

CONSTITUTIONAL TYPE IN ADOLESCENTS

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ABSTRACT. The study includes data of 449 boys and 465 girls in Sofia and 169 boys and 192 girls in Smolyan aged 9 to 17. A proper somatotyping schedule is used to trace the constitution and its changes in adolescence in the capital of Sofia and in the smaller town Smolyan. The suitability of this schedule is confirmed by correlation analysis. In the investigated adolescents intersexual differences in somatotype are established already in the juvenile stage of development (higher mesomorphism in boys, higher endomorphism in girls). These differences persist and increase during the puberty. In the same time significant differences are found in the somatotype of the adolescents in the capital and in Smolyan. The boys from the smaller town are more mesomorphic, and girls – more mesoendomorphous than Sofia ones. A probably reason of these differences is the higher physical activity in the smaller town, and peculiarities in the way of nutrition.

KEY WORDS. Somatotype, adolescence, stage of maturation, city-town differences, intersexual differences.

INTRODUCTION

The constitution in adolescents and its relations with the processes of growth, physical and sexual maturation are object of many studies [2, 3, 5]. In Bulgaria the somatotype of adolescents until quite recently were studied mostly as concerns the sport activity [8, 13, 16, 18]. However, since the development of the human organism in the childhood and the adolescence is under the influence of the social environment, we should expect social differences in the somatotype. Such differences were in fact established during the analysis of anthropological data about the physical development of adolescents from two different by population number and social characteristics urban settlements in Bulgaria (the capital city of Sofia and the ruralized town of Smolyan) [9, 10, 11]. In these studies, however, the differences in

the somatotype are only shortly mentioned as a part of the physical development without any numeral evaluation.

The aim of present study is exactly to analyse in details the changes of the somatotype according the chronological age and the stage of sexual maturation in two settlements, different by their sociological characteristics.

MATERIAL AND METHODS

This study is based on the data from individual measurements of 449 boys and 465 girls in the city of Sofia and of 169 boys and 192 girls in the town of Smolyan, aged 9 to 17 years, investigated in 1984-1987. Some measurements, necessary for evaluation of the somatotype after the most popular schedule of Heath-Carter [19] were omitted in the initial plan of the investigation. It is well known, however, that "almost every problem in anthropology needs for its solution an individual method or modification of methods in connection with its specificity. There are not universal methods, every method has its own peculiarities and a specific area of application [6]. At the same time in spite of the existence of numerous and various classifications of constitutional types, in fact the investigators determine three major types, named by different, i.e. synonymous terms [7]. For example I.Salivon and N.Polina elaborate modification of other popular schedule of constitutional typology, this of Chtetsov [15], for the needs of its adaptation to materials from mass investigations in Belarussian schoolchildren [17]. In Bulgaria attempts to create their own somatotypological schedules has been made by D.Kadanoff and his students [7] and also by G.Angelov [1]. That was the reason to make an attempt to use a proper schedule of determination of the constitutional type, adapted to our material. In the proposed here schedule the particular components of the somatotype are determined on the base of the same or analogical somatic parameters, as in the Heath-Carter schedule. Thus the present schedule can be considered as a modification of the Heath-Carter one. The endomorphism is evaluated on the basis of the sums of the skinfolds on the extremities. The mesomorphism is evaluated on the basis of the relative biacromial width (biacromial index) and the relative upper arm (biceps) muscle circumference. The ectomorphism – on the basis of the body mass index. The standard deviation score method is used for the evaluation of these parameters. As a control (basis) sample 199 boys of Sofia in juvenile stage of development (mean age 11.2 years) are used (TABLE 1). The somatotype of this basic sample is accepted to be 3:3:3.

FORMULAE

$$\text{End} = \frac{1}{2} \cdot (((\text{Sua} - \text{M}(\text{Sua}))/\text{SD}(\text{Sua}) + (\text{Sth} - \text{M}(\text{Sth}))/\text{SD}(\text{Sth})) + 3$$

$$\text{Mez} = \frac{1}{2} \cdot (((\text{BI} - \text{M}(\text{BI}))/\text{SD}(\text{BI}) + (\text{RMCua} - \text{M}(\text{RMCua}))/\text{SD}(\text{RMCua})) + 3$$

$$\text{Ect} = 3 - \frac{1}{2} \cdot (((\text{BMI} - \text{M}(\text{BMI}))/\text{SD}(\text{BMI}))$$

Sua – Sum of 4 upper arm skinfolds

Sth – Sum of 4 thigh skinfolds

BI – Biacromial index (Biacromial diameter/height)

RMC_{Cua} – Relative upper arm muscle circumference (upper arm muscle circumference/height), where the upper arm muscle circumference is evaluated after the formula

$MC_{Cua} = C_{ua} - 3,14 / 4 \cdot C_{ua}$ (C_{ua} – upper arm circumference, MC_{Cua} – upper arm muscle circumference).

