MORPHOLOGICAL CHARACTERISTICS OF THE FACE IN 7-17YEAR OLD SCHOOLCHILDREN FROM SOFIA

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ABSTRACT . The results presented constitute a part of a complex anthroplogical study of 7- to 17-year old pupils from Sofia realized as mixed – longitudinal and transversal one. The changes of three main height, three main breadth facial sizes and four indices of the face determining the morphological face characteristics have been traced. A total of 3639 measurements have been taken – 1785 for the boys and 1854 for the girls. The dynamics of the age dependent alterations in the face sizes and indices has been recorded. An earlier onset of the face elongation during puberty is recorded in the girls as compared to the boys, the changes in the bigonial breadth being best marked followed by the bizygomatic breadth and frontal breadth. Compared to the height sizes the breadth sizes reach more rapidly the values of the adult individuals. The sexual differences are most clearly expressed in all face sizes as early as at the age of 7.

KEY WORDS. morphological characteristics, height sizes of the face, breadth sizes of the face, indices of the face, sexual differences, growth velocity.

INTRODUCTION

One of the problems of modern physical anthropology is related to the study on growth and development of infants and adolescents. To a great extent the interest is focused on the investigation of the age-related changes in body size, body nutrition state, sexual maturation and constitutional characteristics. Investigating the age – related changes of the facial and cerebral parts of the head provoke no lesser interest. Studies in that trend have been carried out both in the more distant past [1, 2, 5, 6, 10] and at the end of the 20-th century and the beginning of the present one [4, 7, 9, 11] . The aim of the present study is to trace the dynamics of the changes of the major height and breadth sizes and proportions determining the morphological characteristics of the face between 7 and 17, to record the growth velocity of the features under study and to look for certain sexual differences.

MATERIAL AND METHODS

7-17-year old schoolchildren from five Sofia schools have been subjected to the study. The latter has been initially planned as a longitudinal one but the yearly changes in the schoolchildren's individual representatives did not allow for its completion as such. In order to supplement the numbers of the students from the corresponding age groups so that they would not fall under 100 individuals each year new schoolchildren have been additionally investigated. That is why the study was actually accomplished as mixed – a longitudinal and transversal one. The number of boys under study varies between 118 and 190 and from 127 and 204 for the girls. A total of 3639 individual measurements – 1785 for the boys and 1854 for the girls have been taken after the classical method for the period 1993-2001 (October-November) [3]. The age-related changes of the physiognomical height (tr-gn) and morphological height (n-gn) of the face, the physiognomical upper face height (n-sto), the smallest frontal breadth (ft-ft), the bizygomatic breadth (zy-zy) and the bigonial breadth (go-go) have been traced and analyzed. Four indices characterizing the ratios between the studied features: jugo-frontal (4:6), jugo-mandibular (8:6), morphological (18:6) and physiognomial upper face index (19:6) were calculated. The growth velocity of the features under study was calculated using the formula $(X2 - X1) \times 100 / X2$ where X1 is the medium value from the preceding year and X2 – that from the next year. The sexual differences were assessed by the statistical significance of the differences in the sizes between both sexes for each feature separetely. Their significance was checked by the Student's t-criterion at a level of significance P<0,05. They were quantitavely estimated by the help of the sexual differences index (ISD) which was calculated after the formula $(X \male - X \female) \times 100 / X \male$.

RESULTS AND DISCUSSION

The head sizes growth is closely related to the development of the brain. Human brain starting from its embryonic stage develops faster than the other organs and in the new-born baby it constitutes 25% of its weight in the adult, and at the age of 10- it is 95% [8]. Accordingly, the cranium should reach its final stage of development much earlier than other skeletal portions. The cerebral part of the head is developed earlier than its facial one. The facial part sizes accordingly as compared to those of the cerebral part reach the values typical of the grown-up individuals at a considerably later stage. The percent increase of the face sizes in the 17-year old pupils as opposed to those of the adults Bulgarians (National Anthropological Programme, 1989-1992, unpublished data). The mean values of physiognomical height in both sexes are the ones closest to those of the adults (98,1% for the boys and 98,7% for the girls). Next come the bigonial breadth (96,6% and 100% respectively), the smallest frontal breadth (96,2% 97,2% respectively), the bizygomatic breadth (95,2% and 96,2%), the morphological height (95,1 and 94,8%) and last comes – the physiognomical upper face height (93,5% and 92,7%).

