Coll. Antropol. **31** (2007) 4: 1121–1125
Original scientific paper

Craniofacial Characteristics of Croatian and Syrian Populations

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A B S T R A C T

Craniofacial area is a part of the human body which undergoes the greatest changes during development and is characterized by uneven growth. External and internal factors affect the growth and development of craniofacial structures. They are responsible for the occurrence of specific craniofacial characteristics in different races or populations within the same race. The present study investigates the possible differences of the basic head and face shapes between the Croatian and Syrian populations. The sample included 400 subjects of both sexes aged 18–24 years and was divided into a Croatian and a Syrian group with 200 subjects each. Six variables defined according to Martin and Saller were measured by standard anthropometric instruments[19]. The results of the study demonstrated statistically significant differences between our subjects in all variables except face width. The dolichocephalic head type and the mesoprosopic face type were predominant in the Croatian population, while the brachycephalic head type and the euryprosopic face type dominated in the Syrian population.

***Key words**: anthropometry, craniofacial structures, Croatian and Syrian populations*

Introduction

Anthropometry, an anthropologic method used since the 18th century for classifying different human races[1], plays an irreplaceable role in modern medical genetics[2,3], gynecology[4], dental medicine[5], craniofacial surgery[6,7] and in many other branches of medicine.

The craniofacial area is one of the parts of the body which undergoes major changes, particularly the face[8], which is therefore frequently the subject of much research. Craniofacial anthropometry is instrumental in the comparison of values obtained by measuring various of head and face components of the healthy and diseased population[9–11], children and adults, or members of different races. Thus, Bookstein et al[12] studied human fossil skulls as well as skulls of members of different races and age groups. Farkas et al[13] and Hajniš et al[14] compared some craniofacial characteristics of the members of *Caucasian*, *Negroid* and *Mongolese* race, and Al-Jasser[15] compared craniofacial characteristics of *Saudi* ethnic groups with the standards defined for the white race. Similar studies of craniofacial characteristics of of white race members only were pursued by Deniker[16], Czekanovski[17] and Muretić et al[18].

The rate of craniofacial growth was demonstrated to be uneven, i.e., the periods of accelerated growth of these structures and the periods of retarded growth alternate[13,19]. This is particularly pronounced in certain periods during life[20] and is characterized by variable progression, depending on the magnitude and time of the changes[21]. Except during the fetal period, the major and the fastes changes take place later after birth and during puberty and during puberty, as demonstrated by numerous reports[12,20,22–26]. Moreover, three-dimensional studies have shown that the growth of craniofacial structures occurs in different interrelated directions[27].

The growth and development of these structures is influenced by internal (genetic)[3,28] and external factors (climate, air pollution, economic conditions, time)[29–31] and long-term evolutionary changes[32,33].

The craniofacial system is known to consist of two components: the neurocranium and the viscerocranium.

Received for publication July 6, 2006

Each is derived from a different basis, grows owing to numerous developmental and functional interactions, and undergoes intramembranous and enchondral ossification[12,34]. These points clearly suggest the complexity of factors influencing the growth and development of the craniofacial system within the same population or between different races. Studies attempting to fill certain gaps or to provide missing information such as, we believe, this one, always attract great attention. Available references provide no information on the craniofacial characteristics of the *Syrian* population and, thus, also on the degree of influence of different factors on the development of the craniofacial system in this population. In order to accurately assess the craniofacial characteristics of the *Syrian* population in this study, appropriate variables were analyzed and their values compared with the same variables in the *Croatian* population.

The main aim of this study has been to investigate possible differences concerning craniofacial characteristics between the *Croatian* and *Syrian* population, regardless of gender, and identify these differences on the bases of the following:

1. the most significant anthropologic head and face parameters,
2. head and face indexes.

Subjects and Procedures

The sample included 400 subjects of both sexes divided into two groups, i.e. the *Croatian* and the *Syrian* group with 200 subjects each (100 male and 100 female subjects). The subjects were 18–24 years old. All measurements were performed on the sample in Zagreb, Damascus and Aleppo.

Head and face dimensions were measured directly on all subjects by standard anthropometric instruments,i.e., the cephalometer, sliding gauge and measuring tape. Six variables were measured, four of them directly while head and face indexes were obtained by calculation. All variables were determined by basic definitions according to Martin and Saller[19] and designated as follows:

1. head length (glabella-opistocranion) g-op;
2. head width (eurion-eurion) eu-eu;
3. face width (zygion-zygion) zy-zy;
4. total face height (nasion-gnathion) n-gn;
5. head index HI;
6. face index FI.

