Sexual Differences and Reached Growth of Cephalometric Features in Children at the Age between 3 and 6 Years

Y. Zhecheva

Institute of Experimental Morphology and Anthropology with Museum,
Bulgarian Academy of Sciences, Sofia

The aim of the work is to characterize the sexual differences of cpehalometric features in children from Sofia at the age between 3 and 6 years and to assess the reached growth for single features regarding the same ones in adult persons. The metrical data about 7 basic cpehalometric features in 640 children (320 boys and 320 girls) aged 3 — 6 years are investigated. Boys have bigger head measurements than girls but girls come more close to the final measurements for the respective features in adult women. Most close to the final size is the head length, while the morphological face height had to gain much more, i.e. the face is awaited to become longer.

Key words: children, head measurements, sexual differences, reached growth.

Introduction

During the period of growth and development for the single body parts and organs occur alterations characteristic with different for both sexes velocity and scope [1]. The cephalometric features are among the anthropological characteristics that change quickly during childhood [5]. For instance the head height at birth is relatively big being 1/4 part from the entire stature of the newborn, at 6 years it is 1/6 part of the stature, and in adult individuals it is already 1/8 part of it [3].

The aim of the work is to characterize the sexual differences of cephalometric features in children from Sofia at the age between 3 and 6 years and to assess the reached growth for single features regarding the same ones in adult persons.

Material and Methods

The data presented are part of a detailed transversal anthropological study carried out in seven kindergartens in Sofia City (June 2004 — May 2005). Totally 640 children (320 boys and 320 girls) aged 3-6 years are investigated.

The metrical data about 7 basic cephalometric features are computed statistically by the variation analysis [4].

The comparative assessment about strength of sexual differences was made on the base of relative Index Units (IU) that are elaborated by Wolanski's [2] index of relative inter-group differences, called in this case the Index of Sexual Differences (ISD).

$$ISD = 2 \times [(\bar{x}_1 - \bar{x}_2) \times 100] / (\bar{x}_1 + \bar{x}_2), \text{ where } \bar{x}_1 = \bar{x}_{boys}, \ \bar{x}_2 = \bar{x}_{girls}$$

The degree of sexual differences' expression is categorized by the cut off points at P_{25} and P_{75}, which are evaluated on the base of ISD data for the investigated features during the entire studied period. The sexual differences are of a *low degree expression* when the index is up to

1.54 IU (P_{25}); from 1.55 IU till 3.18 IU (P_{75}) they are of a *middle degree expression*; and over 3.18 IU — of a *high degree expression*.

For the assessment of the reached growth about each cephalometric feature towards its measurement in adults are used data for adult Bulgarian population (30 - 40 years) reported in the National Anthropological Program elaborated in the IEMAM, BAS.

