

Cephalofacial Differences Between Males 18 Years of Age and 20-30 Years of Age

Diferencias Cefalofaciales entre Hombres de 18 Años y de 20-30 Años

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SUMMARY: The human skull is comprised of many flat and irregular bones, divided into two groups: cranial and facial bones. The size, shape and growth of the human skull are the product of many interrelated internal and external factor interactions. The purpose of the present study was to explore the systematic differences in cephalofacial size and shape classification between two measured groups of different ages and different period of done measurements. Five cephalofacial variables and four cephalofacial indexes were measured on 795 entities of the Kosovo Albanian population in two different timelines; 401 male entities aged 20–30 years old were measured during the timeline 1997-1999, while 394 male entities aged 18 years old were measured during the timeline 2016-2018. The gained data were analyzed in terms of basic descriptive statistical parameters and the percentage of distribution of results. The most pronounced differences between the age groups of 18 year-olds and the age group of 20-30 year-olds, are mainly emphasized in the morphological height of the face, total facial index and transverse cephalic index. While in other dimensions, the distribution of results is very similar. Differences between groups can be justified by the age at which the growth of the cephalofacial bones ends and the influence of external factors such as nutritional and socio-economic factors.

KEY WORDS: Head length; Morphological face height; Cephalic indexes; Total face index.

INTRODUCTION

From the ethno-anthropological point of view, the chronological study of the nations anthropological status helps compare the anthropological features between nations in different period of time. Also, the common position of the ethno-anthropologists is that the information collected from the measurement of the human head/skull (cephalo/craniofacial variables) enables a more reliable study of the anthropological status of nations (Coon, 1939; Ylli, 1975; Dhima, 1985). The anthropometric method of cephalometry is used in identification, forensic medicine, clinical diagnosis, plastic surgery, oral and maxillofacial surgery, orthodontics, archeology and ethno- anthropology (Rexhepi & Brestovci, 2014).

The human bones development begins in the embryo's mesenchyme and occurs through two processes: endochondral and intramembranous osteogenesis. While endochondral ossification is responsible for developing long and short bones, intramembranous ossification is responsible for the development of flat and irregular bones (Jin *et al.*,

2016). The human head/skull is a bony structure comprised of many flat and irregular bones, joined by sutures, which are divided into two groups: cranial (neurocranium) and facial bones (visceral cranium). The size, shape and growth of this bony structure are the product of many, still not fully understood, interrelated internal and external factor interactions such as phylogenetic, developmental, functional (Lieberman *et al.*, 2000), racial and ethnic affiliation (Morton, 1839; Enlow, 1968; Yokota, 2005), climate and environmental factors (Morton; Radovic *et al.*, 2000; Buretic-Tomljanovic *et al.*, 2007), socio-economic factors (Eder, 1995), nutritional factors (Shils & Shike, 2005) and genetic influences (Rexhepi & Meka, 2008; Vijay Kumar *et al.*, 2012).

While the cranium grows quickly during a child's early development (causing neurocranial morphological changes in size and shape), the facial bones grow much slower and are responsible for changing the form of the skull/head throughout a person's life (Scheuer & Black, 2004).

This bone structure development process starts between the 23rd and 26th days of gestation; meanwhile, the skull sutures commence closing from age 22 onward.

According to Krogman (1962), the assessment of suture closure may be used as a predictor criterion for age estimation of the entity.

This study aims to explore the systematic differences in cephalofacial size and shape classification between two measured groups of different ages and different period of done measurements.

MATERIAL AND METHOD

Research design. The study data are derived from the national project titled "Morphological characteristics of Kosovo Albanian population", which has been accomplished by the Institute of Sports Anthropology (INASP) in Pristina, Kosovo. This research has a cross-sectional exploratory and descriptive nature.

Site of study and sampling. The measurements were done on 795 entities of the Kosovo Albanian population in two different timelines; 401 male entities aged 20–30 years old have been measured during the timeline 1997-1999, while 394 male entities aged 18 years old have been measured during the timeline 2016-2018. Sample selection of entities was chosen randomly, always respecting the rule that their psycho-physical, dental and soft tissue condition were in the normal range.