The mean values of the height sizes of the face increase unevenly during the studied age period (Table1.). The physiognomical height in both sexes between 7 and 9 increases significantly and at an almost equal rate. A certain acceleration of its

increase between 13 and 15 is observed. In the girls this acceleration is at an almost equal rate between 9 and 11 and between 11 and 13. In the boys an acceleration in the increase of the morphological and physiognomical upper face height is observed in the age interval of 11-13 years and especially between 13 and 15. In the girls this fact is observed between 9 and 11 and especially between 11 and 13 after which the intensity of the increase is considerably attenuated (Fig.1, 2).

The tendencies in the breadth size increase differ from those in the height size one (Table 2.). The frontal breadth, the bizygomatic breadth and especially the bigonial breadth grow most intensively during the years from 7 to 9. The next accceleration of the increase is observed in the boys during the age interval of 13-15 years and in the girls – 11-13 years after which the rate of increase considerably drops (Fig.1, 2). The fluctuations in the mean values of the jugofrontal and jugomandibular indices which render information about the horizontal proportions of the face are usually in the limits of a defined category (Table 3.). According to the jugofrontal index both sexes fall into the category broad. Judging from the jugomandibular index the boys are in the category medium and the girls – broad. The mean values of the morphological and physiognomic upper face index vary more intensely than those of the jugofrontal and jugomandibular indices which is due to the different growth velocity in the height and breadth face sizes. According to the morphological index the boys below 10 years of age are euryprosops between 11-14 – mesoprosops and only between 15-17 years leptoprosop. Between 7 and 11 the girls are in the category mesoprosop and after that age they are leptoprosops. Consequently the elongation of the face in the puberty period occurs earlier in the girls. The same tendency has been established in girls from the town of Jena, Germany [9]. With respect to the physiognomical upper face index the boys are in the category mesen during the entire age period under study. The girls below 10 years of age are on the euryen – mesen border after which they fall steadily into mesen. The sexual differences are very clearly expressed in all face sizes as early as the age of 7 (P<0,01). By the help of ISD it was established that they are greater in height face sizes with a preavalence for the boys especially in the period between 15-17 years of age.

CONCLUSION

The period from 7 to 17 years of age is characterized with significant changes in the face size values and their proportions which take place at a differing growth velocity between the separate age groups. The boys under study display faces of pronounced breadth in the upper part and of medium breadth in lower part of the face. In the girls the faces are broad both in the upper and the lower parts. An earlier onset of the face elongation during puberty is recorded in the girls as compared to the boys. The height sizes grow most intensively in the boys between 13 and 15 and in the girls between 11 and 13. The breadth sizes grow most intensively in both sexes between 7 and 9 years. The changes in the bigonial breadth being most best marked followed by the bizygomatic and the frontal breadths. Compared to the height sizes they reach more rapidly the values of the adult individuals. The sexual differences are very clearly expressed in all face sizes as early as the age of 7. The knowledge of these dynamic

changes of the face can be of use both for a comparative morphological characterization in an age-related aspect and also for helping clinico-applied anthropology.

