Estimation of stature from facial indices among Iranian medical students

Soheila Madadi, Fatemeh Tahmasebi, Maryam Khanehzad, Shokofeh Kazemzadeh, and Gholamreza Hassanzadeh[*]

Department of Anatomy, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran.
[*]Correspondence to Gholamreza Hassanzadeh (email: hassanzadeh@tums.ac.ir).

Objective   Anthropometric data, particularly nasofacial dimensions, is important in sex determination, forensic medicine and plastic surgery. The aim of this study is to assess the facial indices, to classify the type of face and to determine the relation between stature and facial height and facial width among Iranian medical students.

Methods   This study was done on 200 medical students (100 males and 100 females), in the age range of 18–30 years. Stature, facial height and facial width were measured by using a standard spreading caliper and facial index calculated for determination of facial type. The linear regression used for examining the relationship between stature and facial length and facial width.

Results   The result of study showed that the mean and standard deviation of the facial index of males and female students were 87.53 ± 8.81 and 89.25 ± 10.09, respectively. The facial index did not have statistically significant difference between two groups ($P = 0.202$). According to the results, the dominant type of facial shape in male students was mesoprosopic and in female students were europrosopic. There was a correlation between stature and facial height ($r = 0.27$, $P = 0.000$) and facial width ($r = 0.54$, $P = 0.000$).

Conclusion   The data of this study can be beneficial in face reconstruction, clinical diagnosis and forensics applications.

Keywords   Facial height, facial width, facial index, stature

Introduction

Craniofacial measurement is an important part of anthropology and medicine that determine the morphological features of the face and head.[1] Shape of face is affected by many agents, for instance, gender, race and ethnicity, nutritional, climate, socio-economic, and genetic factors.[1,2] The determination of facial parameters is useful in plastic surgery, forensics applications, head and face reconstruction, oral and maxillofacial surgery, orthodontics, clinical diagnosis and treatment planning.[3–5]

According to craniofacial measurements, shape of faces are classified into five anatomical types that include: hypereuryprosopic, euryprosopic, mesoprosopic, leptoprosopic and hyperleptoprosopic.[6] By using facial measurements for example facial height, facial width and facial index is beneficial to identify the genetically and acquired defects. Facial type can be an effective element to increase capability of obstructive sleep apnea for instance a person with euryproscopic facial type prefers the nasal breathing mode.[7,8] Comparing the facial index differences among parents, offspring and sibling may be a sign for genetic transition.[9] In addition, different studies showed a relation between the stature with body parts measurement, but there is few studies in this field among Iranian population.[10–12] These kinds of studies might be beneficial for stature estimation in growth defects and skeletal dysplasia cases.[13]

The aim of this study is to determine the facial indices and to classify the facial type in Iranian medical students. And also this study assessed the relationship between facial width and facial height with the stature in Iranian medical students.

Materials and Methods

This study was carried out on 200 medical students of Tehran University of Medical Sciences, Tehran, Iran (100 males and 100 females), with age range of 18–30 years with normal craniofacial configurations.

The students were sitting on the chair, and their head were in the anatomical position.

Facial height and facial width were measured by using a standard spreading caliper with scale. The measurement of facial height was taken the distance between nasion (n) and gnathion (gn). And the measurement of face width was taken the distance between zygion (zy) of right and left side.

To calculate facial index the following formula was used:

$$\text{Facial index} = \frac{\text{Facial length}}{\text{Facial width}} \times 100$$

The anatomical landmarks used in measuring of the parameters were defined as follows:

Nasion (n): the point on the nasal root in the midpoint of the nasofrontal suture.

Gnathion (gn): the lowest point on the lower border of the mandible in the midline.

Zygion (zy): it is the most lateral point on the zygomatic arch.

According to facial index, face shapes were classified to five categories that include (Banister's classification) (14):

1. Hypereuryprosopic (very broad, short face): facial index <79.9.
2. Euryprosopic (broad, short face): facial index 80–84.9.
3. Mesoprosopic (average, round face): facial index 85–89.9.
4. Leptoprosopic (long, narrow face): facial index 90–94.9.
5. Hyperleptoprosopic (very long, narrow face): facial index >95.

The stature (standing height) of subjects was measured as distance between the vertex and the heel in centimeters. Individuals stood barefoot on a flat surface and their head was stated in the Frankfort horizontal plane.[15] The data were analyzed by SPSS 16 software and expressed as mean ± SEM. Independent-samples t-test was used for comparison of the means of the anthropometric measurements. The relationship

between quantitative data was assessed by Pearson's correlation coefficient and linear regression was used to determine the relation between stature with facial length and facial width. Statistical significance was considered to be $P \leq 0.05$.