BMI – Body mass index показатель (weight/height in square)

$M(x)$ и $SD(x)$ – mean value and standard deviation of the parameter x in the basic sample.

Smolyan has been chosen for comparison with Sofia because its population shows many peculiarities, typical for the little towns and the villages (the phenomenon of ruralization). In general the examined in Smolyan students are from families with more children, lower incomes, lower education and professional status of their parents than Sofia ones. Thus their sexual maturation is retarded by 0.6-0.7 years [12]. That is the reason the somatotype to be traced also by the stage of development and not only by calendar age. For this purpose the stages of sexual maturation are determined after Schwidetzky-Pavilonis [4, 11, 15].

RESULTS AND DISCUSSION

In the schoolchildren, investigated in Smolyan and in a part of Sofia schoolchildren it was possible to use both schedules. The calculated after the proposed schedule values of the major components of the somatotype show a high degree of correlation (0.58-0.87) with the corresponding components, calculated after Heath-Carter methods (TABLE 2). The high level of statistical significance of this correlation (over 0.001) confirms the suitability of the modified schedule for analysis of the somatotype.

The numeral evaluations of the major components of the somatotype according the sex, the chronological age and the stage of sexual maturation are presented in TABLE 3 and TABLE 4. (Fig. 1 and 2). They show that Smolyan adolescents are more massive (less ectomorphic) in all ages and developmental stages. A digression can be observed only in the prepuberty. It can not be verified statistically because of the small number of investigated in this stage. However, since it is observed in both sexes in the same stage of development (and only in it!) it have to be mentioned.

The higher massiveness of Smolyan boys is a result of a strongly expressed mesomorphism. The level of their subcutaneous fat tissue, i.e. the endomorphism, is lower. In Smolyan girls, however, the massiveness is a result of a more developed fat tissue (higher endomorphism) and only in second place – of higher mesomorphism. The analysis of the separate parameters show, that in fact Smolyan girls present a higher biacromial index than Sofia ones, but their relative muscle upper arm circumference is even lower [9]. The analysis of some additional somatic parameters confirms, that Smolyan boys are more mesomorphic (athletic) and Smolyan girls – more mesoendomorphous than Sofia ones.

As for the intersexual differences, girls are manifestly more endomorphic than boys and boys – more mesomorphic than girls in both settlements. These differences can be observed already in the juvenile stage and rise during the puberty, because in

girls the endomorphism increases more quickly than in boys, and in boys – the mesomorphism increases more quickly than in girls. The ectomorphism decreases in both sexes and is approximately on the same level in boys and girls.

It is difficult to make a comparison with other studies, since in Bulgaria the human constitution has not been studied in dependence of the level of urbanization. Foreign data tell us for a higher body mass index in adolescents with a lower social status (analogically to the case with Smolyan adolescents). Usually the explanation is a more developed subcutaneous fat tissue [14]. Our data show that at least in boys the reason can be a higher development of the osteomuscular system, may be because of a higher physical activity in childhood and adolescence in the smaller settlements.

CONCLUSION

The suitability of the proposed modified somatotypological schedule is confirmed by correlation analysis. In the investigated adolescents intersexual differences in somatotype are established already in the juvenile stage of development (higher mesomorphism in boys, higher endomorphism in girls). These differences persist and increase during the puberty. In the same time significant differences are found in the somatotype of the adolescents in the capital and in Smolyan in 1980s. The boys from the smaller town are more mesomorphic, and girls – more mesoendomorphous than Sofia ones. A probably reason of these differences is a higher physical activity of childrens and adolescents in the smaller town, and some peculiarities in the way of nutrition. Additional studies (new investigations and also an analysis of yet published, but not analysed data) are necessary to establish if this tendency was typical for the whole country and if it persists until now.

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TABLE 1. Mean values and their standard deviations of the anthropological parameters, which determine the somatotype in the basic sample (boys, Sofia, juvenile stage of maturation)..

