



GENDER-BASED DIFFERENCES IN FACIAL INDEX: AN ANTHROPOMETRIC STUDY OF PUNJABI POPULATION

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ABSTRACT Anthropometry, the science of measuring human body proportions, has documented differences in facial traits among populations. Facial morphology variations, shaped by genetics, climate, and environment. Anthropometric measurements, especially facial dimensions, are vital for assessing age, sex, and ethnic differences. After taking approval from the Institutional Ethical and Research Committees of Sri Guru Ram Das University of Health Sciences, Sri Amritsar and obtaining written informed consent, a cross-sectional study was conducted in the Department of Anatomy, Sri Guru Ram Das Institute of Medical Sciences and Research on 1420 study participants (710 males and 710 females) in the 18–25 age group. Participants with craniofacial defects, or relevant medical conditions were excluded. The morphological facial index was calculated using morphological face length (measured with a digital sliding vernier caliper) and face width (measured with a spreading caliper). The results were tabulated. Independent t-test and chi-square test was used. Statistical Significant differences were found ($p < 0.001$, highly significant). Males had mean morphological face length and face width of 112.5 ± 6.6 mm and 140.1 ± 6.3 mm, respectively, while females had means of 103.6 ± 5.3 mm and 132.9 ± 7.7 mm, with morphological facial indices of 80.3 ± 3.9 and 78.2 ± 5.5 , respectively. Sexual dimorphism was observed and morphological facial index being more in males. Males had euryprosopic face whereas females had hypereuryprosopic face. This study could be used as a baseline for further studies in the identification of a Punjabi population and will be highly useful for clinicians in planning facial reconstruction surgeries, forensic experts in identification and researchers.

KEYWORDS : Anthropometry, Morphological facial index, Sexual dimorphism, Punjabi population.

INTRODUCTION

Anthropometry provides a reliable and scientific method for assessing facial soft tissue proportions, despite minor measurement variations (Chandra *et al.* 2012). Human facial features show considerable variation across ethnic groups due to genetic, environmental, and geographical influences, and this diversity is particularly evident in a country like India with its vast ethnic heterogeneity (Prasanna *et al.* 2013). Anthropometric analysis, especially of facial parameters, plays a crucial role in understanding these variations, as the face is the most distinctive part of the body and serves as an important marker for identifying individuals, sexes, and populations (Chhabra *et al.* 2015).

Geographical and ethnic factors further contribute to population-specific differences in facial morphology, emphasizing the importance of establishing regional anthropometric standards (Ansari *et al.* 2019). In the current era, with increasing natural and man-made disasters, accurate identification of individuals has become essential, and craniofacial anthropometry serves as a valuable tool in forensic investigations by aiding in the determination of sex, ethnicity, and identity (Gupta *et al.* 2019). Moreover, the face plays a vital role in communication and aesthetic perception, and its dimensions—particularly facial height and width—are used to derive the facial index, an important parameter in clinical assessment, reconstructive surgery, and anthropological research (Kumar *et al.* 2020).

Despite its significance, there is a scarcity of population-specific data for many Indian groups, including the Punjabi population. Therefore, the present study aims to establish a comprehensive database of facial anthropometric parameters—such as facial length, width, facial index, and facial type—in the Punjabi population, thereby contributing to clinical, forensic, and anthropological applications.

MATERIAL AND METHOD

The Present study was conducted in the Department of Anatomy, after taking approval of Institutional Ethical and Research Committees of Sri Guru Ram Das Institute of Medical Sciences and Research, Sri Guru Ram Das University of Health Sciences, Sri Amritsar. A cross-sectional study was conducted on 1420 study participants (710 males and 710 females) in the 18–25 age group by convenient sampling technique.

Inclusion criteria:

Punjabi Population in the age group of 18–25 years.

Exclusion criteria:

Study Participants with congenital craniofacial defects, facial reconstructions, growth disorders like stunted growth or excessive growth, and Chronic skin conditions.

Anthropometric landmarks:

Nasion (N): It is the intersection point between the frontal and nasal bone, marked by a small depression at the root of the nose.

Gnathion (Gn): Lowest point in the midline of the lower border of the mandible.

Zygion (Zy): The most prominent lateral point of the zygomatic arch.