Results

In this study, the facial height was assessed and the results revealed that the mean and standard deviation facial height of male and female students were 12.32 ± 1.06 and 11.57 ± 1.12 cm, respectively. There was a significant difference in the facial height of students between two sex groups ($P = 0.0001$, Table 1). According to Table 1, mean and standard deviation facial width of male and female students were 14.11 ± 0.76 and 13.00 ± 0.64 cm, respectively. There was a significant difference in the facial width of cases between two sex groups ($P = 0.0001$). The obtained results showed that mean and standard deviation of the facial index of male and female students were 87.53 ± 8.81 and 89.25 ± 10.09 respectively. Also facial index was not statistically significant difference between male and female students ($P = 0.202$, Table 1).

According to the results, the common face shape for male and female students were mesoprosopic (round face) and europrosopic (broad face), which was 33% and 36% for male and female students, respectively. The second most dominant face shape for males was europrosopic that was 25% but for females it was mesoprosopic and leptoprosopic (long face) that each of them was 20%. The rare face shape was hypereuryprosopic (very broad face) for both groups, which was 11% and 8% for males and females, respectively (Table 2, Figs. 1 and 2).

Mean and standard deviation stature of male and female students were 177.202 ± 6.04 and 161.94 ± 6.17 cm, respectively. There was a significant difference in the stature of students between two groups ($P = 0.000$, Table 3).

Also, there was a correlation between stature with facial height and facial width that was statistically significant. Pearson
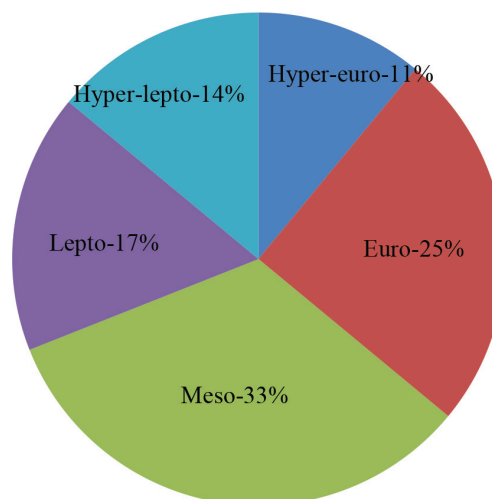

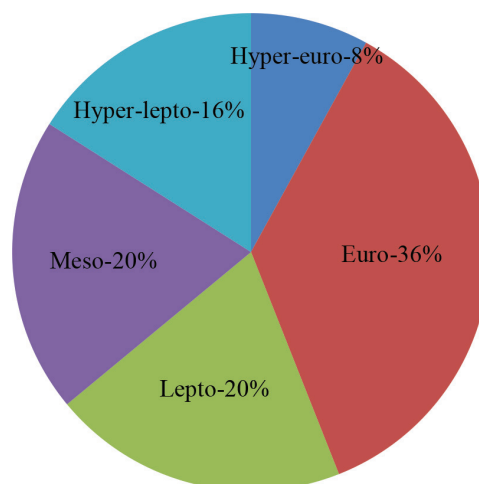Fig. 1 **Morphological variation of facial index in male students.**

Fig. 2 **Morphological variation of facial index in female students.**

Table 1. **Comparison of facial height, facial width and facial index in male and female students**

Parameters	N		Mean ± SD	
	Male	Female	Male	Female
Facial height	100	100	12.32 ± 1.06	11.57 ± 1.12
Facial width	100	100	14.11 ± 0.76	13.00 ± 0.64
Facial index	100	100	87.53 ± 8.81	89.25 ± 10.09

SD: standard deviation; *N*: number of samples.

Table 2. **Distribution of facial type in male and female students**

Face shape	Range of facial index	Male	Female
(1) Hypereuryprosopic (very broad face)	<79.9	11	8
(2) Europrosopic (broad face)	80–84.9	25	36
(3) Mesoprosopic (round face)	85–89.9	33	20
(4) Leptoprosopic (long face)	90–94.9	17	20
(5) Hyperleptoprosopic (very long face)	>95	14	16

Table 3. **Comparison of stature in male and female students**

Groups	N	Mean ± S.D
Male	100	177.202 ± 6.04
Female	100	161.94 ± 6.17

SD: standard deviation; *N*: number of samples.

correlation (*r*) for stature with facial height and facial width was 0.27 and 0.54, respectively ($P = 0.000$, Table 4). The correlation between stature with facial height and width are shown in Scatter graphs (Fig. 3).