T a b l e 1. Cephalometric characterization of the children and adults

Age	♂							♀							Intersexual differences		
	n	$\bar{x}$	SD	SEM	V	min	max	n	$\bar{x}$	SD	SEM	V	min	max	Abs. diff.	t-test	ISD
Head circumference																	
3	80	506.9	11.8	1.3	2.3	482	537	80	491.0	13.4	1.5	2.7	460	518	15.9	8,0**	3.19
4	80	508.7	13.5	1.5	2.7	475	550	80	501.2	15.0	1.7	3.0	460	545	7.5	3.2*	1.48
5	80	519.1	11.1	1.2	2.1	488	545	80	508.8	13.7	1.5	2.7	485	555	10.3	5.2**	2.00
6	80	523.6	12.0	1.3	2.3	500	550	80	511.8	12.1	1.4	2.4	482	540	11.8	6.2**	2.28
30-40	236	579.2	16.3	1.1	2.8	540	625	276	552.0	16.2	1.0	2.9	512	597	-	-	-
Head length																	
3	80	174.2	5.7	0.6	3.3	162	187	80	167.7	5.7	0.6	3.4	155	180	6.5	7.2**	3.80
4	80	174.2	5.8	0.6	3.3	160	189	80	171.7	6.2	0.7	3.6	150	191	2.5	2.6*	1.44
5	80	177.9	5.5	0.6	3.1	165	191	80	174.0	6.8	0.8	3.9	159	194	3.9	4.0**	2.22
6	80	180.0	6.0	0.7	3.4	165	191	80	174.7	6.0	0.7	3.4	153	188	5.3	5.5**	2.99
30-40	236	190.6	6.7	0.4	3.5	170	215	276	180.3	5.8	0.4	3.2	165	195	-	-	-
Head breadth																	
3	80	137.6	4.6	0.5	3.4	126	152	80	134.4	4.6	0.5	3.5	121	148	3.2	4.4**	2.35
4	80	140.3	5.0	0.6	3.6	129	158	80	136.4	5.2	0.6	3.8	127	157	3.9	4.7**	2.82
5	80	142.6	5.0	0.6	3.6	130	153	80	138.0	5.4	0.6	3.9	128	157	4.6	5.7**	3.28
6	80	142.6	5.1	0.6	3.6	133	155	80	138.2	5.0	0.6	3.6	116	149	4.4	5.3**	3.13
30-40	236	156.9	6.1	0.4	3.9	139	172	276	148.6	5.5	0.3	3.7	133	164	-	-	-
Minimal frontal breadth																	
3	80	97.8	3.8	0.4	3.9	90	107	80	95.5	3.5	0.4	3.6	84	106	2.3	3.9**	2.38
4	80	99.1	4.0	0.4	4.0	90	113	80	97.9	3.6	0.4	3.7	90	109	1.2		1.22
5	80	100.5	4.0	0.4	4.0	92	110	80	98.8	4.3	0.5	4.3	87	117	1.7	2.5*	1.70
6	80	101.4	4.0	0.4	3.9	92	114	80	100.0	3.7	0.4	3.7	87	109	1.4	2.4*	1.39
30-40	236	114.5	5.1	0.3	4.4	97	131	276	109.2	5.1	0.3	4.7	97	124	-	-	-
Bizygomatical breadth																	
3	80	112.2	4.5	0.5	4.0	105	127	80	109.7	3.8	0.4	3.5	100	119	2.5	3.9**	2.25
4	80	114.3	4.6	0.5	4.0	102	132	80	112.9	5.0	0.6	4.4	104	133	1.4	1.8	1.23
5	80	117.6	4.9	0.6	4.2	106	132	80	113.7	4.5	0.5	3.9	100	127	3.9	5.3**	3.37
6	80	119.0	5.0	0.6	4.2	108	136	80	115.9	4.3	0.5	3.7	102	127	3.1	4.3**	2.64
30-40	236	143.5	5.6	0.4	3.9	130	157	276	134.6	4.7	0.3	3.5	122	149	-	-	-
Bigonial breadth																	
3	80	85.9	4.8	0.5	5.6	76	99	80	85.1	3.7	0.4	4.4	77	95	0.8	1.1	0.94
4	80	89.4	4.5	0.5	5.0	79	104	80	87.8	4.4	0.5	5.0	78	101	1.6	2.1*	1.80
5	80	91.1	4.8	0.5	5.3	79	102	80	88.4	4.7	0.5	5.3	80	107	2.7	3.5**	3.00
6	80	92.9	4.3	0.5	4.6	85	108	80	89.8	5.3	0.6	5.9	76	104	3.1	4.0**	3.39
30-40	236	109.8	6.3	0.4	5.8	93	130	276	101.7	5.2	0.3	5.2	90	118	-	-	-
Morphological face height																	
3	80	94.1	5.1	0.6	5,4	82	111	80	90.4	4.8	0.5	5.3	80	102	3.7	4.8**	4.01
4	80	96.1	5.5	0.6	5,7	85	115	80	95.2	5.1	0.6	5.3	82	107	0.9	1.0	0.94
5	80	100.3	5.0	0.6	4,9	91	120	80	96.0	4.5	0.5	4.7	85	106	4.3	5.7**	4.38
6	80	101.3	5.5	0.6	5,4	84	112	80	99.1	4.7	0.5	4.8	84	108	2.2	2.7*	2.20
30-40	236	126.2	7.2	0.5	5,7	104	149	276	116.5	5.9	0.4	5.0	104	136	-	-	-

*P< 0,05; ** P< 0,001

T a b l e 2. Reached growth in children towards cephalometric measurements in adults (%)