Anthropometric parameters

1. Morphological face length (N-Gn): It is vertical distance measured from nasion to gnathion.

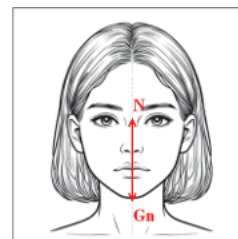


Figure 1: Morphological face length

2. Face width (Zy-Zy): It is transverse width measured between right and left Zygion.

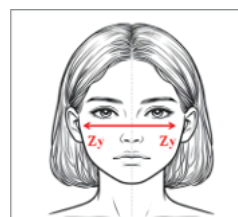


Figure 2: Face width

For the calculation of morphological facial index = Morphological

face length/Face width $\times 100$. With the help of morphological facial index the study group is divided into different types of face shapes according to Banister's classification. Shown in Table 1

TABLE-1: Classification of Facial Index.

Facial Shape and Types	Range of Facial Index
Hypereuryprosopic (Very broad face)	Less than 79.9
Euryprosopic (Broad face)	80-84.9
Mesoprosopic (Round face)	85-89.9
Leptoprosopic (Long face)	90-94.9
Hyperleptoprosopic (Very long face)	More than 95

Instruments and units:

- Digital sliding vernier caliper
- Spreading caliper
- All the measurements were taken in millimeter (mm)

Procedure for taking measurements:

Measurements were taken between 9am-5pm to minimize diurnal variations. Participants' details (name, age, gender, etc.) were recorded, and informed consent was obtained. Participants sat relaxed in Frankfurt's plane, with glasses/jewellery removed. Landmarks were marked with the help of surgical skin marker. Measurements were taken twice, ensuring accuracy. Facial index was calculated after measuring the anthropometric parameters.

Statistical Analysis:

Statistical analysis included Independent t- test and Chi-square test, with $P < 0.001$ considered highly significant. These tests compared means, and evaluated differences between males and females. Data was compiled in Microsoft Excel and the software used was statistical Package for Social Sciences in bracket SPSS version 23.0.

RESULTS

A total of 1420 study participants (710 males and 710 females) in the 18–25 age group was included.

Table-2: Gender Differences of Anthropometric Parameters

Anthropometric Parameters	Mean $\pm$ SD (mm) Male	Mean $\pm$ SD (mm) Female	p value
Morphological face length	112.5 $\pm$ 6.6	103.6 $\pm$ 5.3	0.001**
Face width	140.1 $\pm$ 6.3	132.9 $\pm$ 7.7	0.001**
Morphological facial index	80.3 $\pm$ 3.9	78.2 $\pm$ 5.5	0.001**

p value 0.001**, Highly significant

The morphological face length in males (112.5 $\pm$ 6.6 mm) was significantly greater than in females (103.6 $\pm$ 5.3 mm, $p < 0.001$). Conversely, face width was slightly higher in males (140.1 $\pm$ 6.3 mm) compared to females (132.9 $\pm$ 7.7 mm). The face width difference between genders was highly significant ($p < 0.001$). The morphological facial index differed significantly ($p < 0.001$) between males (80.3 $\pm$ 3.9) and females (78.2 $\pm$ 5.5). Euryprosopic (broad face) was the most common type in males, while hypereuryprosopic (very broad face) predominated in females.

DISCUSSION

The present study establishes facial anthropometric norms for the Punjabi population, revealing significant sexual dimorphism with males exhibited larger facial dimensions than females likely attributed due to increased skeletal and muscular development in males, influenced by androgen hormones.

Bar graphs revealed population-specific variations in facial indices between males and females, separately with the (present study population) exhibited distinct differences compared to national and international data. These Variations can be attributed to factors like age, sample size, ethnicity, genetics, environment, and geographical location, nutrition indicating broad inter-population variability, understanding these norms are crucial for treatment planning, as applying international or national standards may not suit the Punjabi population.

The present study demonstrated that the predominant facial phenotype among Punjabi males is euryprosopic, while Punjabi females predominantly exhibit a hypereuryprosopic facial type, indicating relatively broader facial dimensions and a lower facial index. the findings of punjabi males are in concordance with studies conducted

on Punjabi-Brahmins and Jatt Sikhs (Kaur *et al.* 2020), as well as populations from Turkey (Ozsahin *et al.* 2016) and Central Nigeria (Chia and Anyanwu, 2020) males, where similar broad facial patterns were reported, suggesting a possible shared genetic or ethnic influence on craniofacial morphology.