The basic variables were used to calculate the HI and FI values according to the following formulae:

$$HI=(eu–eu / g–op) \times 100 \qquad FI=(n–gn / zy–zy) \times 100$$

The derived HI and FI variables were used to evaluate basic craniofacial types as defined by the criteria according to Martin and Saller[19]. All measurement results were statistically processed (X, SD, SE, min, max) for each variable. All the variables were tested for arithmetic mean differences between the *Croatian* and *Syrian* samples by Student t-test at the level of significance $p<0.05$.

TABLE 1
BASIC STATISTICAL PARAMETERS OF VARIABLES FOR THE CROATIAN POPULATION

Variable	X	SD	SE	min	max
g-op /mm/	192.38	7.75	0.55	173	219
eu-eu /mm/	140.33	9.89	0.70	103	175
zy-zy /mm/	132.49	8.23	0.58	110	155
n-gn /mm/	113.76	8.49	0.60	88	140
HI	72.60	5.72	0.40	52	89
FI	86.07	7.01	0.49	67.69	105.74

X – arithmetic mean, SD – standard deviation, SE – standard error, min – minimum value, max – maximum value

TABLE 2
BASIC STATISTICAL PARAMETERS OF VARIABLES FOR THE SYRIAN POPULATION

Variable	X	SD	SE	min	max
g-op /mm/	184.94	6.60	0.47	170	196
eu-eu /mm/	152.66	9.32	0.66	129	168
zy-zy /mm/	132.73	8.81	0.62	106	150
n-gn /mm/	109.96	6.50	0.46	94	128
HI	82.04	3.28	0.23	67	88
FI	83.12	6.32	0.45	69.13	101.63

X – arithmetic mean, SD – standard deviation, SE – standard error, min – minimum value, max – maximum value

Results

The results of our study are presented in Tables 1, 2 and 3 and Figures 1–6 separately for the *Croatian* and *Syrian* populations. Table 1 and 2 contain basic parameters for the *Croatian* and *Syrian* populations, respectively.

The arithmetic mean differences of the studied variables for both populations are presented in Table 3 which demonstrates the following:

1. Head length (g-op) was statistically significantly higher in the *Croatian* population sample ($p<0.001$) – Figure 1.
2. Head width (eu-eu) was statistically significantly higher in the *Syrian* population sample ($p<0.0001$) – Figure 2.
3. Face width (zy-zy) showed no statistically significant difference between the *Croatian* and *Syrian* populations ($p>0.05$) – Figure 3.
4. Total face height (n-gn) was statistically significantly higher in the *Croatian* population sample ($p<0.001$) – Figure 4.
5. The head index (HI) was statistically significantly higher in the *Syrian* population sample ($p<0.001$) – Figure 5.
6. The face index (FI) was statistically significantly higher in the *Croatian* population sample ($p<0.0001$) – Figure 6.

TABLE 3
THE TESTING OF IN ARITHMETIC MEAN DIFFERENCES BETWEEN VARIABLES FOR THE *CROATIAN* AND *SYRIAN* POPULATIONS

Variable	t	df	p
g-op /mm/	10.343	388.2	<0.001
eu-eu /mm/	12.832	398	<0.0001
zy-zy /mm/	0.281	398	>0.05
n-gn /mm/	5.028	372.7	<0.001
HI	20.215	315.1	<0.001
FI	4.418	398	<0.0001

df – degrees of freedom, p – probability

Based on the results of our study shown in Tables 1, 2 and 3, it is evident that there are statistically significant differences between the two groups of subjects for all the variables studied except face width. *Croats* were found to have longer and narrower heads than *Syrians*. According to the head index which is significantly lower in *Croats*, the dolichocephalic head type predominates in *Croatian* subjects while the brachycephalic head type prevales among *Syrian* subjects.

As the face index is higher in *Croats*, the mesoprosopic face type prevails in the *Croatian* population, and the euryprosopic type in *Syrian* population.

Discussion

Anthropometric studies of specific craniofacial morphological features in different races, but also within certain races or ethnic groups, are still of topical interest and their results are applied both in anthropology and many other fields of science. Taking into account the numerous factors affecting the growth and development of craniofacial structures, we may assume the existence of differences in head and face morphology between members of different races.

