EVALUATION OF THE STUDENTS' (5th – 8th GRADE) SOMATOTYPE AND BODY MASS INDEX PLOVDIV

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ABSTRACT

Purpose: The somatotype or the so-called body construction is a complex morphological characteristic with significant genetic determination but its separate components undergo different changes during the postnatal ontogenetic development.

Objective: The present analysis is part of a research of adolescents' physical development at the age of 11 – 14 in Plovdiv. Its aim is to analyze and evaluate their somatotype depending on BMI.

Materials and methods: a method for somatotype determination after Heath–Carter method and mathematical-statistical methods have been applied (Pearson non-parametric test, dispersion analysis Oneway – ANOVA test), the results have been processed with SPSS Statistics v.19 program package.

Results: The applied Pearson non-parametric test has found significant difference between the boys and the girls ($\chi^2 = 20,32$; $df = 2$; $p < 0,0001$). The boys' greatest share is for the mesomorphic somatotype 56 (40,3%) and the girls' greatest relative share is about the endomorphic somatotype 57 (46,7%). Almost the same share for both genders is about the ectomorphic somatotype – for the boys 48 (34,5%) and the girls 44 (36,1%). It has been proven a dependency between BMI and the somatotype ($p < 0,0001$; $F = 88,44$).

Conclusion: Most of the boys have athletic and proportional bodies and the body fat is predominant for the girls. This fat is typical for the endomorphic somatotype which is abdominal with relatively large body, short upper and lower limbs, and all body parts have round and soft shapes.

Key words: somatotype, BMI, adolescents

INTRODUCTION

The somatotype is a method for comprehensive assessment of human body structure and shape based on 10 anthropometric indexes. The basic three somatotype components are endomorphic, which is typical with a relative development of body fat; mesomorphic, which is typical with relative muscle – skeletal development, and ectomorphic component, which is typical with relative body linearity. The predominance of one of the three components defines the human somatotype (2, 4, 5).

The somatotype or the so-called body construction is a complex morphological characteristic with significant genetic determination but its separate components undergo different changes during the postnatal ontogenetic development. Their eco-sensitivity

mainly reflects the individual type of physical activity, particularity of nutrition and eating habits, different diseases, etc. So far, all targeted analyzes have shown that the age affiliation does not significantly affect any changes in human basic somatotype and they stay at the same somatotype zone throughout their whole life. All age-related changes that have been found are mainly related to the transition to adjacent somatotype categories. According to standard Heath – Carter somatotype method, there are 13 somatypes - respectively four versions to endomorphic, mesomorphic, and ectomorphic groups and one central somatotype (1). This detailed classification is extremely important for adolescents who are professionally orientated towards sport because the different somatypes are typical for different sports disciplines and can be beneficial for the athletes' accomplishments (3). We are going to examine the somatotype in its three main components: endomorphic, mesomorphic, and ectomorphic.

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AIM

The present analysis is part of a research of adolescents' physical development at the age of 11 – 14 in Plovdiv. Its aim is to analyze and evaluate their somatotype depending on BMI.

MATERIALS AND METHODS

261 students from 5th, 6th, 7th, and 8th grade in Plovdiv are the objects of the study. The following methods have been used: a method for somatotype determination after Heath–Carter method which is based on 10 anthropometric indexes and mathematical-statistical methods (Pearson non-parametric test, dispersion analysis Oneway – ANOVA test). The results have been processed with SPSS Statistics v.19 program package. The graphs and the tables have been made with Microsoft Office Word and Excel 2010.

RESULTS

The study has covered 261 children – 139 boys (53,3%) and 122 girls (46,7%). Pearson non-parametric test has been done and it has shown significant difference between boys and girls ($\chi^2 = 20,32$; $df = 2$; $p = 0,0001$). When comparing the boys and the girls with the three main somatotype components, the following results have been reached: almost the same share for both genders is about the ectomorphic somatotype – for the boys 48 (34,5%) and for the girls 44 (36,1%). The greatest share for the boys is for the mesomorphic somatotype 56 (40,3%), and the girls' greatest relative share is about the endomorphic somatotype 57 (46,7%) (**Figure 1**).

Figure 1. Relative shares for boys and girls in relation to the three main somatotype components.

Compared by age, the data has shown the adolescents' somatotype changes. The greatest change happens at the age 10 – 13 but there is no statistically important difference for the different ages ($p > 0, 05$).

For the two basic age groups (11 – 12 and 13 – 14), the applied non-parametric test for hypothesis proof has shown there is statistically significant difference at the two age groups for the boys ($\chi^2 = 9,29$; $df = 2$; $p = 0,01$) and there is no difference for the girls ($p > 0,05$). The three somatotypes have equal

shares for the 11 – 12 years old boys but the mesomorphic somatotype has the greatest share for the 13 – 14 years old boys 25 (51,0%). The endomorphic somatotype has the greatest share for the girls from both age groups. The ectomorphic somatotype comes next and the mesomorphic somatotype has the smallest share.

Dispersion analysis Oneway – ANOVA test has been used to find the BMI mean values in somatotypes (**Table 1**) and its relation to the somatotype.

Table 1. BMI – mean values in somatotypes.

	N	Mean	SD	Std. Error
Endomorphic	92	22,432205	3,2418022	,3379812
Mesomorphic	78	22,563885	3,9330779	,4453334
Ectomorphic	93	17,345961	1,4522675	,1505931

It has been proven statistic dependency between BMI and somatotype ($p = 0,0001$; $F = 88,44$). Higher BMI index has been found for individuals with endomorphic and mesomorphic somatotypes where the BMI mean for endomorphic type is 22,43 ($SD \pm 3,24$), and 22, 56 ($SD \pm 3,93$) for the

mesomorphic somatotype. BMI is lowest for the ectomorphic type 17,34 ($SD \pm 1,45$).

Applying the same analysis, we have found the BMI mean for somatotypes for every gender (**Table 2**), and the statistical dependency has been proven for both genders (for the boys $p = 0,0001$; $F = 44.82$, and for the girls $p = 0,0001$; $F = 46.51$).

Table 2. BMI – mean values in somatotypes for both genders.

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	N	Mean	SD	Std. Error	N	Mean	SD	Std. Error
Endomorphic	35	23,27	3,40	,57	57	21,91	3,05	,40
Mesomorphic	56	22,76	4,29	,57	21	22,17	2,85	,62
Ectomorphic	48	17,32	1,56	,22	44	17,38	1,35	,20

For the boys, the highest BMI is for the endomorphic somatotype where the mean values are 23,27 ($SD \pm 3,40$), and for the girls, the highest BMI is for the mesomorphic type 22,17 ($SD \pm 2,85$).

CONCLUSION

The boys are more athletic especially at the age 13 – 14 comparing to the girls where the endomorphic somatotype is predominant for both age groups – the girls have more body fat than muscles. The students have been divided into two main age groups (11-12 and 13-14) where a significant difference has been seen for the boys' somatotype – at the age 11 – 12 there is equal share for the three somatotypes but at the age 13 – 14 the mesomorphic type is predominant. The endomorphic somatotype is predominant for both girls' age groups. It shows most of the boys are athletic, with harmonic proportions, and the body fat is predominant for the girls which is typical for the endomorphic somatotype – it is abdominal, with relatively large body, short upper and lower limbs, and all body parts have round and soft shapes.

BMI influenced the somatotype which fact is statistically proven. The lowest BMI has been seen in the ectomorphic somatotype which is typical for the taller and slim people with longer limbs.

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