Measuring tools and data collection. Respecting the International Biological Program protocols, five cephalofacial variables have been measured by the professional measuring team of the INASP, using professional anthropometrical instruments (anthropological cephalometer, anthropometric tape, as well as sliding compass) with accuracy of 1 mm:

- G-Op (glabella-opistocranium) – head length;
- Eu-Eu (eurion-aurion) – head width;
- V-Po (vertex-porion) – head height;
- N-Gn (nasion-gnathion) – morphological face height;
- Zy-Zy (bizygomatic) – Maximal facial breadth;

The differentiates between two groups regarding the distribution of the particular cephalofacial types (according to Martin-Saller scale) were analyzed in terms of four cephalofacial indexes:

- Horizontal cephalic index (HCI) - shows the ratio of the

maximum width of the head (Eu-Eu) to its maximum length (G-Op) multiplied by 100 ($HCI = (eu-eu / g-op) \times 100$).

- Vertical cephalic index (VCI) – shows the ratio of the maximum height of the head to its maximum length multiplied by 100 ($(v-po / g-op) \times 100$);

- Transverse cephalic index (TCI) – shows the proportion of the maximum head height to its maximum breadth multiplied by 100 ($(v-po / eu-eu) \times 100$);

- Total facial index (TFI) – shows the relation of the morphological height of the face to its maximum breadth ($(n-gn / zy-zy) \times 100$).

Data analysis. The gained data were analyzed in terms of basic descriptive statistical parameters. According to their cephalofacial characteristics, the entities categorization was done based on the distribution of their values according to the respective scale (Lebzelter-Saller scale, Routil scale). Comparisons of cephalofacial characteristics were determined by systematic differences between two groups of entities based on the basic descriptive parameters and the percentage of distribution of results.

Ethical considerations. This project was approved by the Ethics Committee of the Institute of Sports Anthropology.

RESULTS AND DISCUSSION

Table I shows the basic statistical parameters findings (Mean, Min. and Max. values, and SD) for the measured cephalofacial variables of both treated groups. While the mean values of the data indicate systematic differences between groups of measured subjects, the low values of Standard Deviation indicate the normal distribution of the measured variables mainly concentrated near their mean values.

The measured groups realize systematic differences in almost all the measured variables. The 18-year-old age group compared to the 20-30 age group shows higher average values in the variables that inform about the length and height of the head and the horizontal and vertical cephalic index.

The classification data of the two measured groups (Table II) regarding cephalofacial dimensions, always respecting the correspondent scale, are listed as follows:

- Head length (G-Op): age group 20-30 years old is mainly characterized by the long head (48.9 %) and medium-long head (28 %), compared to age-group 18 years old which is primarily characterized by the long head (45.69 %) and very long head (31.47 %);

- Head width (Eu-Eu): Both measured groups are characterized by wide and medium head (age-group 20-30 years old: 49.6 %, 32.9 %; age-group 18 years old: 40.36 %, 42.39 %);
- Regarding the head height dimension (V-Po), both groups are mainly characterized by the medium high head and low head (age-group 20-30 years old: 45.9 %, 26 %; age-group 18 years old: 41.37 %, 37.82 %);
- Regarding the face width (Zg-Zg), the age group 20-30 years old is characterized with the medium-large face (43.6 %) and narrow face (22 %), while the 18-year-old age group is characterized with the medium-large face (52.54 %) and large face (26.65 %);
- The morphological facial height (N-Gn) does the most pronounced differentiation between the two measured groups. Age group 20-30 years is characterized by moderately high face (33.7 %) and high face (30.2 %), while the age group 18 years is characterized by high face (37.31 %) and very high face (32.74 %).