Linear regression analysis showed a relation between stature with facial height and facial width in all cases. According to the results, the facial width can predict the stature better than facial height (Table 5).

Discussion

In this study the facial index of students of Tehran University of Medical Sciences in the range of 18–30 years old evaluated. Facial index calculated by ratio of facial height to facial width and multiplied by 100. The result of study showed that the mean

Table 4. Pearson correlation (r) between stature with facial height and facial width

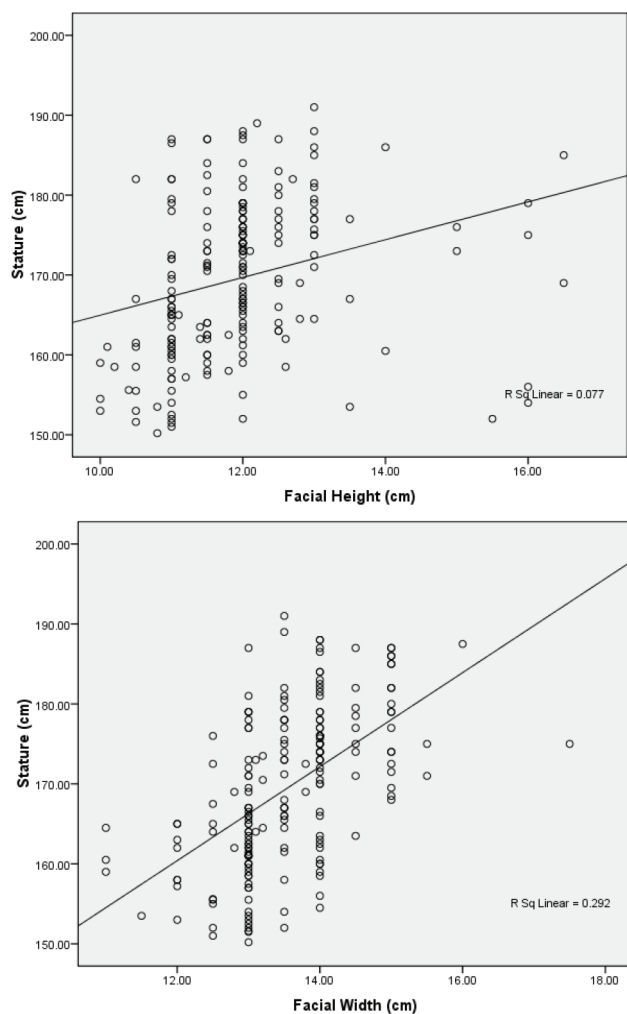| Variable	Pearson correlation (r)	P
Facial height	0.27	0
Facial width	0.54	0

Fig. 3 Correlation between stature (cm) and facial height (cm) and facial width (cm).

Table 5. Linear regression for estimation of stature from facial height and facial width

Regression equation	SEE		R^2	P
	FW	FH		
S = 141. 33 + 2.36 (FH)	0.58	–	0.07	0
S = 89.85 + 5.87 (FW)	–	0.65	0.29	0
S = 77.01 + 1.51 (FH) + 5.49 (FW)	0.508	0.65	0.32	0

S: stature, FH: facial height, FW: facial width, SEE: standard error of the estimate, R^2: coefficient of determination.

facial index of male and female cases were 87.53 and 89.25, respectively. It was not statistically significant difference between two gender (P = 0.202). The involved students came from various ethnic and geography. And biological, geographical,

race, gender and nutritional condition were effective factors on the facial indices and stature.[16] Our findings were similar to Shetti et al.'s study. They showed that mean facial index for males was 87.19 and mean facial index for females was 86.75 in Indian students with a statistically significant difference between two groups (P = 0.018).[17] Kumar et al. reported the mean facial index among adult Haryanvi Banias was 86.09 in males and 84.84 in females and the dominant face type in males and females were mesoprosopic and europrosopic, respectively. These findings are similar to our research.[18] According to Wai et al.'s study, the mean facial index in male and female Malay young adults were 87.04 and 90.59, respectively, and the face form of males were mesoprosopic and of females were leptoprosopic, respectively. In Chinese young adults, the facial index was 85.90 in male cases and 85.40 in female cases with a mesoprosopic face type for both genders. The mean facial index in male and female Indian young adults was 92.14 and 92.99, respectively, with leptoprosopic face type for both genders.[19]

