

DETERMINATION OF SEX FROM TOTAL FACIAL INDEX

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Abstract

Background: Anthropometry is defined as the measurement of the human body dimensions and its implication in medical science. Sex determination is an important aspect of forensic anthropology and archaeology. The total facial index is one of the parameters used for sex determination. This study aimed to find out sexual variation of TFI in individuals of Gujarat region in India.

Materials and Methods: This study was conducted on 510 individuals (243 males & 267 females) aged between 18 and 30 years. In the present study the landmarks used were Zygion (zy), Nasion (n) and Gnathion (gn). The facial length was measured from the nasion (n) to the gnathion (gn), and the facial width was measured between the right and left zygion using digital sliding calipers. The TFI was calculated as the ratio of facial height to facial width.

Result: The Total Facial Index has higher mean value on the side of males as compared to females and this difference is statistically highly significant. In the present study, face shape is classified in five groups. The predominant face type in the study group is mesoprosopic which is followed by euriprosopic, leptoprosopic, hyperleptoprosopic and hypereuriprosopic face shape respectively. In female, most predominant type is euriprosopic and in male is mesoprosopic. This difference is statistically highly significant. Analysis for gender difference in Total Facial Index shows higher value for males as compared to females. Mean index for male is 90.19 and for female 87.06.

Conclusion: The Total Facial Index is a reliable parameter for sex determination. The study shows that the Total Facial Index shows highly significant values for males as compared to females. The Total Facial Index should be used in conjunction with other parameters for accurate sex determination.

INTRODUCTION

Anthropometry simply means the measurement of the human individual. Anthropometry is defined as the measurement of the human body dimensions and its implication in medical science.^[1] Craniofacial anthropometry, as an important part of anthropometry, is used for the determination of the morphological characteristics of the head and face.^[2] Anthropometric measurements of the face provide objective data for facial analysis and assessment. The human face is one of the most beautiful and functional creations in nature. Its importance has been documented in arts and science since the beginning of modern civilization. The identification of aesthetic facial qualities began with ancient civilizations such as Egyptians and Greeks who

captured their ideas of beauty in art form. Face must conform to stringent proportions in order for it to be aesthetically pleasing.

Sex determination is an important aspect of forensic anthropology and archaeology. It helps in identifying the sex of skeletal remains or unidentified bodies. The total facial index is one of the parameters used for sex determination.

The Total Facial Index (TFI) is a measure that assesses the relative proportion of the facial features. It is calculated as the ratio of the facial height to facial width. This study aimed to find out sexual variation of TFI in individuals of Gujarat region in India. The objective of this study is to discuss the sex difference in TFI in Gujarat region and to compare the findings of the present study with similar studies done earlier.

MATERIALS AND METHODS



Figure 1: A photograph showing measurement of total face height



Figure 2: a photograph showing measurement of face width

This study was conducted on 510 individuals (243 males & 267 females) aged between 18 and 30 years. The study was conducted in a medical college of Bhavnagar district of Gujarat region in India. Ethical clearance was obtained from the institutional review board. Informed consent was obtained from all participants.

The participants were asked to sit in a comfortable position with their head in the Frankfurt horizontal plane. Facial measurements were obtained using a digital sliding caliper with an accuracy of 0.01 mm. In the present study the landmarks used were standard landmarks which were used in the various craniofacial anthropometric studies. These landmarks were:

Zygion (zy)	Most lateral point of each of zygomatic arches
Nasion (n)	Point at the intersection of frontal and two nasal bones
Gnathion Or Menton (gn)	The lowest median landmark on the lower border of the mandible

The facial length was measured from the nasion (n) to the gnathion (gn), and the facial width was measured between the right and left zygion using digital sliding calliper (Figure 1 & Figure 2). The TFI was calculated as the ratio of facial height to facial width.

Total Facial index =

$$\frac{\text{Total facial height} \times 100}{\text{Face width (bizygomatic distance)}}$$

The data were analysed using descriptive statistics and the t-test was used to compare the TFI between males and females.

RESULTS

The statistical data which were extracted from the calculation and analysis were tabulated in [Table 1 to 5] to show different parameters at a glance.

