A cross-sectional study of facial index in Western Uttar Pradesh population between 18-25 years of age

Shanmukha Varalakshmi Vangara¹, Dhananjay Kumar², Neel Kamal Arora³

¹Assistant Professor, ²Associate Professor, ³Professor and Head, Department of Anatomy, Shri Ram Murti Smarak Institute of Medical Sciences, Bhojipura, Bareilly, Uttar Pradesh, India

ABSTRACT

Background: Facial anthropometry is the scientific study of measurements and proportions of the human face. There is huge paucity in the metric measurements of face in Indian population. This study is involved in collecting facial anthropometric data of Western Uttar Pradesh population of age group between 18-25 years. Aims and Objectives: This study aims at evaluating predominant facial phenotype, using facial height and facial width of Western Uttar Pradesh population as study subjects. Materials and Methods: The study was conducted on 200 medical and paramedical students of Shri Ram Murti Smarak Institute of Medical Sciences (SRMS-IMS), Bareilly, Uttar Pradesh. The study subjects were of 18-25 year’s age, belonging to Western Uttar Pradesh region. Digital Vernier Caliper was used to measure the facial parameters. The data was analyzed using statistical tool SPSS 16.0 version. Results: In the present study it is found that facial height and width are more in males compared to females. This difference is statistically significant. On analyzing facial index, hyperleptoprosopic face is the predominant phenotype in males as well as in females, followed by leptoprosopic type in males and mesoprosopic type in females. However, gender differences in facial index are not statistically significant at p<0.05. Conclusion: The current study reveals that facial parameters can be used to determine the gender of an individual on the basis of height and width.

Key words: Nasion; Gnathion; Zygion; Euryprosopic; Mesoprosopic; Leptoprosopic; Hyperleptoprosopic

INTRODUCTION

Facial anthropometry is the scientific study of measurements and proportions of human face. The facial structure is a signature of ethnicity, age, sex and race of an individual.1,2 Anthropometric features such as stature and facial phenotype vary from region to region depending on genetic, environmental, nutritional and climatic factors. As India is a land of diversity comprising of people from different genetic and cultural traits, there is a need for population specific data in terms of facial anthropometry.3 The technique of anthropometry attains its significance because of its reliability and cost effectiveness. This is used to record trends of growth and development as well as therapeutic purposes with a significant degree of accuracy.4 Facial anthropometric measurements are of great significance in 2D or 3D computerized facial models.5 It is also of great aesthetic significance since facial proportions and symmetry are considered as determinants of beauty. This is an important factor in restoring self-confidence of an individual. The suitable knowledge of region specific facial measurements can be used to preserve the facial features at the time of reconstructive, plastic and cosmetic surgeries. It is also helpful in dental and rhinoplastic surgeries and identification of a person in forensic studies.

MATERIAL AND METHODS

The study was conducted in the Department of Anatomy of Shri Ram Murti Smarak Institute of Medical Sciences
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Prior clearance was obtained from institutional ethical committee. The study sample comprised of 200 medical and paramedical students of the Institution. Subjects were from Western Uttar Pradesh and were chosen randomly. The study was conducted on 101 male and 99 female students of age between 18-25 years. Subjects chosen had no history of craniofacial trauma, facial scars or plastic surgery and congenital malformations. Verbal and written consents in English and regional languages were taken from the participants after detailed explanation of purpose and procedure of the study.

The subjects were made to sit on a stool with head held upright and fixed in Frankfurt’s plane with mandible in the maximum intercuspal position and mouth closed.

Following bony landmarks were marked:
- Nasion: A well-marked depression at the root of the nose which overlies the junction of frontonasal and internasal sutures.\textsuperscript{7,8}
- Gnathion: the lowest point on the lower border of the chin in the midline\textsuperscript{6}
- Zygion- the most prominent point on the zygomatic arch\textsuperscript{9}

Using these landmarks, the following measurements were taken with digital Vernier caliper:

Facial height (FH) - linear distance between nasion to gnathion.
Facial width (FW) - linear distance between two zygomatic prominences.

These measurements were taken in the same way under similar conditions.

From these measurements, facial index\textsuperscript{10} was calculated as follows:

\[
\text{Facial Index (FI)} = \frac{\text{Facial Height}}{\text{Facial Width}} \times 100
\]

The FI is used to classify face into five facial phenotypes: Hyperleptoprosopic, leptoprosopic, mesoprosopic, euryprosopic and hypereuryprosopic. Facial types were categorized according to Bannister’s classification of prosopic index\textsuperscript{11} as follows:

<table>
<thead>
<tr>
<th>Facial Types</th>
<th>Common name</th>
<th>FI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypereuryprosopic</td>
<td>Very broad face</td>
<td>&lt;79.9</td>
</tr>
<tr>
<td>Euryprosopic</td>
<td>Broad face</td>
<td>80-84.9</td>
</tr>
<tr>
<td>Mesoprosopic</td>
<td>Round face</td>
<td>85-89.9</td>
</tr>
<tr>
<td>Leptoprosopic</td>
<td>Long face</td>
<td>90-95</td>
</tr>
<tr>
<td>Hyperleptoprosopic</td>
<td>Very long face</td>
<td>&gt;95</td>
</tr>
</tbody>
</table>

Statistical analysis was done using descriptive statistics and Student’s (independent) t-test with the help of SPSS16.0 version. Statistical significance was set at \(p<0.05\).

