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SOMATOTYPE IN 11 YEARS OLD MACEDONIAN ADOLESCENTS

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Abstract

The aim of this study was to evaluate sex and ethnic differences of somatotype in Macedonian adolescents at the age of 11 years.

In this study 315 adolescent students (167 males and 148 females), from Macedonian and Albanian nationality at age of 11 years were included from primary schools in two cities: Skopje and Strumica in R. Macedonia. Ten anthropometric parameters were measured using standard equipment and measurement technique to assess the somatotype according to Heat–Carter somatotyping method.

Although there were not significant sex and ethnic differences of somatotype components between the groups at the age of 11 years, from the obtained results we concluded that males and females of Macedonian ethnic group had higher values for endomorph component than their Albanian pears, who had higher values for mesomorph and ectomoph component.

Ethnic group should be taken in mind for easier evaluation and understanding of differences in anthropometric parameters of growth and body composition in Macedonian adolescents.

***Key words**:* adolescents, somatotype, endomorphy, anthropometry

Introduction

The term somatotype and it is three components (endomorh, mesomorph and ectomorph) were first described in 1940 by Sheldon and his co-workers. According to him, endomorphy means relative predominance of soft roundness throughout the various regions of the body, mesomorphy means the relative predominance of muscle, bone and conective tissue and ectomorphy means relative predominance of linearity and fragility. Later Heat and Carter introduced the simplified method for somatotyping and in the last few decades anthropometric somatotyping is one of the most used methods which describes the body shape and composition. It has been the most used for studying body physics variations in children, adolescents and adults among populations, age changes and sex differences [1, 2].

Somatotype in the period of childhood and adolescence changes because of the different time of puberty and sexual maturity [3, 4, 5, 6]. In many anthropological studies that have examined the growth and development in children and adolescents, the knowledge about changes in somatotype during growth has contributed to better understanding of sex and age differences and changes in body composition [7, 8, 9, 10].

Macedonia is a multiethnic country in which a heterogeneous population composed of mixture of different religious and linguistic affiliations, lives on a small space with limited resources. Albanians are the largest ethnic minority in the Republic of Macedonia. Macedonians and Albanians differ in some aspects of living style, eating habits, socioeconomic and cultural aspects, so we could expect differences in body constitution. Considering that there have not been enough studies on the somatotype of the adolescents in R. Macedonia of both ethnic groups this study had a goal to assess the sex and ethnic differences of anthropometric characteristics and somatotype of two ethnic groups of Macedonian adolescents both males and females, at the age of 11 years.

Material and methods

Subjects

Data were obtained from a cross-sectional sample of students of three primary schools in two cities in R. Macedonia: Skopje and Strumica. The sample included 315 adolescent students (167 males and 148 females) at the age of 11 years, from selected schools and classes, which gave their consent for participation in the research. In order to avoid mistake in the selection of sample, volunteer students were not included. Subjects were grouped according to sex and ethnicity. The University Human Research Ethics Committee approved the experimental protocols.

Anthropometry and somatotyping

For evaluation of somatotype ten anthropometric variables were selected and measured according to the International Biological Program (IBP): body height, elbow diameter and knee diameter; body weight, four skinfolds (triceps, subscapular, supraspinale and calf); and two circumferences (arm and calf). The following standard anthropometric instruments were used: for measuring body height anthropometer by Martin, with 1 mm reading accuracy; decimal weight scale; "John Bull" caliper square for determination of skin-folds with pressure of 10 g/cm^2 and precision of 0.1 mm; elastic band, also with 1 mm reading accuracy, for measuring circumferences; and caliper square for measuring of diameters with reading precision of 1 mm and weight scale for measuring body weight. Anthropometric measurements were made during school hours, not interrupting the lessons. Subjects were standing, facing ahead, and body height was measured as maximum distance from the floor to the highest point on the head. Shoes were off, both feet together, and arms at the sides. Heels, buttocks and upper back were in contact with the wall. Body height measurement can vary throughout the day, usually being higher in the morning, so to ensure reliability we measured height at the same time of the day.

Somatotype components were assessed using the Carter Heat somatotyping method. The anthropometric somatotype was calculated by the following equations (14):

Endomorphy = $-0.7182 + (0.1451 \times X) - (0.00068 \times X2) + (0.0000014 \times X3)$, where X = (sum of triceps, subscapular, and supraspinal) × (170.18/height, cm).

Mesomorphy = (0.858 × humerus breadth) + (0.601× femur breadth) + (0.188 × corrected arm girth) + Postural Stability in Children 175 (0.161 × corrected calf girth) − (height × 0.131) + 4.5, where corrected arm and calf circumferences are the respective limb circumferences minus the triceps and medial calf skinfolds.