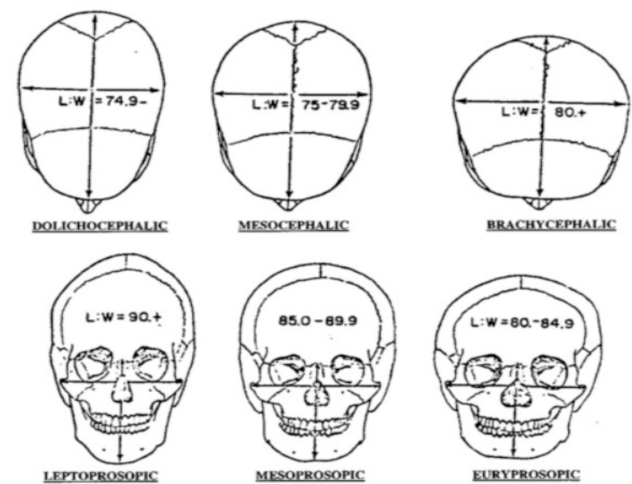
Based on cephalofacial indices (Table III), a relatively similar distribution of results can be observed when it comes to horizontal cephalic index (HCI) and vertical cephalic index (VCI), compared to transverse cephalic index (TCI) and the total facial index (TFI). Most of the tested subjects of both groups are characterized by Brachycephalic, and Low Hypsicephalic heads. Meanwhile, in terms of the transverse cephalic index (TCI), the age group 20-30 years old is characterized by a Tapeinocephalic (66.6 %) head type and with a Leptoprosopic (31.3 %) and Hyperleptoprosopic (28.3 %) face type (a low, flattened skull and with a long narrow face), in contrast to the age group 18 years old which is characterized by the Metriocephalic head type (50.25 %) and the Euryprosopic (35.28 %) – Mesoprosopic (30.71 %) face type (Fig. 1).

Based on the data of the above tables, we can conclude that the most pronounced differences between the age group 18 years old and the age group 20-30 years old are mainly

emphasized in the morphological height of the face, total facial index and transverse cephalic index. While in other dimensions, the distribution of results is very similar.

Differences between groups can be justified by the age at which the growth of the cephalofacial bones ends and the influence of external factors.

The fact that facial bones grow more slowly and end up growing later, compared to the bones of the head, made them even more responsible for changing the shape of the head during life (Scheuer & Black). Among the external factors influencing the shape of the head and the general morpho-functional development are undoubtedly the nutritional factors and socio-economic factors. The 20-year time difference of cephalofacial measurements made between the two groups and the major socio-economic changes that have occurred in post-war Kosovo, in 1999, within this period reinforce the influence of these external factors.



(From Broadbent, et. al: *Bolton Standards of Dentofacial Developmental Growth*. St. Louis: C.V Mosby, 1975, p. 69)

Fig. 1. The figurative appearance of different types of horizontal cephalic index and total facial index.

Table I. Descriptive parameters.

Variables:	Age-group 20-30years old (401 entities)				Age-group 18years old (394 entities)			
	Min	Max	X	SD	Min	Max	X	SD
G-OP	168.00	209.00	188.79	6.31	152.00	212.00	190.08	7.16
Eu-Eu	116.00	191.00	157.71	6.46	139.00	208.00	155.63	6.45
V-Po	104.00	143.00	121.52	6.97	108.00	162.00	139.85	6.04
N-Gn	105.00	144.00	122.44	6.45	102.00	168.00	117.81	6.83
Zy-Zy	109.00	155.00	135.87	8.12	108.00	150.00	127.02	6.50
HCI	61.70	100.53	83.59	3.72	70.00	152.08	84.58	7.04
VCI	52.74	76.00	64.41	3.80	71.89	110.05	81.95	4.01
TCI	63.64	93.97	77.14	4.85	57.14	83.66	66.92	3.67
TFI	74.31	115.60	90.38	6.45	62.50	98.50	81.75	4.48

Table II. Classification of the measured subjects based on the cephalofacial dimensions.

Head Length G-Op (Lebzelter-Saler scale) Scale-Value		Age-group:		18 years old	
		N° entities	%	N° entities	%
Very short head	x-169	1	0.20	3	0.76
Short head	170-177	16	4.00	10	2.54
Medium long head	178-185	113	28.00	77	19.54
Long head	186-193	196	48.90	180	45.69
Very long head	194<	76	18.70	124	31.47
Head Width Eu-Eu (Lebzelter-Saler scale)					
Very narrow head	> 139	4	1.00	1	0.25
Narrow head	140-147	11	2.70	31	7.87
Medium large head	148-155	132	32.90	167	42.39
Large head	156-163	199	49.60	159	40.36
Very large head	164<	55	13.70	36	9.14
Head Height V-Po (Routil scale)					
Very low head	x-109	14	3.50	40	10.15
Low head	110-117	103	26	149	37.82
Medium high head	118-125	184	45.90	163	41.37
High head	126-133	81	20.20	37	9.39
Very high head	134 <	19	4.70	5	1.27
Face Width Zg-Zg (Lebzelter-Saler scale)					
Very narrow face	> 127	61	15.20	11	2.79
Narrow face	128-135	90	22	65	16.50
Medium large face	136-143	175	43.60	207	52.54
Large face	144-151	72	18.00	105	26.65
Very large face	152<	3	0.70	6	1.52
Very low face	> 111	19	4.70	3	0.76
Low face	112-117	73	18.20	22	5.58
Medium high face	118-123	135	33.70	93	23.60
High face	124-129	121	30.20	147	37.31
Very high face	130 <	53	13.20	129	32.74