Age	Head. Circumf.		Head length		Head breadth		Min. frontal breadth		Bizygomat. breadth		Bigonial breadth		Morph. face height	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
3	87.5	88.9	91.4	93.0	87.7	90.4	85.4	87.5	78.2	81.5	78.2	83.7	74.6	77.6
4	87.8	90.8	91.4	95.2	89.4	91.8	86.6	89.7	79.7	83.9	81.4	86.4	76.1	81.7
5	89.6	92.2	93.3	96.5	90.9	92.9	87.8	90.5	82.0	84.4	83.0	87.0	79.5	82.4
6	90.4	92.7	94.4	96.9	90.9	93.0	88.6	91.6	83.0	86.1	84.6	88.2	80.2	85.0
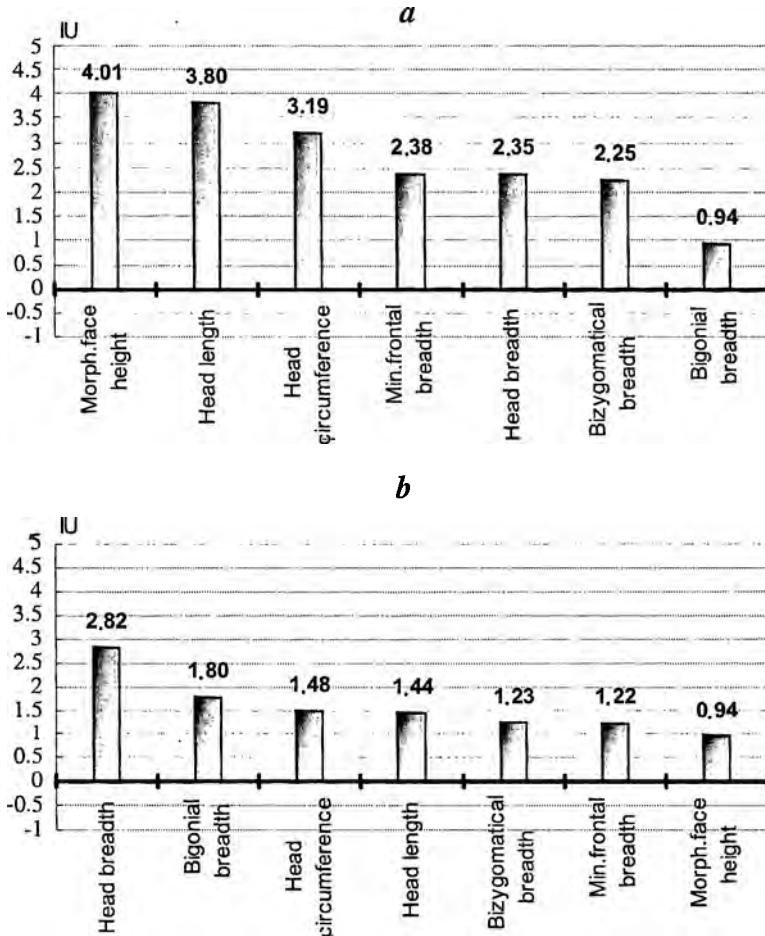
Fig. 1. Sexual differences according to ISD data presented in descendent order:
a — in 3 years old children; *b* — in 4 years old children

Results

During the entire period of investigation the boys have bigger head measurements than girls, like the directions of sexual differences in adults are. The established sexual differences are statistically significant in all ages, while only in 3 from 28 comparative couples such significance is missing.