Three equations were used to calculate ectomorphy according to the height weight ratio (HWR): If HWR is ≥40.75 then ectomorphy =(0.732 × HWR) − 28.58; if HWR is less than 40.75 but greater than 38.25, then ectomorphy = (0.463 ×HWR) − 17.63; if HWR ≤38.25, then ectomorphy= 0.1.

Statistics

The data were analyzed with descriptive statistics represented by measures of central tendency and its deviation (arithmetic mean value and standard deviation). The significant differences between groups, were evaluate by ANOVA, on significance level $p < 0.05$. The statistical package for the social sciences (version 20.0, SPSS Inc, Chicago, IL) was used for all statistical analysis. Somatotype-Calculation and Analysis V1.1. Monte Goulding, Sweat Technologies, Mitchell Park, South Australia software was used to determine somatotypes.

Results

The study included 315 adolescent students (167 males and 148 females), from two ethnic groups Macedonian and Albanian at the age of 11 years, from Skopje and Strumica. Anthropometric measurements of both Macedonian and Albanian adolescents at the age of 11 years are given in Table 1. Males of both ethnic groups had higher values for height and weight compared with females, and males and females from Macedonian nationality had higher values for height and weight compared with their peers of Albanian ethnic group. There were no sex or ethnic significant differences.

Somatotypes of Macedonian adolescents at the age of 11 years by sex and ethnic groups were classified in thirteen categories following Carter's classification (Carter 1980). The frequency and

distribution of 13 categories of somatotype (Carter, 1980) are shown in Table 2. At the age of 11 years male examinees of Macedonian nationality belonged to three somatotype categories: mesomorphic endomorph (26%), central type (10%), mesomorph-endomorph (14%) and balanced ectomorph (18%), while other adolescents belonged to other categories (Table 2; Fig. 1). Males from Albanian nationality belonged mainly to mesomorph somatotypes: mesomorphic endomorph (23%), mesomorph ectomorph (14%), mesomorphic ectomorph (19%) and central type (14%) (Table 2; Fig. 2).

Table 1. Anthropometric variables in 11- year-old adolescents by sex and ethnic group

	Males		Females	
Age 11 years	Macedonian	Albanian	Macedonian	Albanian
Variable	Mean ± SD	Mean ± SD	Mean±SD	Mean±SD
HWR	43.12± 2.28	43.60± 2.81	43.56± 2.51	44.38 ± 2.02
Height	151.53± 7.29	150.09± 7.33	152.11± 7.04	150.27± 7.12
Weight	44.51± 9.95	42.69 ±14.06	43.96± 11.54	39.63 ± 8.30
Triceps SF	15.85± 6.28	14.80 ±8.25	16.17± 7.01	14.15± 4.68
Subscapular SF	10.55± 6.11	10.07 ±7.76	11.26± 5.90	9.32± 4.14
Supraspinale SF	12.11± 6.87	12.44 ±10.24	12.76± 7.17	10.60± 5.06
Calf SF	13.16± 5.80	14.27 ±8.32	13.99± 6.31	13.46± 5.11
Arm Girth	24.27± 3.20	23.70 ±4.03	23.35 ± 3.32	21.94± 2.41
Calf girth	31.14 ±3.44	31.02 ±3.98	31.29± 3.47	30.06± 3.42
Humerus B	5.78± 0.42	5.94 ±0.52	5.49± 0.43	5.67± 0.45
Femur B	8.72± 0.71	8.87±0.66	8.25± 0.71	8.46± 0.53
n	122	45	105	43

Significant differences were found ($p<0.05$) [a]$p<0,05$ (ethnic differences) , [b]$p<0,05$ (sex differences)

Table 2. Somatotype categories (%) in adolescents at the age of 11 years by sex and ethnic group

	Males		Females	
Somatype categories (%)	Macedonian	Albanian	Macedonian	Albanian
Endomorph-ectomorph	2	0	9	2
Ectomorfic endomorph	0	0	6	5
Balanced endomorph	3	0	5	7
Mesomorphic endomorph	26	23	31	19
Mesomorph-endomorph	14	7	9	7
Endomorphic mesomorph	8	9	2	20
Balanced mesomorph	4	0	0	5
Ectomorphic mesomorph	2	5	0	2
Mesomorph-ectomorph	2	14	1	2
Mesomorfic ectomorph	8	19	9	5
Balanced ectomorph	18	9	24	36
Endomorphic ectomorph	0	0	0	0
Central type	10	14	5	7
N	122	45	105	43