In contrast, several studies across different populations have reported mesoprosopic facial type as the most common. This includes males from Manipuri (Devi *et al.* 2016), Western Maharashtra (Nivale *et al.* 2020), and Malay-Malaysian (Wai *et al.* 2015) populations, and females from South Indian (Prasanna *et al.* 2013), Delhi North Indian (Chhabra *et al.* 2015), Malay-Malaysian (Yesmin *et al.* 2014), Sri Lankan (Chandimal *et al.* 2015), and Turkish (Ozsahin *et al.* 2016) groups. Additionally, both sexes showed mesoprosopic predominance in populations such as North Indian, Uttar Pradesh (Kataria *et al.* 2015), Jaunsari, Uttarakhand (Ansari *et al.* 2019), Haryana (Gupta *et al.* 2019), Noida (Zohra *et al.* 2022), Chinese-Malaysian (Wai *et al.* 2015) and Iranian (Madadi *et al.* 2019), although some of these findings were statistically non-significant.

Leptoprosopic facial type, characterized by a relatively longer and narrower face, has been reported as predominant among males in Delhi North Indians (Chhabra *et al.* 2015), Malay-Malaysians (Yesmin *et al.* 2014), and Sri Lankans (Chandimal *et al.* 2015), and among females in Malay-Malaysian populations (Wai *et al.* 2015). Furthermore, both sexes in Central Serbian (Jeremic *et al.* 2013) and Indian-Malaysian (Wai *et al.* 2015) populations also demonstrated leptoprosopic predominance.

On the other hand, hyperleptoprosopic facial type, representing an even narrower facial morphology, was observed among South Indian males (Prasanna *et al.* 2013), Bangladeshi females (Farhat *et al.* 2020), and in both sexes in South Indian (Chandra *et al.* 2012), North Indian (Prasanna *et al.* 2013), Western Uttar Pradesh (Vangara *et al.* 2021; non-significant), and Ghanian (Maalman *et al.* 2019) populations.

Variation in facial phenotypes reflects significant ethnic and geographic diversity influenced by genetic, nutritional status, environmental factors and adaptive evolution. The predominance of broader facial types in the Punjabi population highlights the need for population-specific anthropometric standards for forensic and clinical applications.

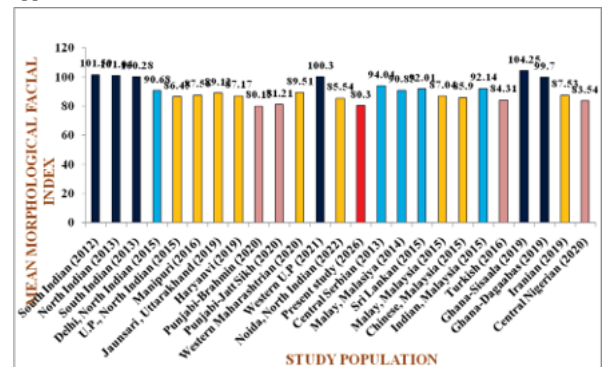


Figure 1: Mean Morphological Facial Index Comparison (Males)

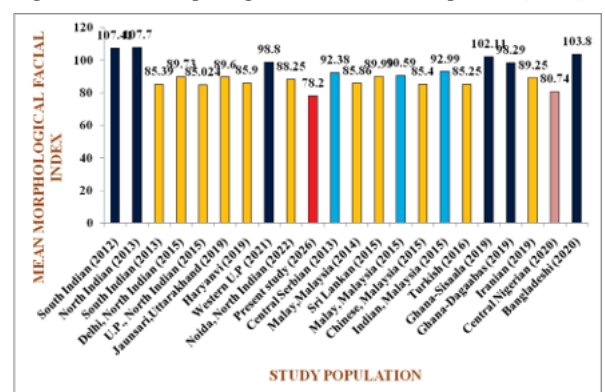


Figure 2: Mean Morphological Facial Index Comparison (Females)

CONCLUSIONS

This study reinforces sexual dimorphism in the Punjabi population and provides baseline facial anthropometric data for males and females aged 18–25 years. These population-specific norms reflect unique genetic and demographic influences and are valuable for clinical applications, forensic identification, facial reconstruction, and future research.

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