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Table 1. Age changes in the basic height sizes of the face

Feature	Age (years)	Boys			Girls			t-test	ISD
		n	X	SD	n	X	SD		
Physiognomical face height	7	182	160.47	7.60	177	156.44	7.70	4.99	2.51
	8	190	162.40	7.99	182	158.15	8.01	5.12	2.62
	9	189	166.21	7.66	181	161.76	7.79	5.54	2.68
	10	190	167.81	7.80	186	163.47	7.66	5.44	2.59
	11	183	169.69	7.92	204	166.32	8.24	4.10	1.99
	12	172	171.95	8.20	190	169.06	7.73	3.44	1.68
	13	166	174.51	8.84	184	171.02	8.53	3.75	2.00
	14	139	177.48	8.35	138	171.30	8.16	6.23	3.48
	15	124	181.46	8.08	137	172.88	7.35	8.94	4.73
	16	133	183.14	9.34	127	171.01	7.63	11.49	6.62
	17	118	184.83	9.54	137	172.01	7.36	11.87	6.94
Morphological face height	7	182	101.00	4.77	177	98.16	3.99	6.13	2.81
	8	190	101.53	4.56	182	99.12	4.12	5.35	2.37
	9	189	102.44	4.45	181	100.00	4.47	5.26	2.38
	10	190	103.71	4.55	186	101.29	4.40	5.24	2.33
	11	183	105.85	4.82	204	103.69	4.92	4.36	2.04
	12	172	108.04	4.88	190	106.07	4.94	3.81	1.82
	13	166	110.53	5.50	184	107.79	5.14	4.80	2.48
	14	139	113.86	6.17	138	108.30	5.46	7.94	4.88
	15	124	117.36	6.14	137	108.99	4.97	12.03	7.13
	16	133	118.78	6.33	127	109.61	5.08	12.91	7.72
	17	118	120.43	6.73	137	110.12	5.42	13.33	8.56
Physiognomical upper face height	7	182	62.85	3.42	177	60.85	3.13	5.78	3.18
	8	190	63.54	3.52	182	61.98	3.07	4.56	2.46
	9	189	64.13	3.50	181	62.75	3.11	4.01	2.15
	10	190	64.82	3.40	186	63.47	3.20	3.97	2.08
	11	183	65.92	3.37	204	64.97	3.53	2.71	1.44
	12	172	67.60	3.62	190	66.23	3.54	3.63	2.03
	13	166	69.08	3.97	184	67.24	3.58	4.54	2.66
	14	139	70.91	4.66	138	66.90	3.72	7.92	5.66
	15	124	72.81	4.05	137	67.57	3.40	11.26	7.20
	16	133	72.87	4.15	127	67.57	3.51	11.14	7.27
	17	118	73.69	3.88	137	68.07	3.71	11.77	7.63

Table 2. Age changes in the basic breadth sizes of the face

Feature	Age (years)	Boys			Girls			t-test	ISD
		n	X	SD	n	X	SD		
Frontal breadth	7	182	100.68	3.67	177	98.65	3.39	5.45	2.02
	8	190	102.26	3.69	182	100.42	3.21	5.14	1.80
	9	189	103.37	3.76	181	101.28	3.39	5.66	2.02
	10	190	103.95	3.68	186	102.21	3.38	4.78	1.67
	11	183	104.39	3.89	204	102.83	3.52	4.12	1.49
	12	172	105.11	3.88	190	103.81	3.67	3.27	1.24
	13	166	106.22	3.90	184	105.08	3.69	2.80	1.07
	14	139	106.86	4.02	138	105.30	3.65	3.38	1.46
	15	124	108.07	4.18	137	106.10	3.70	4.01	1.82
	16	133	109.24	4.33	127	106.02	3.88	6.32	2.95
	17	118	109.71	3.88	137	106.28	3.60	7.28	3.13
Bizygomatic breadth	7	182	118.71	4.58	177	116.60	4.22	4.54	1.78
	8	190	121.90	4.60	182	119.67	4.05	4.97	1.83
	9	189	123.54	4.69	181	121.19	4.12	5.13	1.90
	10	190	124.68	4.57	186	122.18	4.35	5.43	2.00
	11	183	125.11	4.43	204	122.56	4.38	5.68	2.04
	12	172	126.40	4.48	190	124.36	4.55	4.30	1.61
	13	166	127.90	4.86	184	125.96	4.62	3.82	1.52
	14	139	130.31	4.97	138	126.76	4.49	6.24	2.72
	15	124	133.29	4.74	137	127.66	4.31	10.00	4.22
	16	133	134.79	4.90	127	128.98	4.31	10.16	4.31
	17	118	136.08	4.72	137	129.41	4.42	11.59	4.90
Bigonial breadth	7	182	90.71	4.28	177	88.97	4.07	3.95	1.92
	8	190	94.84	4.30	182	92.98	4.22	4.21	1.96
	9	189	97.39	4.28	181	95.20	4.17	4.99	2.25
	10	190	98.79	4.15	186	96.72	4.20	4.81	2.10
	11	183	99.16	4.05	204	97.05	4.25	5.00	2.13
	12	172	100.37	4.28	190	99.06	4.28	2.91	1.30
	13	166	101.70	4.45	184	100.35	4.47	3.88	1.33
	14	139	102.91	4.97	138	100.38	4.85	4.29	2.46
	15	124	105.13	4.61	137	100.64	4.68	7.80	4.27
	16	133	104.72	5.09	127	100.72	4.65	6.62	3.82
	17	118	105.09	5.40	137	101.50	4.27	5.82	3.42