	Sum of 4 upper arm skinfolds (Sua), mm	Sum of 4 thigh skinfolds (Sth), mm	Biacromial index (BI), %	Relative upper arm muscle circumference (RMCua), %	Body mass index (BMI), kg/sq. m.
N	180	180	194	176	195
M	45.58	81.43	21.04	12.53	17.67
SD	20.05	36.52	0.98	1.49	2.78

TABLE 2. Correlations between the somatotype components, evaluated by the schedule, used in this study and Heath-Carter schedule.

Sex	Investigated individuals and correlation coefficient after the component		Sofia	Smolyan	Total
Males	N		172	168	340
	Component	I	0.743	0.755	0.711
		II	0.580	0.598	0.590
III		0.801	0.794	0.805	
Females	N		78	191	269
	Component	I	0.710	0.861	0,711
		II	0,702	0,674	0,683
III		0,842	0,863	0,869	

P < 0.001 for all correlations.

TABLE 3. Somatotype in adolescents in Sofia and Smolyan according the chronological age (means, standard deviations and significance of intersample differences).

Sex	Age, years at last birthday	Number		Endomorphism		Mesomorphism		Ectomorphism	
		Sofia	Smolyan	Sofia	Smolyan	Sofia	Smolyan	Sofia	Smolyan
FEMALES	9-10	99-100	15	3.4 0.7	3.8 0.7	2.8 0.9	3.1 0.5	3.0 0.7	2.5* 0.8
	11	65	22	3.5 0.7	3.9* 0.5	2.7 0.6	3.3*** 0.6	2.8 0.9	2.7 0.6
	12	58	37	3.3 1.0	4.0*** 0.8	2.6 0.8	3.1*** 0.7	2.5 1.2	2.4 0.9
	13	86	19-20	3.7 0.7	3.8 0.7	2.9 0.7	3.2 1.0	2.1 1.3	2.1 1.3
	14	49	26	4.2 1.0	4.4 0.6	3.1 0.6	3.4 1.0	1.8 1.0	1.4 1.2
	15	63	35	4.4 0.9	4.3 0.7	3.0 0.9	3.3 0.7	1.6 1.2	1.6 0.8
	16	41	33	4.1 0.7	5.2*** 0.6	3.1 0.7	3.9*** 0.9	1.8 1.1	0.5*** 1.2

MALES	9-11	154-172	23	3.0 0.8	2.5*** 0.4	3.1 0.8	3.8*** 0.7	2.9 1.0	2.5* 0.7
	12	65-72	46	3.5 1.2	3.0** 0.8	2.9 0.9	3.8*** 0.7	2.5 1.2	1.9* 1.3
	13	69	33-34	3.4 0.8	2.6*** 0.8	3.0 0.9	3.7*** 0.9	2.5 0.9	2.2 1.1
	14	60	26	3.1 0.9	2.8 1.1	3.4 0.8	3.9* 0.9	2.0 1.0	1.4 1.7
	15	36	23	3.5 1.4	2.6* 0.7	3.9 0.9	4.1 0.9	1.6 1.2	1.6 1.3
	16	29	15-16	3.2 1.5	2.3** 0.4	4.6 1.0	4.6 0.8	1.3 0.9	1.3 0.8

*- p<0.05; ** - p<0.01; ***- p<0.001

TABLE 4. Somatotype in adolescents in Sofia and Smolyan according the stage of sexual maturation (means, standard deviations and significance of intersample differences).

Sex	Stage of sexual maturation	Number		Endomorphism		Mesomorphism		Ectomorphism	
		Sofia	Smolyan	Sofia	Smolyan	Sofia	Smolyan	Sofia	Smolyan
FEMALES	Juvenilis-1	61-62	15	3.2 0.6	3.5 0.6	2.7 0.8	3.1* 0.6	3.4 0.6	3.0* 0.5
	Juvenilis-2	36	14	3.5 0.8	4.0* 0.7	2.7 0.7	3.2** 0.6	3.1 0.7	2.2*** 0.8
	Prae-puberitas	37	10	3.5 0.8	3.9 0.7	2.8 1.0	3.2 0.6	2.6 1.1	2.8 0.8
	Phasis cetera	72	35	3.6 0.9	4.0* 0.8	2.7 0.7	3.1* 0.9	2.6 1.1	2.3 1.2
	Phasis lenta	127	31	3.8 0.8	4.1* 0.5	2.8 0.7	3.1 0.8	2.1 1.0	2.0 0.9
	Post-puberitas	100	37-38	4.1 0.8	4.2 0.7	3.1 0.7	3.4* 0.7	1.6 1.0	1.7 0.7
	Adultus	31	49	4.3 1.1	5.0** 0.6	3.5 0.9	3.8 0.9	1.3 1.5	0.5* 1.1
MALES	Juvenilis	176-199	43-44	3.0 1.0	2.5*** 0.6	3.0 0.8	3.7*** 0.7	3.0 1.0	2.7* 0.9
	Prae-puberitas	30-31	22	3.4 0.8	2.8** 0.6	3.3 1.0	3.5 0.7	2.2 1.2	2.4 0.8
	Phasis cetera	94	48-49	3.3 0.9	3.1 1.0	3.0 0.8	3.7*** 0.8	2.3 1.0	1.6*** 1.4
	Phasis lenta	104	40-41	3.2 1.2	2.5*** 0.6	3.7 1.0	4.3*** 0.7	1.8 1.0	1.5 1.2
	Post-puberitas	15 21	11 13	3.5 2.2	2.5 0.8	4.7 1.1	4.7 1.2	1.1 1.0	0.8 0.9
	Adultus	6	2						