Table III. Cephalofacial indexes (Martin-Saller scale).

HCI	Age-group 20-30 years old			Age-group 20-30 years old		
	Scale-Value	N° entities	%	N° entities	%	
Dolichocephalic	71.0 - 75.9	10	2.5	18	4.57	
Mesocephalic	76.0 - 80.9	82	20.4	146	37.06	
Brachycephalic	81.0 - 85.9	206	51.4	176	44.67	
Hyperbrachycephalic	86.0 - 90.9	99	24.7	54	13.71	
Ultrabrachycephalic	91.0 - x	4	1	18	4.57	
VCI						
Chamaecephalic	x - 57.9	11	2.7	1	0.25	
Orthocephalic	58.0 - 62.9	129	32.2	52	13.20	
Low Hypsicephalic	63.0 - 67.9	192	47.9	198	50.25	
Moderate Hypsicephalic	68.0 - 72.9	65	16.2	128	32.49	
High Hypsicephalic	73.0 - x	4	1	15	3.81	
TCI						
Tapeinocephalic	> 78.9	267	66.6	96	24.37	
Metriocephalic	79.0 - 84.9	111	27.7	216	54.82	
Acrocephalic	85.0 <	23	5.7	82	20.81	
TFI						
Hypereuriprosop	x - 78.9	8	2	59	14.97	
Euryprosop	79.0 - 83.9	58	14.5	139	35.28	
Mesoprosop	84.0 - 87.9	96	23.9	121	30.71	
Leptoprosop	88.0 - 92.9	126	31.3	54	13.71	
Hyperleptoprosop	93.0 - x	114	28.3	21	5.33	

This study confirms cephalofacial morphometric differences between the age group 18 years and the age group 20-30 years. For a more concrete explanation of these findings, of course, longitudinal research will have to be done. Regular periodic measurements will precisely highlight the period when the cephalofacial morphometric dimensions change from the age of 18 to the age of 25. Such a longitudinal study will be our next goal.

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RESUMEN: El cráneo humano está compuesto por huesos planos e irregulares, divididos en dos grupos: huesos craneales y faciales. El tamaño, la forma y el crecimiento del cráneo humano son el producto de muchas interacciones de factores internos y externos interrelacionados. El propósito del presente estudio fue explorar las diferencias sistemáticas en la clasificación de tamaño y forma cefalofacial entre dos grupos de diferentes edades y en diferentes períodos de mediciones. Se midieron cinco variables cefalofaciales y cuatro índices cefalofaciales en 795 entidades de la población albanesa de Kosovo en dos líneas de tiempo diferentes. Se midieron 401 entidades masculinas de 20 a 30 años. Durante el periodo 1997-1999 se midieron 401 entidades masculinas de 20 a 30 años, mientras que 394 entidades masculinas de 18 años se se midieron durante el periodo 2016-2018. Los datos obtenidos se analizaron en términos de parámetros estadísticos descriptivos básicos y el porcentaje de distribución de los resultados. Las diferencias más pronunciadas entre los grupos de edad de 18 años y el grupo de 20-30 años, se enfatizan principalmente en la altura morfológica de la cara, índice facial total e índice cefálico transversal. Mientras que en otras dimensiones, la distribución de resultados es muy similar. Las diferencias entre grupos pueden estar asociadas a la edad en la que finaliza el crecimiento de los huesos cefalofaciales y la influencia de factores externos, tal como aspectos nutricionales y socioeconómicos.

PALABRAS CLAVE: Longitud de la cabeza; Altura morfológica de la cara; Índices cefálicos; Índice facial total.

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