Sharma et al.'s study revealed the mean facial index of Nepalese students for males and females as 87.20 and 86.81, respectively. The difference between two groups was not statistically significant (P = 0.553). The most common face shape between male Nepalese students was euryprosopic and females was mesoprosopic, which is completely contrary to our study, that the dominant type of facial shape for males students was mesoprosopic and females students was europrosopic.[20] Also, our findings differed from the study of Kurnia et al.[7] that reported the dominant face type was leptoprosopic type in male and mesoprosopic type in female among Chinese in Indonesia. Azizi et al.[21] showed the most common facial type was hyperleptoprosopic type among males and females in Qazvin, Iran. The study of Jahanshahi et al. showed that the face form of the native Fars and Turkman males were mesoprosopic. And the face form of the native Fars and Turkman females were euryprosopic, which is similar to the results of this study. The least common facial shape in the native Fars males was hyperleptoprosopic and hypereuryprosopic and in females were hyperleptoprosopic. The least common facial shape in the Turkman males and females were hypereuryprosopic and leptoprosopic, respectively. In this study, the rare type of face form was hypereuryprosopic for both sexes, which in male students is similar to the findings of Jahanshahi et al.'s study in Fars and Turkman males. Also, the mean facial index of Fars males and females were 88.22 and 84.48, respectively. The mean facial index of Turkman males and females were 87.25 and 81.48, respectively that is closely similar to the results of this study.[22] The results of this study resembled with Salve et al.[23] study that showed the dominant face type in Andhra region males and females were mesoprosopic and euryproscopic, respectively.

According to gained results the dominant face shape in females are euryprosopic, while in males are mesoprosopic. It indicates that female students have a rather broad face than male students. This study that had been carried out on 200 students, presented the anthropometrical differences between students of Tehran University of Medical Sciences.[18] Generally, types of face shape are affected by geographical and ethnical factors and show broad, round or long faces in every population.[22] The facial indices assessment can be used for sex determination, forensics medicine, and facial plastic surgeries. And more researches are required in a larger sample between Iranian population to apply in the medical and surgical purposes.[19]

In this study, stature was compared with facial height and facial width of the students and the results of study showed a correlation between them.

The correlation coefficient (*r*) between stature and facial height and facial width was 0.27 and 0.54, respectively. The linear regression equation showed that stature is estimated by facial height and facial width.

Linear regression analysis showed a poor relation between stature and facial height (S = 141. 33 + 2.36 × Facial height (cm), R^2 = 0.07, SEE = 0.58) and a moderate relation between stature and facial width (S = 89.85 + 5.87 × Facial width (cm), R^2 = 0.29, SEE = 0.65).

In several studies, the stature estimated from body parts including cephalofacial, upper and lower limb measurements such as forearm length, and foot length.[24–28]

Krishan et al. showed the correlation between stature with facial height (*r* = 0.34) and facial width (*r* = 0.46) in North Indian population. The result of their study is similar to this study which shows facial width is more reliable for stature estimation than facial height.[29]

Sahni et al. used facial height for prediction of stature in northwest Indians and its correlation coefficient (*r*) was 0.21 in males and 0.18 in females.[30]

Agnihotri et al.'s study showed a correlation between stature with facial height (*r* = 0.32 in males and *r* = 0.16 in females) and facial width (*r* = 0.17 in males and *r* = 0.27 in females). Their result showed that facial height is a more suitable parameter in males than facial width for estimation of stature while in females it is vice versa.[31]

Wankhede et al. reported a relation between stature with facial height in males (*r* = 0.19) and females (*r* = 0.14) of central Indian population that it was lower than result of this study. This variance could be affected by climatic, geographic or ethnic difference.[32]

In addition, this study showed that the prediction of facial width for stature estimation is more reliable than facial height among Iranian medical students, whereas the anthropometric features are affected by elements such as different races, nutrition, genetic and geographical situation,[33] the regression models of the stature from other parts of body can be different in the various regions. Also the correlation between facial indices and stature can be useful in identifying nasofacial dysmorphology, maxillofacial and facial reconstruction surgeries, stature estimation, and the application of forensic. Hence, further studies in different races are required to estimate the stature.

Acknowledgment

Conflicts of Interest

The authors declare no conflicts of interest. ◼

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