreme ranges of fat content level. For 1114 boys and 1025 girls aged 6.6 the 95th percentile of skinfolds for obese children and the 5th percentile for lean children were a base for selection of 107 obese children (55 boys and 52 girls) and 138 slim ones (71 and 67) respectively. Body height, body mass, 5 skinfolds and body mass index (BMI) were measured. Physical fitness was assessed using four tests: sit and reach (flexibility), standing-broad jump (explosive strength), sit-ups (trunk strength and endurance) and step-test.

A significant correlation between features of somatic development and physical fitness in children at the threshold of elementary school was only observed in lean boys and less numerously in obese girls. They explain no more than one-fifth of physical fitness conditions in investigated children. These observations should be taken into account in the assessment of physical fitness of children from extreme ranges of body fat content.

Key words: *physical fitness, somatic development, body composition, children*

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Introduction

The right evaluation of physical fitness during childhood causes many difficulties.

One of them includes different levels of physical development, and another one is the occurrence of correlations between the level of development of somatic features and physical fitness. Relationships between somatic features and physical fitness were investigated by many authors (Osinski 1988, Ignasiak 1998, Oja and Jurimae 1997, Drabik 1989). Several studies have indicated that obesity has a negative influence on performance of physical fitness (Raudsepp and Jurimae 1998, Graf et al. 2004, Pate et al. 1989).

In this study the relationships between features of somatic development and physical fitness in children aged 6-7 from extreme ranges of body fat content were evaluated. Physical fitness of children from these ranges is seldom analyzed in the context of their physical development (Malina et al. 1995, Ignasiak et al. 2000, Maciaszek 2001, Deforche et al. 2003). This refers especially to children at the threshold of elementary school.

Material and methods

1114 boys and 1025 girls from Gdansk were subjected to investigation. The average age of both, boys and girls, was 6,6 ± 0,4 years. Measurements of body height and body mass were the basis for calculations of the body mass index (BMI). Skinfold measurements were made at the following sites: biceps, triceps, subscapular, suprailiac and calf. The measurements were performed on the right side of body by the Lange device for measuring skinfolds. The obesity criterion was the level of the 95th percentile of the sum of skinfolds and the 5th percentile for lean children. Number of obese children, with different obesity ranges, included 55 boys and 52 girls, and lean children 71 and 67 respectively. Physical fitness was assessed using four tests: sit and reach (flexibility), standing-broad jump (explosive strength), sit-ups (trunk strength and endurance). These tests were conducted according to standard principles (Eurofit 1989). To evaluate cardiorespiratory endurance a 3 -minute step- test was performed with a step of 30,5 cm high and a pace of 24 steps per minute. Average post exercise heart rate (HR) made up the capacity coefficient (Ww) (Kasch 1961). The HR was recorded every 5 seconds during aminute of restitution, using asport tester PE 3000. The significance of correlations, separate for girls and boys, were determined on the basis of Pearson coefficients. The investigations were carried out at a Health Promotion and Child Fitness Center in Gdansk.

Results

Table 1 presents the coefficient values of correlation in the group of lean boys.

Table 1

Values of correlation coefficients in lean boys

Physical development feature	Sit-ups	Sit and reach	Standing-broad jump	Step test
Body height	0,17	0,13	0,46 ***	-0,06
Body mass	0,24 *	0,15	0,42 ***	-0,18
BMI	0,18	0,09	0,15	-0,21
Trunk skinfolds	0,25 *	0,08	0,09	-0,18

* $p < 0,05$ *** $p < 0,001$

In the group of lean boys statistically significant correlations were observed between body height and standing-broad jump, body mass and standing-broad jump and sit-ups tests. In case of the latter test the strength of correlation was considerably weaker. Approximate value of correlation coefficient was defined between the sum of trunk skin folds and a sit-ups test.

Table 2 presents correlation coefficients of lean girls.

Table 2

Coefficients of correlation in lean girls

Physical development feature	Sit-ups	Sit and reach	Standing-broad jump	Step test
Body height	0,05	-0,19	0,22	-0,05
Body mass	0,12	-0,11	0,14	-0.02
BMI	0,16	0,09	-0,05	0,05
Trunk skinfolds	-0,01	0,18	-0,02	0,2

Table 3

Coefficients of correlation in obese boys

Physical development feature	Sit-ups	Sit and reach	Standing-broad jump	Step test
Body height	0,1	-0,01	0,04	-0,14
Body mass	-0,06	0,1	0,01	-0,14
BMI	-0,14	0,17	0,01	-0,1
Trunk skinfolds	-0,24	0,05	-0,31 *	0,10

$p < 0,05$

Statistically significant correlations between features of physical development and tests of physical fitness were not observed in the group of lean girls.

In the group of obese boys (table 3) a statistically significant correlation occurred between the sum of trunk skin folds and standing-broad jump.

In the group of girls with the largest quantity of adipose tissue (table 4) two statistically significant correlations were observed. They occurred between the step-test and body mass as well as the body mass index (BMI).

Table 4

Coefficients of correlation in obese girls

Physical development feature	Sit-ups	Sit and reach	Standing-broad jump	Step test
Body height	0,11	-0,04	0,04	0,00
Body mass	0,19	0,14	-0,05	0,31 **
BMI	0,21	0,21	-0,09	0;44 ***
Trunk skinfolds	-0,08	0,17	-0,26	0,19

** $p < 0,01$ *** $p < 0,001$

Discussion

Most of all statistically significant correlations were observed in the group of lean boys.

The results of standing-broad jump in 20% were determined by body height and in about 18% by body mass. Positive correlations show that taller and heavier boys from this group achieve better results. This is confirmed by observations of 4 and 5 year-old children performed with reference to body height exclusively (Oja and Jurimae 1997). Positive correlations were also revealed in this group between the test for trunk muscle strength and endurance as well as body mass and the sum of trunk skin folds. Probably the low level of fat content was accompanied by a small muscle mass.

The correlation referred to may also point to apositive influence of advanced development and biological maturity in these subjects. Other, not investigated in this study, factors determining the level of physical fitness e.g. proportions of undertaken physical activity may explain the lack of statistically significant correlations in lean girls. A statistically significant inverse correlation between explosive strength of leg muscles and the sum of trunk skin folds in obese boys confirms the negative influence of adipose tissue on performance. This justifies the significance of fat distribution, even in such a homogeneous group. Statistically significant dependencies with reference to physical capacity occurred only in girls with the largest quantity of fat content.

The results of this test depended on body mass index in over 19% (the higher BMI the lower the level of cardiorespiratory endurance) and in about 10% on body mass. No statistically significant correlations between the flexibility test and somatic features were observed. This is well known from investigations carried out on older children (Maciaszek and Szeklicki 1998, Osinski 1988, Wolanski and Parizkowa 1976).

Conclusions

A correlation between features of somatic development and physical fitness in children at the threshold of elementary school was only observed in lean boys and less numerously in obese girls. They explain no more than one-fifth of physical fitness in the investigated population of children. These observations should be taken into account in the assessment of physical fitness of children from extreme ranges of body fat content.

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