Craniofacial Characteristics of Croatian and Syrian Populations

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ABSTRACT

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 instruments19. 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 races1, plays an irreplaceable role in modern medical genetics2, gynecology4, dental medicine5, craniofacial surgery6,7 and in many other branches of medicine.

The craniofacial area is one of the parts of the body which undergoes major changes, particularly the face3, 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 population8-11, children and adults, or members of different races. Thus, Bookstein et al12 studied human fossil skulls as well as skulls of members of different races and age groups. Farkas et al13 and Hajniš et al14 compared some craniofacial characteristics of the members of Caucasian, Negroid and Mongolese race, and Al-Jasser15 compared craniofacial characteristics of Saudi ethnic groups with the standards defined for the white race. Similar studies of craniofacial characteristics of white race members only were pursued by Deniker16, Czekanovski17 and Muretić et al18.

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 alternate13,19. This is particularly pronounced in certain periods during life20 and is characterized by variable progression, depending on the magnitude and time of the changes21. Except during the fetal period, the major and the fastest changes take place later after birth and during puberty and during puberty, as demonstrated by numerous reports12,20,22-26. Moreover, three-dimensional studies have shown that the growth of craniofacial structures occurs in different interrelated directions27.

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 changes32,33.

The craniofacial system is known to consist of two components: the neurocranium and the viscerocranium.
Each is derived from a different basis, grows owing to numerous developmental and functional interactions, and undergoes intramembranous and enchondral ossification. 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 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 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 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:

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

The derived HI and FI variables were used to evaluate basic craniofacial types as defined by the criteria according to Martin and Saller. 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 $p<0.05$.

### 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 1

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

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

### Table 2

<table>
<thead>
<tr>
<th>Variable</th>
<th>X</th>
<th>SD</th>
<th>SE</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>g-op /mm/</td>
<td>184.94</td>
<td>6.60</td>
<td>0.47</td>
<td>170</td>
<td>196</td>
</tr>
<tr>
<td>eu-eu /mm/</td>
<td>152.66</td>
<td>9.32</td>
<td>0.66</td>
<td>129</td>
<td>168</td>
</tr>
<tr>
<td>zy-zy /mm/</td>
<td>132.73</td>
<td>8.11</td>
<td>0.62</td>
<td>106</td>
<td>150</td>
</tr>
<tr>
<td>n-gn /mm/</td>
<td>109.96</td>
<td>6.50</td>
<td>0.46</td>
<td>94</td>
<td>128</td>
</tr>
<tr>
<td>HI</td>
<td>82.04</td>
<td>3.28</td>
<td>0.23</td>
<td>67</td>
<td>88</td>
</tr>
<tr>
<td>FI</td>
<td>83.12</td>
<td>6.32</td>
<td>0.45</td>
<td>69.13</td>
<td>101.63</td>
</tr>
</tbody>
</table>

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

### Table 3

<table>
<thead>
<tr>
<th>Variable</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>g-op /mm/</td>
<td>10.343</td>
<td>388.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>eu-eu /mm/</td>
<td>12.832</td>
<td>398</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>zy-zy /mm/</td>
<td>0.281</td>
<td>398</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>n-gn /mm/</td>
<td>5.028</td>
<td>372.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HI</td>
<td>20.215</td>
<td>315.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>FI</td>
<td>4.418</td>
<td>398</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

df – degrees of freedom, p – probability

![Box & Whisker Plot: G_OP](image1)

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

![Box & Whisker Plot: EU_EU](image2)

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

![Box & Whisker Plot: ZY_ZY](image3)

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

![Box & Whisker Plot: N_GN](image4)

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

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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. and Hajniš et al. measured head width and calculated the head index for young persons of both sexes of all three races, i.e., the Caucasian, Negroid and Mongoloid 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 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 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. 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 and Czekanowski 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. 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.

REFERENCES

KRANIOFACIJALNE OSOBITOSTI HRVATSKE I SIRIJSKE POPULACIJE

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