Table 3. Somatotype components in 11-years-old Macedonian adolescents by sex and ethnic group

	Males		Females	
Age 11 years	Macedonian	Albanian	Macedonian	Albanian
Variable	Mean ± SD	Mean ± SD	Mean±SD	Mean±SD
Endomorphy	4.19 ±1.76	3.94 ±2.20	4.33 ±1.79	3.84 ±1.37
Mesomorphy	3.93±1.29	4.21±1.39	3.15±1.34	3.25±1.13
Ectomorphy	3.02 ± 1.61	3.46±1.80	3.37±1.71	3.91±1.48
n	122	45	105	43

Significant differences were found ($p<0.05$) [a]$p<0,05$ (ethnic differences) , [b]$p<0,05$ (sex differences)

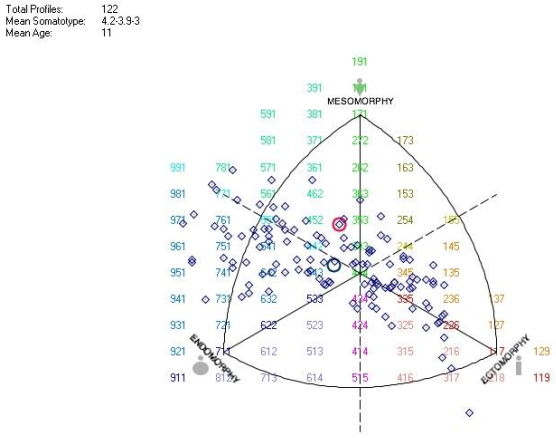

Figure 1. Somatochart, displaying somatotype categories in male adolescents by Macedonian nationality -11 years old

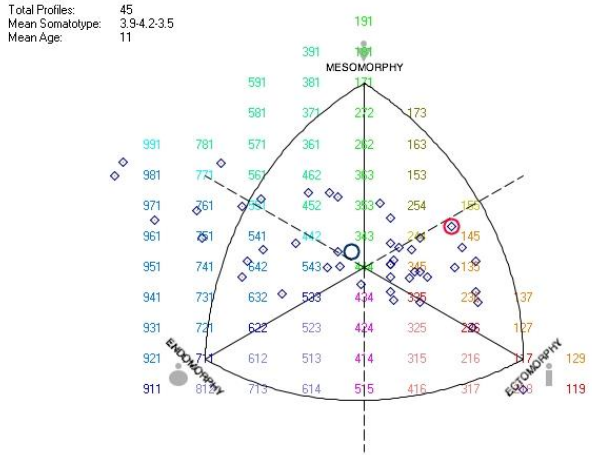

Figure 2. Somatochart, displaying somatotype categories in male adolescents by Albanian nationality -11 years old

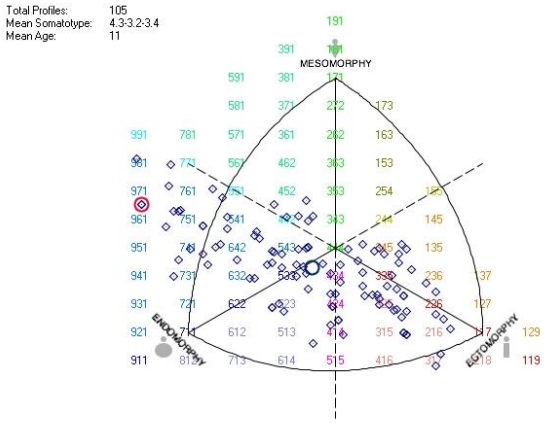

Figure 3. Somatochart, displaying somatotype categories in female adolescents by Macedonian nationality -11 years old

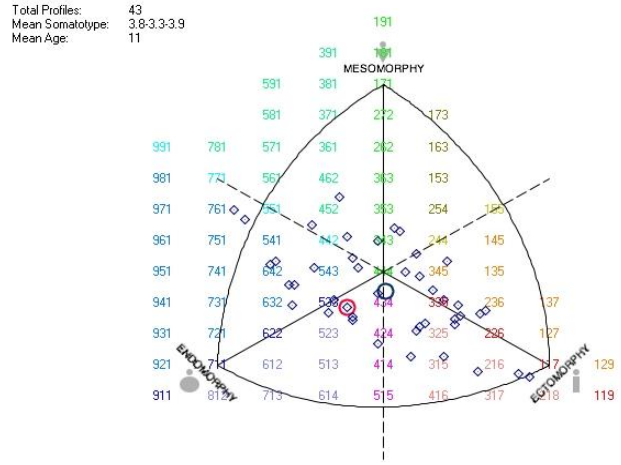

Figure 4. Somatochart, displaying somatotype categories in female adolescents by Albanian nationality -11 years old