Bookstein et al[12] investigated how evolution, development and function influence various cranial components. Their studies were performed on skulls of *Caucasians* including newborns and adolescents, the skulls of adult members of different races (*Caucasian*, *Negroid*, *Mongolese*), and on human fossil skulls. In terms of evolution, the results showed a linear interaction between the cranial vault and the face, the cranial vault and the base,

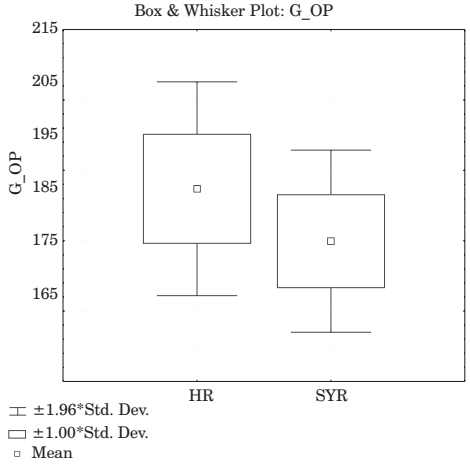

Fig. 1. Head length (g-op) in Croatian and Syrian subjects.

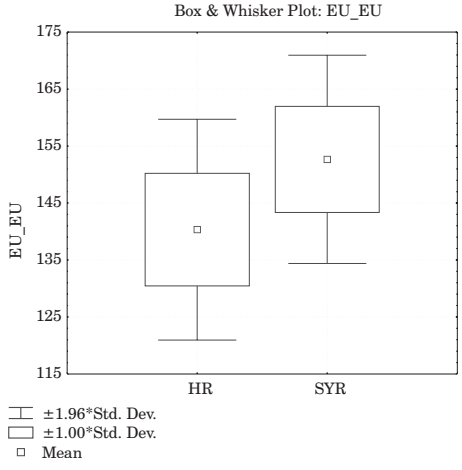

Fig. 2. Head width (eu-eu) in Croatian and Syrian subjects.

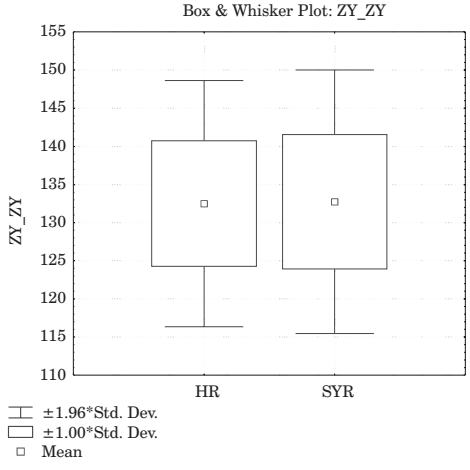

Fig. 3. Face width (zy-zy) in Croatian and Syrian subjects.

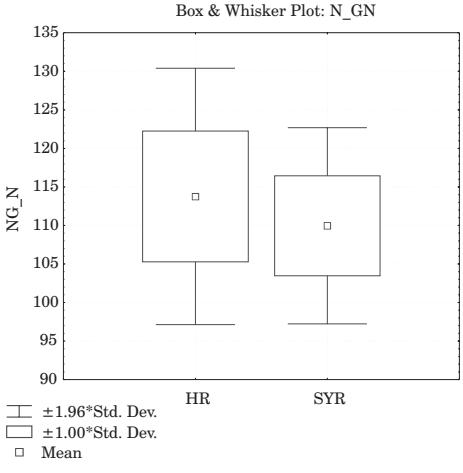

Fig. 4. Total face height (n-gn) in Croatian and Syrian subjects.