* - p<0.05; ** - p<0.01; ***- p<0.001

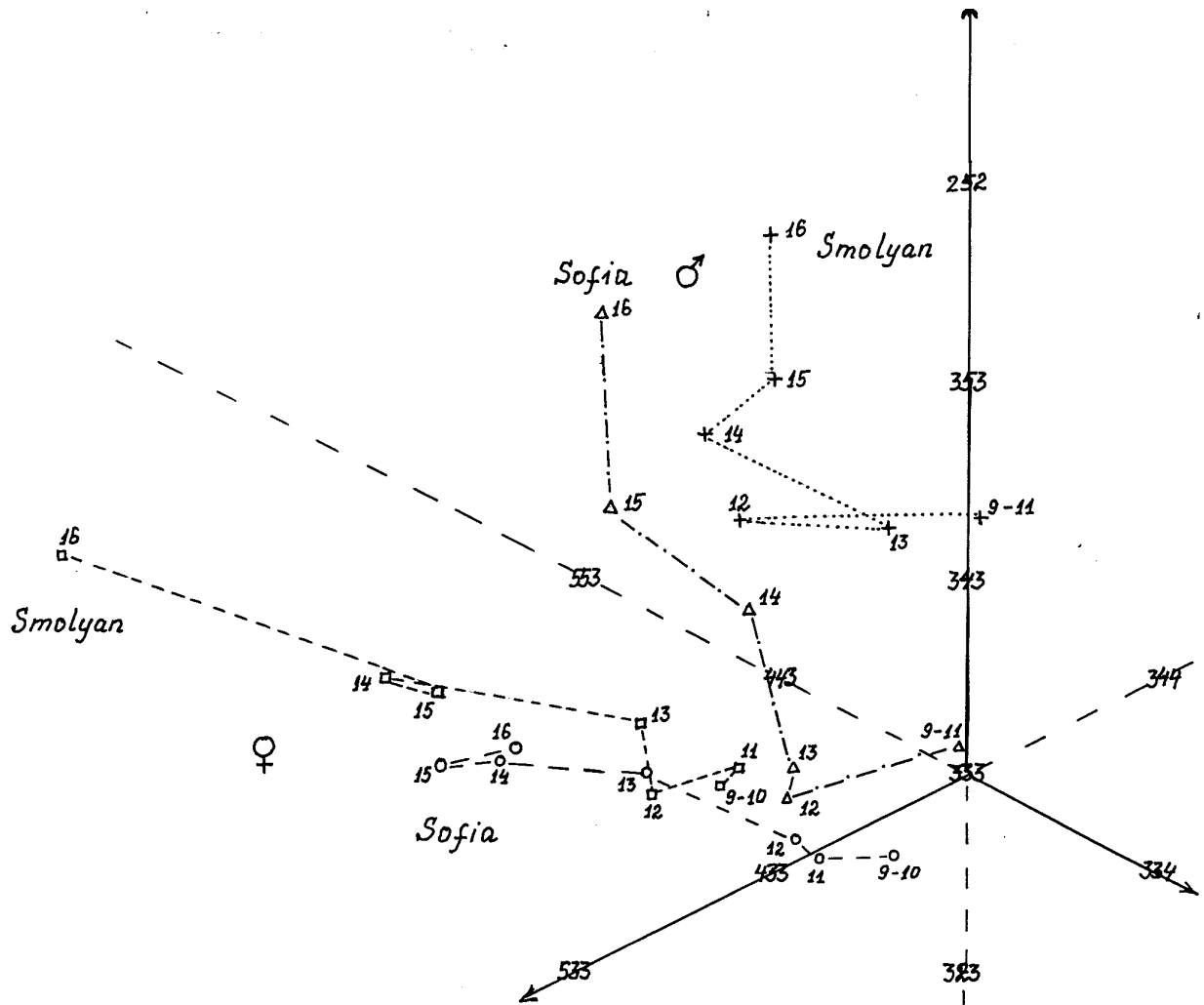


FIG. 1. Somatotype in adolescents in Sofia and Smolyan according the chronological age.