[Table 1] shows the different measurements with its Minimum (Min.), Maximum (Max.), Mean and standard deviation values.

Table 1: Distribution of study group according to different variable (510)

Sr. No.	Variable	No.	Min.	Max.	Mean	Standard Deviation
1	Age (years)	510	18	30	22.2294	3.78659
5	Face Width/ BZD (cms)	510	8.19	14.44	11.8826	0.72222
6	Face Height (cms)	510	8.64	13.19	10.4967	0.70314

(BZD – Bizygomatic Distance)

The comparison is made in the parameters on the basis of gender. Table – 2 shows gender wise distribution of total face height and face width with values of mean and standard deviation in the study group.

Table 2: Gender-wise distribution of craniofacial parameters

Sr. No.	Craniofacial parameters (cm)	Mean		Std. Deviation		p value
		Male (243)	Female (267)	Male (243)	Female (267)	
4	Face Width/ BZD	12.0737	11.7053	0.7317	0.6712	0.000*
5	Face Height	10.8580	10.1681	0.6793	0.5459	0.000*

(*p < 0.01 – Highly significant statistically)

The gender distribution shows that, out of 510 study participants majority are female i.e. 267 (52.35%) and male participants are 243 (47.65%). All the parameters have higher values for males as compared to the females and these differences are highly significant statistically.

With the help of these standard craniofacial measurements, Total Facial Index is calculated and compared between males and females of study group.

Table 3: Distribution of Total Facial Index (Present study)

Sr. No.	Craniofacial index	Mean		Std. Deviation		p value
		Male (243)	Female (267)	Male (243)	Female (267)	
1	Total Facial Index	90.1936	87.0574	7.1122	5.4665	0.000*

(*p < 0.01 – Highly significant statistically)

[Table 3] shows that Total Facial Index tabulated above has higher mean value on the side of males as compared to females and this difference is statistically highly significant.

Further the study group is classified into different groups based upon various head shapes, face shapes and nose shapes. Total Facial Index is used to classify the study group in different phenotypes of face. Based on this index, the types of face shapes were categorized according to Banister's classification.^[3-6]

Table 4: Classification of Total Facial Index

Sr. No.	Face shape	Range of Total Facial Index
1	Hyperuriprosopic	Up to 79.9
2	Euriprosopic	80 - 84.9
3	Mesoprosopic	85 - 89.9
4	Leptoprosopic	90 - 94.9
5	Hyperleptoprosopic	>= 95

Hyperuriprosopic = very short/ broad faced

Euriprosopic = short/ broad faced

Mesoprosopic = moderate in facial form

Leptoprosopic = long/ narrow faced

Hyperleptoprosopic = very long/ narrow faced

Table 5: Distribution of Total Facial Index (Face Shapes of Present Study)

Sr. No.	Phenotype	Sex		Total
		Male	Female	
1	Hyperuriprosopic	7	20	27
		25.93%	74.07%	5.30%
2	Euriprosopic	42	87	129
		32.56%	67.44%	25.29%
3	Mesoprosopic	83	84	167
		49.70%	50.30%	32.75%
4	Leptoprosopic	66	58	124
		53.23%	46.77%	24.31%
5	Hyperleptoprosopic	45	18	63
		71.43%	28.57%	12.35%
	Total	243	267	510
	Chi square	p = 0.000		

(p < 0.01 – Highly significant statistically)

Table 6: Comparison of the craniofacial anthropometric norms between different studies and present study

Sr. No.	Parameter	Sex	Present study Mean cms. + SD	Malaysian Indians, ^[7] Mean cms. + SD	Indian, ^[8] (Farkas's study) Mean cms. + SD
1	BZD (Face width)	Male	12.0737+ 0.73174	13.63+ 0.48	13.58+ 0.43
		Female	11.7054+ 0.67121	12.67+ 0.39	12.49+ 0.84
2	Total face height	Male	10.8580+ 0.67937	11.64+ 0.47	11.55+ 0.60
		Female	10.1681+ 0.54597	10.81+ 0.42	10.15+ 0.55

Table 7: Comparison of Total Facial Indices between different studies and present study

