

## *Anthropology*

# Body Proportionality during the Growing up Period

*A. Nacheva, L. Yordanova, E. Lazarova*

*Institute of Experimental Morphology and Anthropology, Bulgarian Academy of Sciences, Sofia*

The aim of the present study is to characterize the formation of the specific for both sexes body proportionality during childhood and youth in boys and girls throughout 7 and 17 years of age. The data in the present work are a part of complex anthropological investigation (1993-2001) of 7-17 years old schoolchildren from Sofia city (1778 boys and 1824 girls). The bio-statistical characteristics of 5 basic body proportions and 5 relations in the growing up aged 7, 9, 11, 13, 15, and 17 years are analyzed and assessed. The results show that in 17 years old boys and girls, body structure is still far removed from those in 30-40 years old men and women. The 17 years old girls, lag more markedly in the formation of breadth body and extremity proportions, while the 17 years old boys lag in the formation of lower extremity length proportion, and its interrelation with the length of upper body segment.

*Key words:* body configuration, anthropometrical proportions and relations, childhood, youth.

## Introduction

The proportionality of different body parts vary from birth till body maturation and reflect the conformity between the individual development stage and proportionality of separate body parts [1, 2, 3, 4]. The aim of the present study is to characterize the formation of the specific for both sexes body proportionality during childhood and youth in boys and girls throughout 7 and 17 years of age.

## Material and Methods

The data in the present study are a part from complex anthropological investigation (1993-2001) of 7-17 years old schoolchildren from Sofia (1778 boys and 1824 girls). The bio-statistical characteristics of 5 basic body proportions and 5 relations in the 7, 9, 11, 13, 15, and 17 years old growing up schoolchildren are analyzed and assessed. The features' names are marked in the table.

## Results about differences between male and female growing up individuals

**Torso.** During the period 7-17 years of age, the torso length proportion is relatively near for both sexes, as the relative length is bigger in the 7 years old children. At 13 years boys and girls have equal proportions, then the relative torso length in boys increases more sensible, and in girls more unnoticeable.

**Chest.** During the entire period of study, girls have relatively deeper chest, and boys have wider chest. In both sexes the chest proportions are bigger at 13 years.

**Shoulders.** Between 7 and 17 years, boys have relatively wider shoulders compared with girls, such as the sexual differences in adults are. Between 7 and 13 years, the relative shoulders' breadth decreases for both sexes, because of the more intensive stature growth in this period probably. In 13 years old boys and girls, the shoulders are relatively narrowest after what the relative shoulder breadth increases more markedly in boys.

**Pelvis.** After 7 years girls have wider pelvis consecutively than boys what are the sexual differences for adults. At 9 years of age for both sexes the bicristal breadth proportion is bigger. After 9 years this proportion decreases consecutively and at 17 the relative bicristal breadth is least for the studied period. The little relative pelvis width in 15 and 17 years old boys and girls compared with adults reflects the more intensive stature growth during this ontogenetic period. It is important to be mentioned the considerably smaller sexual difference for the 17 years old individuals (0,2 Index Units /IU/) compared with adults (1,3 IU). It shows that for both sexes after 17 years the pelvis' configuration will continue its formation until gathering the final pelvis' proportions type for 30-40 years old males and females.

**Acromiocrystal index.** The correlation between bicristal and biacromial breadth distinctly characterized the sexual body configuration differences. Between 7-17 years girls have consequently higher values for this index, i.e. they are with wider relative pelvis measurements. At 9 years for both sexes, pelvis is with widest breadth proportion assigned to the acromion one, and at 17 years pelvis is with narrowest breadth.

**Upper extremities.** During the whole period 7 — 17 years, girls have smaller upper extremity length proportion than boys, what is the sexual difference in adults, as well. The data about breadth-length hand index show that at 7 years, girls have more gracile hands than boys have. These sexual differences maintain till 17 years of age. For both sexes, hand is most massive at 13 years.

**Lower extremities.** At 9 years boys and girls are with better-expressed makroskely. At 13 years the sexual differences are bigger, when the puberty in girls is already finished. After 13 years, the formation of the final lower extremity length proportion accelerates with more intensive rate.

The correlation of both foot measurements in adults shows a little bigger foot breadth proportion in females, probably because of the flatfootness, which occur more frequently in them. Opposite to the adults throughout the period 7 and 17 years, girls have more gracile feet (relatively narrower) compared with boys. The intersexual differences are significant till 11 years, and after this age they diminish. Between 13 and 17 years for both sexes the foot configuration didn't alter.

**Inter-extremities index.** The proportionality between upper and lower extremities length is important characteristics of human body configuration and bears specific information about sexual differences. In the 30-40 years old individuals, the upper extremity length assigned to the lower extremity length is longer in males compared with females. The same is the tendency of sexual differences throughout the period 7-17 ages. These differences are least between 11 and 13 years of age.