Table 3. Age changes in the basic face indices

Feature	Age (years)	Boys			Girls		
		n	X	SD	n	X	SD
Jugofrontal index	7	182	84.86	2.74	177	84.64	2.52
	8	190	83.94	2.75	182	83.96	2.51
	9	189	83.71	2.53	181	83.62	2.58
	10	190	83.41	2.67	186	83.70	2.49
	11	183	83.46	2.36	204	83.94	2.52
	12	172	83.19	2.42	190	83.52	2.56
	13	166	83.09	2.45	184	83.46	2.36
	14	139	82.03	2.28	138	83.10	2.18
	15	124	81.11	2.60	137	83.14	2.50
	16	133	81.08	2.65	127	82.23	2.40
	17	118	80.67	2.69	137	82.16	2.30
Jugomandibular index	7	182	76.44	2.78	177	76.31	2.44
	8	190	77.82	2.67	182	77.71	2.73
	9	189	78.85	2.43	181	78.56	2.52
	10	190	79.25	2.26	186	79.18	2.58
	11	183	79.27	2.27	204	79.20	2.47
	12	172	79.42	2.38	190	79.67	2.39
	13	166	79.54	2.42	184	79.68	2.36
	14	139	78.98	2.56	138	79.21	3.21
	15	124	78.89	2.64	137	78.85	3.08
	16	133	77.70	2.84	127	78.12	3.14
	17	118	77.24	3.12	137	78.46	2.83
Morphological face index	7	182	85.16	4.23	177	84.24	3.46
	8	190	83.37	4.05	182	82.88	3.50
	9	189	83.00	4.04	181	82.56	3.62
	10	190	83.25	3.96	186	82.96	3.67
	11	183	84.66	3.97	204	84.65	3.90
	12	172	85.53	3.81	190	85.34	3.84
	13	166	86.48	4.17	184	85.63	3.83
	14	139	87.43	4.42	138	85.51	4.61
	15	124	88.12	5.00	137	85.43	4.18
	16	133	88.19	4.84	127	85.04	4.23
	17	118	88.56	4.98	137	85.15	4.35
Physiognomical upper face index	7	182	52.99	2.97	177	52.22	2.70
	8	190	52.17	3.08	182	51.83	2.68
	9	189	51.96	2.98	181	51.81	2.70
	10	190	52.03	2.91	186	51.99	2.65
	11	183	52.73	2.84	204	53.04	2.99
	12	172	53.52	2.98	190	53.30	2.95
	13	166	54.06	3.28	184	53.43	3.00
	14	139	54.45	3.51	138	52.82	3.09
	15	124	54.68	3.44	137	52.97	2.85
	16	133	54.12	3.37	127	52.43	2.98
	17	118	54.19	3.04	137	52.64	2.99

Fig. 1. Growth velocity in the basic sizes of the face (boys)

Fig. 2. Growth velocity in the basic sizes of the face (girls)