Sr. No.	Workers	Race	Sample size	Mean Total Facial index	
				Male	Female
1	Golalipour M.J., Haidari K., Jahanshahi M., Farahani R.M. ^[4]	Northern Iran (New borns) Fars and Turkman	420	(Turkman) 80.93 (Fars) 72.95
2	Jahanshahi M, Golalipour M J, Heidari K. ^[5]	Northern Iran Fars and Turkman	407	(Turkman) 87.25 (Fars) 88.22	(Turkman) 81.48 (Fars) 84.48
3	Ngeow W.C. Aljunid, ^[7]	Malaysian Indian	100	85.5	85.4
4	S.H.Garba, A.I.Numan, I.G.Mishara, ^[9]	Maiduguri, Nigeria (Kanuri) (Bura)	120	Kanuri 83.77 Bura 80.74	Kanuri 82.84 Bura 81.03

5	Priyanka Singh and Ruma Purkait, ^[10]	Dangi and Ahirwar (Madhya Pradesh)	245	Age (above 20 years) Dangi 108.0 Ahirwar 81.3	Dangi 106.0 Ahirwar 81.3
6	Present Study	Indian Population	510	90.1936	87.0574

In the present study, face shape is classified in five groups. The predominant face type in the study group is mesoprosopic which is followed by euriprosopic, leptoprosopic, hyperleptoprosopic and hypereuriprosopic face shape respectively. In female, most predominant type is euriprosopic and in male is mesoprosopic. This difference is statistically highly significant.

The graphical representation of Total Facial Index is done in [Figure 3].

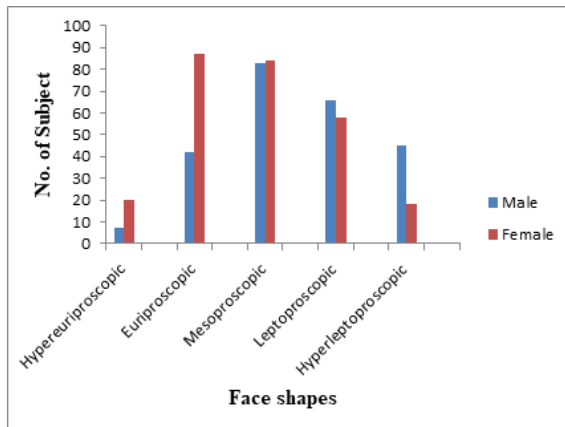


Figure 3: Gender-wise distribution of different types of face shapes with the help of Total Facial Index in study group.

DISCUSSION

Comparison of the craniofacial anthropometric norms between the present study group and Malaysian Indians and previous Indian studies is shown in the following [Table 6].

Total Facial Index is the ratio of face length to face width and is expressed as percentage.

Analysis for gender difference in Total Facial Index shows higher value for males as compared to females. Mean index for male is 90.19 and for female 87.06. These values found in our study are higher than the values observed in Malaysian Indians.^[7]

We found mesoprosopic (32.75%), euriprosopic (25.29%), leptoprosopic (24.31%), hyperleptoprosopic (12.35%) and hypereuriprosopic (5.30%) types of face [Table 5]. The difference between both genders is statistically highly significant.

The study conducted in Malaysian Indians found predominant mesoprosopic face type.

Ghosh and Malik's study on the Indian population reported that the hypereuriprosopic and euriprosopic types of facial forms are present in the highest and equivalent percentages in Santhals. However, females are generally hypereuriprosopic, while males are euriprosopic in their Total Facial Index. It reflects that Santhal females have a relatively broader face than their male counterparts. The hyperleptoprosopic face is the rarest type of

facial form in both genders. The gender difference is statistically significant in their Total Facial Index.

This difference found in different studies may be because of difference in study population, their geographical difference and other factors which may play a role in craniofacial frame of human population.

CONCLUSION

The total facial index is a reliable parameter for sex determination. The study shows that the Total Facial Index shows highly significant values for males as compared to females. The Total Facial Index should be used in conjunction with other parameters for accurate sex determination. Further studies can be conducted on a larger sample size and on different populations to validate the findings of this study.

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