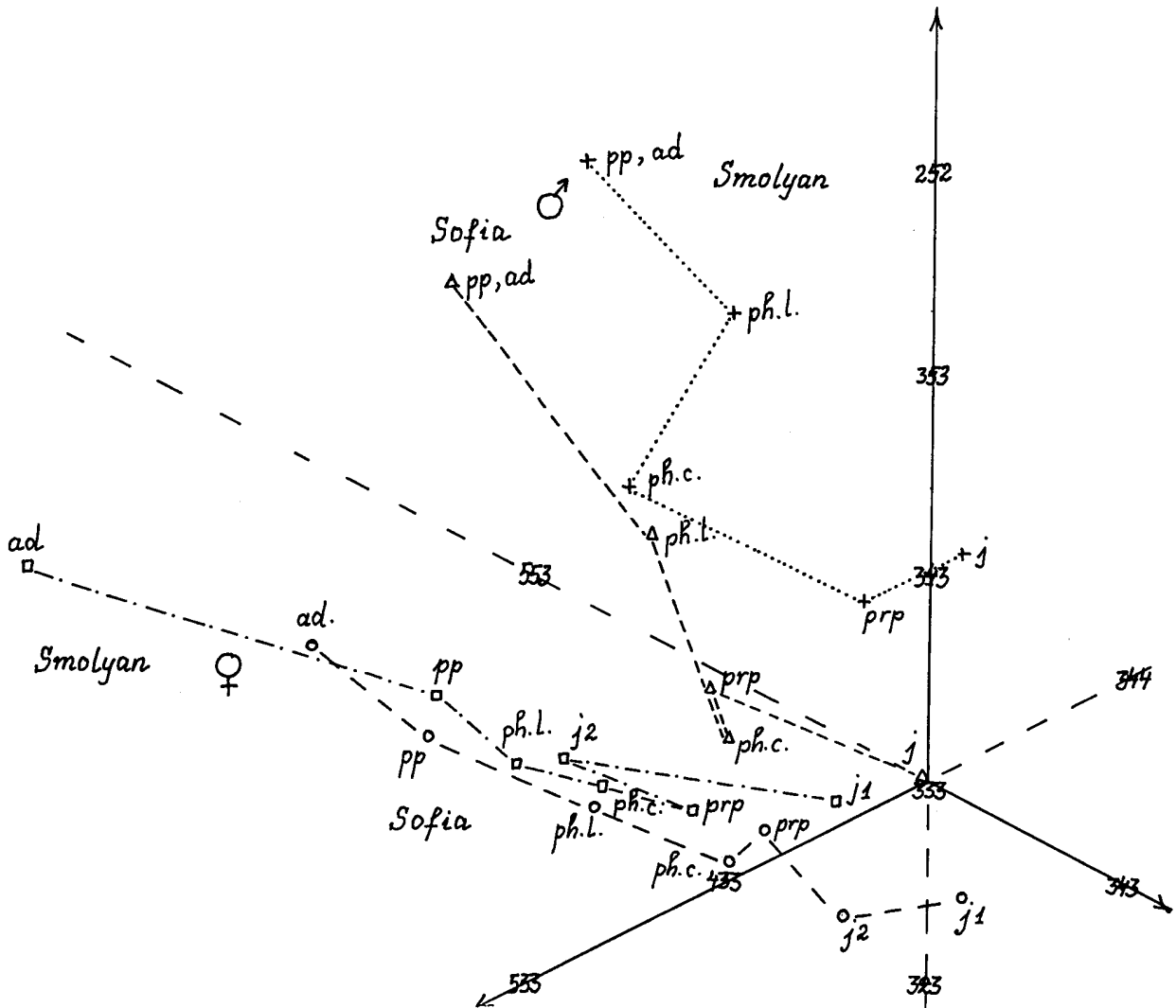


FIG. 2. Somatotype in adolescents in Sofia and Smolyan according the stage of sexual maturation.