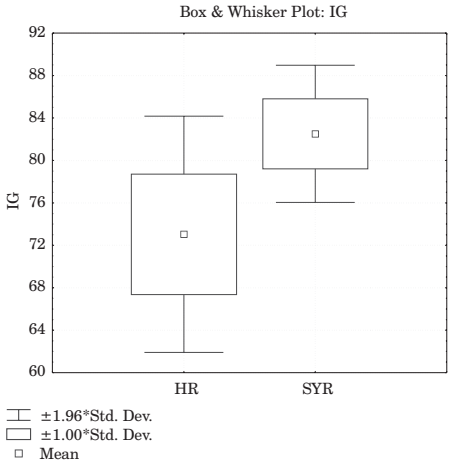

Fig. 5. Head index (HI) in Croatian and Syrian subjects

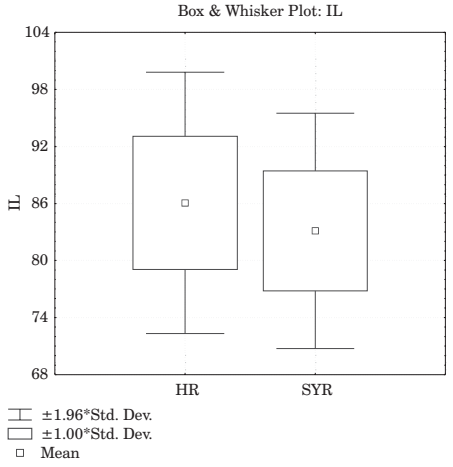

Fig. 6. Face index (FI) in Croatian and Syrian subjects

and the cranial base and the face. However, results related to development and growth from childhood to adulthood demonstrated that face and cranial vault changes were mutually more correlated than those relating to the cranial base. Furthermore, Farkas et al.[13] and Hajniš et al.[14] measured head width and calculated the head index for young persons of both sexes of all three races, i.e., the *Caucasian*, *Negroid* and *Mongolese* races. Their results showed that *North-American whites* have a mesocephalic head type, i.e., a long and medium-wide head, *African Americans* have a dolichocephalic type, i.e., a long and narrow head, while the hyperbrachycephalic type predominated among the *Chinese*, i.e., they have a short and wide head. No significant difference in head height was found in subjects of the three races.

A study Al-Jasser[15] is of particular scientific interest. He focused on the description of the craniofacial characteristics of *Saudi* ethnic groups and compared the results with the standards for the white race according to Steiner's analysis. The study included individuals aged 21–27 years. The results, compared to Steiner's standards, showed that *Saudis* had similar skeletal proportions, but a lesser lower face height compared to *Caucasians*. If some findings for the white population[13,14,18] are compared with our results obtained on the *Syrian* population, certain differences could be established, for example in the head index. While the *North American white* population and the citizens of Mainz have a mesocephalic head, *Syrians* have a brachycephalic type.

Interestingly enough, statistically significant differences among some craniofacial variables may be found even within the same race. Thus, Muretić et al.[18] conducted a three-dimensional study of craniofacial morphological differences between the citizens of Mainz and Zagreb and found that the subjects from Mainz had a longer and narrower head with a higher face than the subjects from Zagreb. Deniker[16] and Czekanovski[17] observed greater body height differences were found in *Caucasian* ethnic groups as compared to head and face measures.

The results obtained by Njemirovskij et al.[35] are also interesting. They attempted to establish the basic head and face types and morphologic and craniofacial differences between the populations of South Dalmatia and Central Croatia. The studies included 100 subjects aged 18-30 years. The results showed that mesocephalia and leptoprosopia prevailed in South Dalmatia, and brachycephalia and euryprosopy in Central Croatia.

Remarkable differences may be noted when our results for head and face indices are compared with the findings of other authors. It is difficult to explain the reasons for these differences. They may have occurred owing to different subject numbers or ages. Just as in *Croatian* subjects, differences in the values of some variables may also be expected within the *Syrian* population. It would be of interest to investigate this further, particularly as we found no data in the available references on craniofacial variables in *Syrians*. It is our view that the differences of investigated parameters could be the result of migration and mixing of the *Syrian* population with other *Arabic* tribes.

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KRANIOFACIJALNE OSOBITOSTI HRVATSKE I SIRIJSKE POPULACIJE

S A Ž E T A K

Tijekom razvoja u tijelu čovjeka najviše se mijenja kraniofacijalno područje čiji je rast neujednačen. Na rast i razvoj kraniofacijalnih struktura utječu unutarnji i vanjski čimbenici. Oni su odgovorni za nastanak određenih kraniofacijalnih osobitosti pripadnika različitih rasa ili populacija unutar iste rase. Ovim radom istraživalo se je postoje li razlike u osnovnim oblicima glave i lica između hrvatske i sirijske populacije. Uzorak se je sastojao od 400 ispitanika oba spola, u dobi od 18 do 24 godine, podijeljenih u hrvatsku i sirijsku skupinu sa po 200 ispitanika u svakoj. Standardnim antropometrijskim instrumentima ispitanicima je mjereno 6 varijabli definiranih po Martinu i Salleru[19]. Rezultati istraživanja pokazali su da između naših ispitanika postoje statistiki značajne razlike u svim varijablama, osim u širini lica. U hrvatskoj populaciji dominira dolihokefalni tip glave i mezoprozopski tip lica, a u sirijskoj brahiokefalni tip glave i euriprozopski tip lica.