For each age group are made descendent formulae according to the data for ISD, by which an idea whether the metrical differences are strongest or slightest in the head parts between both sexes could be gotten.
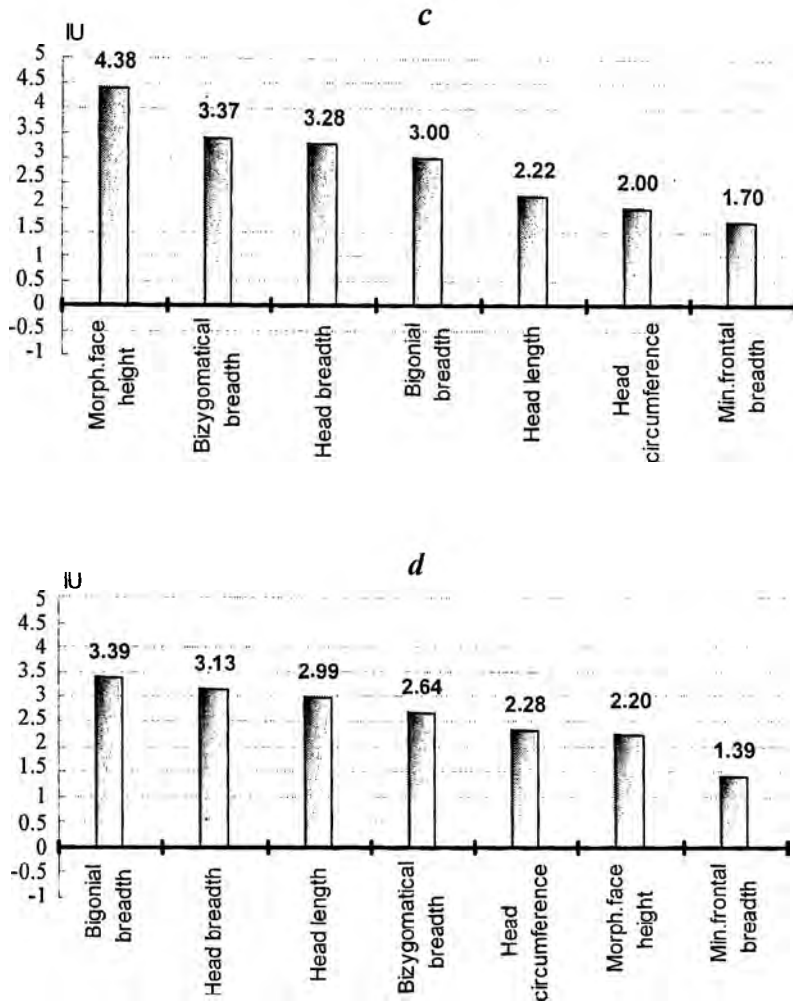
236

Fig. 1. Sexual differences according to ISD data presented in descendent order:
c — in 5 years old children; *d* — in 6 years old children

At 3 years of age the sexual differences are strongly expressed in the morpho-logical face height, head length and head circumference. Concerning the upper face breadths and head breadth, the metrical dominance in boys is of a middle degree and the sexual differences of the mandible breadth are most slightly expressed.

Descendent formulae: Morphological face height (4,01 IU — high) > Head length (3,80 IU — high) > Head circumference (3,19 IU — high) > Minimal frontal breadth (2,38 IU — middle) > Head breadth (2,35 IU — middle) > Bizygomatical breadth (2,25 IU — middle) > Bigonial breadth (0-,94 IU — low).

At 4 years of age the sexual differences are smallest being of middle and low expression's degree. They are better marked in the head breadth and the bigonial breadth, and less — in the morphological face height.
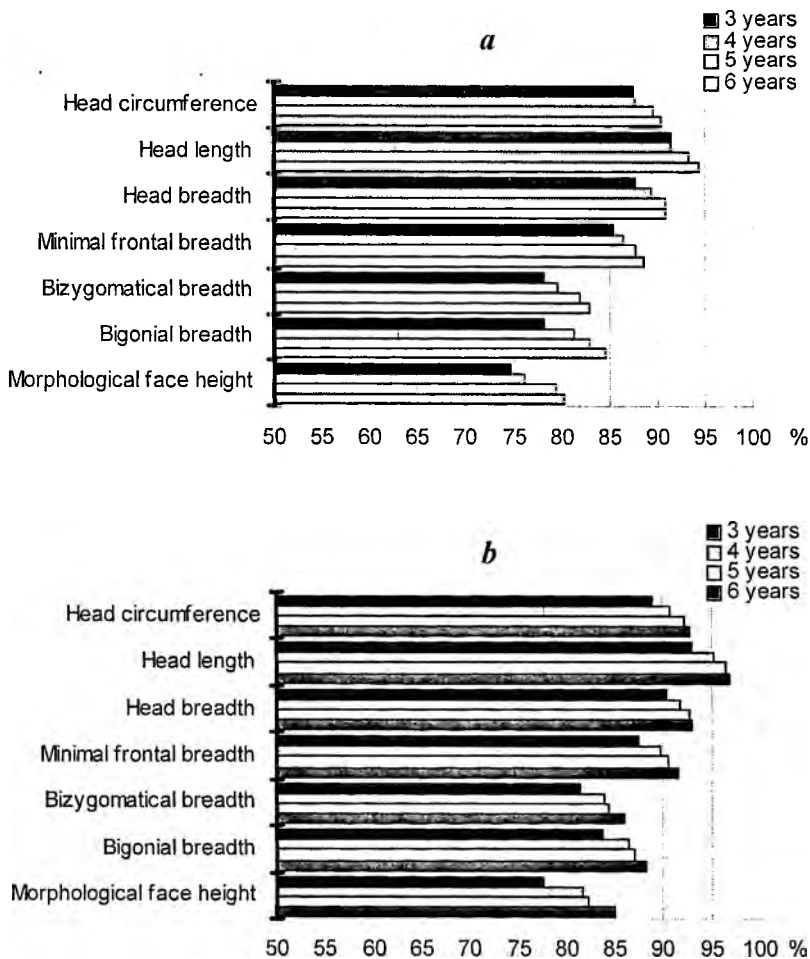
237