Table 1. Investigated features and their statistical data

Sex	Features	7 years n=182		9 years n=189		11 years n=182		13 years n=165		15 years n=124		17 years n=118		Adults n=2427
		X	SD	X	SD	X	SD	X	SD	X	SD	X	SD	X
B o y s	Torso length proportion	29.5	1.8	28.4	1.4	27.3	1.2	26.7	1.4	28.1	1.2	28.3	1.6	31.0
	Thoracal index	71.2	4.6	72.6	4.8	71.9	5.0	72.8	5.2	72.4	6.7	72.0	7.0	72.0
	Biacromial breadth proportion	21.9	0.8	21.8	0.8	21.7	0.8	21.7	0.8	22.3	0.9	22.6	1.1	23.7
	Bicristal breadth proportion	15.2	0.8	15.4	0.9	15.3	1.0	15.1	1.1	14.9	1.1	14.9	1.0	17.6
	Acromiocrystal index	69.8	4.5	70.9	3.9	70.6	4.2	69.5	4.9	66.7	4.3	65.9	4.1	74.3
	Upper extremity length proportion	45.8	1.6	45.5	1.4	45.3	1.2	45.1	1.3	44.7	1.2	44.6	1.4	44.6
	Hand breadth-length index	39.6	3.1	40.9	2.9	41.0	2.3	42.1	2.6	41.2	2.8	41.0	2.9	43.1
	Lower extremity length proportion	57.6	1.6	59.6	1.3	58.3	1.5	59.1	1.3	58.2	1.2	57.7	1.3	56.8
	Foot breadth-length index	37.2	1.8	37.0	1.8	37.0	1.7	37.9	1.9	37.8	2.0	37.9	2.0	38.7
Interextremity index	79.7	3.2	76.3	2.8	77.7	2.7	76.4	2.4	76.9	2.4	77.3	2.6	78.5	
N u m b e r		n=178		n=183		n=205		n=184		n=137		n=135		n=2847
G I R L S	Torso length proportion	28.9	1.4	28.1	1.3	27.3	1.1	26.9	1.2	27.3	1.6	27.5	1.3	31.4
	Thoracal index	71.9	5.1	73.1	5.3	72.2	6.0	73.9	5.8	73.8	6.3	73.0	6.0	72.0
	Biacromial breadth proportion	21.5	0.8	21.5	0.8	21.4	1.0	21.4	1.0	21.7	1.0	21.8	0.9	23.3
	Bicristal breadth proportion	15.0	0.9	15.5	1.0	15.3	1.1	15.3	1.2	15.1	1.0	15.1	0.9	18.9
	Acromiocrystal index	69.7	3.7	72.2	4.3	71.7	4.6	71.4	4.8	69.6	4.4	69.0	4.1	81.3
	Upper extremity length proportion	45.2	1.5	44.8	1.3	45.0	1.2	44.3	1.3	43.9	1.3	43.8	1.3	44.0
	Hand breadth-length index	39.0	3.6	40.2	2.9	40.2	2.5	40.9	3.0	40.6	3.2	40.7	2.5	42.0
	Lower extremity length proportion	57.7	1.4	59.6	1.2	58.0	1.3	58.1	1.3	57.6	1.3	57.3	1.2	57.2
	Foot breadth-length index	36.3	1.9	36.0	1.8	36.5	1.6	37.5	1.8	37.5	2.0	37.6	1.7	39.1
Interextremity index	78.3	2.8	75.3	2.1	77.5	2.4	76.3	2.2	76.2	2.4	76.4	2.4	77.0	

### **Differences between the 17 years old individuals and the adults aged 30-40 years.**

At 17 years the **torso length proportion** for both sexes is considerably lower than those for adults /boys ( $-2,7$  IU); girls ( $-3,9$  IU)/, as in the 17 years old girls the relative trunk length will continue to grow up more intensive than in boys. The **chest form** in boys aged 17 years is already the same as it is in adult males, while the 17 years old girls have still more childish chest configuration. At 17 years the **relative shoulder width** for both sexes have lower values than those in adults /boys ( $-1,1$  IU); girls ( $-1,5$  IU).

The **pelvis proportionality** at 17 for both sexes is far from its configuration for adults /boys ( $-2,7$  IU); girls ( $-3,8$  IU)/. The data about acromiocrystal index show that during puberty and post puberty ages the formation of body breadth configuration drop behind body height configuration because of the more intensive stature growth in them probably. At 17 years the slow-down is more strongly expressed in girls /boys ( $-8,4$  IU), girls ( $-12,3$  IU)/. The sexual difference in the 17 years old individuals is  $3,1$  IU in favour of the female ones, and in the 30-40 years old females it is more than two times higher —  $7,0$  IU. The **upper extremity length proportion** for both sexes show that at 17, the corresponding linear configuration for adults is already shaped up. The formation of the hand massiveness, however, is still forthcoming /boys ( $-2,1$  IU), girls ( $-1,3$  IU)/. The **lower extremity length proportion** shows that in girls at 17 the formation of the corresponding linear configuration is already finished. The boys at 17 are still with relatively longer lower extremities than the males at 30-40. The **proportionality between upper and lower extremities length** in the 17 years old girls are closer to the respective ones in adults ( $-0,6$  IU), while in the 17 years old boys this difference is ( $-1,2$  IU), i.e. for them the formation of the final proportion between upper and lower extremities length is forthcoming.

## **Conclusion**

The body configuration of the 17 years old boys and girls is still far from the body configuration of the 30-40 years old men and women.

The backward of the 17 years old girls is more well expressed in the formation of the proportionality of body and extremity breadth measurements, and of the 17 years old boys in the formation of the proportionality of lower extremity length and its correlation to the upper extremity length.

## **R e f e r e n c e s**

1. Growth and Ontogenetic Development in Man IV. — In: Pross. of the Symp., Humpolec, 1989. (Ed. K. Hajnis), 123-136; 175-184.
2. Human Growth. A comprehensive treatise, sec. Edition. T. 3. (Ed. Falkner Fr., J. Tanner), 1987, 331p.
3. K o m e n d a, S., J. K l e m e n t a. Proportion of Body Dimensions in Children and Youth. Praha, 1978, 270p.
4. Physical Status: The Use and Interpretation of Anthropometry. — In: Report of a WHO Expert Committee. Techn. Rep. Series, 854, 1995, 4-33.