Females of Macedonian nationality belonged to balanced ectomorph (24%) and mesomorphic endomorph (31%) so there were no big differences in somatotypes between males and females of Macedonian ethnic group. The rest of female examinees belonged to other somatotypes: central type (5%), mesomorphic ectomorph (9%), endomorph-ectomorph (9%), (Table 2; Fig. 3). Females from Albanian nationality similarly like their male peers and peers of other ethnic group mainly belonged to mesomorphic endomorph (19%) and balanced ectomorph (36%), but differ from their pears with the dominant somatotype endomorphic mesomorph (20%) (Table 2; Fig. 4). From the obtained data about somatotypes we concluded that there were no significant sex or ethnic differences in somatotype at this age.

Sex and ethnic differences of somatotype components (mean values and standard deviations) are shown in Table 3. Although there were not significant sex and ethnic differences of somatotype components between the groups at the age of 11 years, from the obtained results we concluded that males and females of Macedonian ethnic group had higher values for endomorph component compared with their Albanian pears, who had higher values for mesomorph and ectomoph component.

Discussion

According to the research studies on somatotypes of children and adolescents there are differences in body structural components which are specific for every age and in both sexes because of the different time of puberty and sexual maturity. Anthropometric method of somatotyping has a wide use in evaluation between the body composition and physical performances, but very often today is used for studying the body composition in the period of growth and development in children and adolescents [11-14]. According to Carter JEL, Heath BH i Bodzsar EB somatotype is changing at the age from 3 to 8 years as a result of changes in skinfold thickness because of developing subcutaneous fat mass, developing mascles and increasment of lenght of the bones in relation to the lenght of trunk. From the age of 8 yeras till the begining of puberty there are no significant changes in somatotype between the sexes When the puberty begins the sex differences increased as a result of influence of sex hormones, in males increases the muscle mass and in females increasment of subcutaneous fat mass on specific regions of the body [2,13].

In the study of Nikolova M. et al. in Bulgarian adolescents at the age of 8 to 13 years from Plovdiv, Bulgaria, at the age of 11 years mesomorph types are dominant in Bulgarian males and ectomorph in females [15]. In the study of Gakhar I and Malik SL, for the age and sex differences in somatotypes of the adolescents at the age of 10 to 18 years from jats, New Delhi, they suggest that after the age of 14 years the differences of somatotypes are increasing between the sexes [5]. The examinees in early adolescence at the age of 10 and 11 years both males and females are meso-ectomorphs, while after the age of 12 they are more balanced ectomorphs. For somatotype components they found the small increasment of values of endomorph component in males at the age from 10 years till the age of 14 years, while this component in females showed continous increasment till the age of 18 years. In the study of Nikolova M. et al they found that the values of endomorph component in male examinees are significantly decreasing with the age, and the lowest value they had at the age of 11 years, with increasment of 0.5 SE (somatotype unit) at the age of 12 years related with the onset of puberty. Similar with the other studies the females in the study of Nikolova M, had higher values for the endomorph components compared to males, but with the tendency of decreasment with the age [15]. Stoev R. et al, in their study of somatotypes in Bulgarian adolescents at the age from 9 to 17 years, from two cities Smolia and Sofia, found that Smolian adolescents at all age groups were more mesomorph and less ectomorph than their pears from Sofia, and the females from Smolia were more mesomorph then their female pears from Sofia. Females were endomorph while mails were more mesomorph in both groups [16]. In this study we confirmed that at the age of 11 years at the early period of adolescence there were no significant differences in somatotype. Beside that males of both ethnic groups were with higher values for height and weight than females, and males and females from Macedonian nationality were with higher values for height and weight compared with the Albanians. Contrary to endomorph component, mesomorph component or the second component in the somatotype which is a rating on a continuum of musculosceletal robustness relative to stature after the age of 11 years had higher values in males and females of Albanian ethnic group.

In this transversal study which included adolescents of Macedonian and Albanian nationality at the age of 11 years, we had a goal to approach one, untill now not investigated area of assessment of body composition and differences in somatotypes between two ethnic groups of adolescents living in Republic of Macedonia.

Conclusion

Results of our study clearly suggest that in physique investigations, the somatotypes need to be studied in each age and sex separately, and with the consideration of ethnicity of the population. Ethnic group should be taken in mind for easier evaluation and understanding of differences in anthropometric parameters of growth and body composition.

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