Fig. 2. Reached growth in children towards cephalometric measurements in adults:
a — in boys; *b* — in girls

Descendent formulae: Head breadth (2,82 IU — middle) > Bigonial breadth (1,80 IU — middle) > Head circumference (1,48 IU — low) > Head length (1,44 IU — low) > Bizygomatical breadth (1,23 IU — low) > Minimal frontal breadth (1,22 IU — low) > Morphological face height (0,94 IU — low).

At **5 years of age** the sexual differences are of a high and middle degree expression. For the morphological face height, bizygomatical breadth and head breadth the differences between both sexes are strongly expressed, while for the rest ones — they are middle expressed.

Descendent formulae: Morphological face height (4,38 IU — high) > Bizygomatical breadth (3,37 IU — high) > Head breadth (3,28 IU — high) > Bigonial breadth (3,00 IU — middle) >Head length (2,22 IU — middle) > Head circumference (2,00 IU — middle) > Minimal frontal breadth (1,70 IU — middle).

238

At 6 years of age interesting are the sexual differences of bigonial breadth, which occupies the first place in the descendent formulae. This fact shows that in the 6 years old children are observed beginnings of sexual differences concerning the face form in mandible area, which in adult menis markedly more massive and angular-shaped.

Descendent formulae: Bigonial breadth (3,39 IU — high) > Head breadth (3,13 IU — middle) > Head length (2,99 IU — middle) > Bizygomatical breadth (2,64 IU — middle) > Head circumference (2,28 IU — middle) > Morphological face height (2,20 IU — middle) > Minimal frontal breadth (1,39 IU — low).

Assessment of the reached growth in separate ages towards cephalometrical measurements in adults

The general evaluation of the reached growth for cephalometric features in children aged between 3 and 6 years towards the respective measurement in adults shows that for all investigated age groups, as well as, for the seven features girls have gained bigger relative share of the final sizes in adult women than the boys have. The head length came most close to the final size in adults concerning the four age groups and both sexes, while the morphological face height had to gain much more being far removed from the final size in adults.

Conclusions

1. Ever since 3 to 6 years of age boys have bigger head measurements than girls, making the sexual differences looks like the ones in adults.
2. Notwithstanding the metrical priority for boys, the girls during the investigated period come more close to the final measurements for the respective features in adult women.
3. The head measurements of brain shape as a whole outstrip in their development the face measurements concerning both sexes and the four age groups. Most close to the final size is the head length, while the morphological face height had to gain much more, i.e. the face is awaited to become longer.

R e f e r e n c e s

1. G e r v e r, W. J. M., R. D e B r u i n. Pediatric Morphometrics. Utrecht, Netherlands, 1996.
2. W o l a n s k i, N. A symmetria ciala czlwieka i jet zmiennosc w swiette funkcji konczyn. — Przegl. Anthrop., **23**, 1957, 461-464.
3. Б о б е в, Д р., Е. Г е н е в. Педиатрия. С., 2000.
4. Д и м и т р о в, Б., Н. Я н е в. Вероятности и статистика. С., Университетско издателство „Св. Климент Охридски", 1998.
5. К о н д о в а, Н., З л. Ф и л ч е в а. Възрастови промени в кефалометричната и кефалоскопична характеристика на софийски деца в периода 7—11 години. — Journal of anthropology, **2**, 1999, 117—124.