RESULTS

Table 1 shows the descriptive statistics of FH, FW and FI for overall study population. Table 2 shows the descriptive statistics of FH, FW and FI for males and females. Gender differences for all these parameters were calculated using independent t-test.

Mean FH showed statistically significant sexual dimorphism. Mean FW showed significant sexual dimorphism statistically. Mean FI did not show significant difference between the two genders statistically (\(p=0.165\)).

### Table 1: Descriptive statistics of facial parameters in both sexes

<table>
<thead>
<tr>
<th>Parameters</th>
<th>n</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>SD</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>FH (cm)</td>
<td>200</td>
<td>8.35</td>
<td>12.32</td>
<td>10.56</td>
<td>0.68</td>
<td>0.048</td>
</tr>
<tr>
<td>FW (cm)</td>
<td>200</td>
<td>8.35</td>
<td>12.57</td>
<td>10.63</td>
<td>0.68</td>
<td>0.048</td>
</tr>
<tr>
<td>FI</td>
<td>200</td>
<td>79.5</td>
<td>124.55</td>
<td>99.58</td>
<td>7.63</td>
<td>0.53</td>
</tr>
</tbody>
</table>

n - sample size, SD - standard deviation, SEM - standard error of mean

### Table 2: Gender differences of facial parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Gender</th>
<th>Descriptive Statistics</th>
<th>Independent t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>FH (cm)</td>
<td>Male</td>
<td>8.64</td>
<td>11.61</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>8.35</td>
<td>12.32</td>
</tr>
<tr>
<td>FW (cm)</td>
<td>Male</td>
<td>8.35</td>
<td>12.57</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>8.99</td>
<td>12.13</td>
</tr>
<tr>
<td>FI</td>
<td>Male</td>
<td>79.5</td>
<td>115.56</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>84.23</td>
<td>124.55</td>
</tr>
</tbody>
</table>

Min-Minimum, Max-Maximum, SD-Standard Deviation, SEM-Standard Error of Mean, t-Independent t-test value, df-degree of freedom, p-value-Significance

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(SRMS-IMS) Bareilly, Uttar Pradesh. Prior clearance was obtained from institutional ethical committee. The study sample comprised of 200 medical and paramedical students of the Institution. Subjects were from Western Uttar Pradesh and were chosen randomly. The study was conducted on 101 male and 99 female students of age between 18-25 years. Subjects chosen had no history of craniofacial trauma, facial scars or plastic surgery and congenital malformations. Verbal and written consents in English and regional languages were taken from the participants after detailed explanation of purpose and procedure of the study.

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Facial width (FW) - linear distance between two zygomatic prominences.\textsuperscript{10}

These measurements were taken in the same way under similar conditions.
DISCUSSION

Human face is a depiction of biological form and function. Facial features differ among different races and ethnic groups. Very few region specific studies on facial anthropometry have been conducted in India.

![Table with data]

The results of this study reveal that mean values of FH, FW and FI are more in males as compared to females. These gender variations are highly significant statistically for FH and FW at p=0.000 (Table 2).

This study is in agreement with the previous studies conducted by Trivedi H et al., who noticed that maximum FH was 133 mm and 129 mm in males and females, respectively in Indo-Aryan North Indian population. They noticed that males had higher FH than females and the data was found to be statistically significant. Overall, FI mean value of males was 90.16 ± 3.97, whereas in females the mean value was 89.65 ± 5.16. On comparing the data statistically, the difference was found to be significant (P < 0.001).

The face is a dynamic structure that can display a wide range of characteristics. Variation in facial types is encountered in every population. Facial phenotype is a consequence of genetic and environmental factors which in specific regions determine the features of a population.15

Prosopic index classifies individual into hypereuryprosopic, euryprosopic, mesoprosopic, leptoprosopic, hyperleptoprosopic based upon the ratio of FH to the FW.

Studies on sexual dimorphism are primarily based on biological differences between males and females. Determination of sex is an important concern to osteologists and forensic anthropologists for identification of an individual.
According to Kumar M et al.,\(^1^8\) mean morphological FH was 11.07 cm in males and 10.21 cm in females. The bizygomatic breadth in their study was found to be 13.08 cm in males & 12.35 cm in females. The mean FI was 86.09 in males and 84.84 in females. Mean FW was comparatively less in the current study. However, all the measurements were more in males as compared to females in both the studies.

In a study conducted by Kataria et al.,\(^2^1\) in 18-25 years age North Indians, the mean FH in males and females was 11.35 cm and 10.37 cm, whereas the mean FW in males and females was 13.149 cm and 12.237 cm respectively. The difference of facial parameters (FH and FW) in both the genders was highly significant (p < 0.001). The mean FI in males and females was 86.449 and 85.024 respectively and the gender difference of FI was noted significant.

Another study conducted by Radha K et al.,\(^2^4\) involving people of South India, found that mean FH in males and females was 111.3 mm and 104.2 mm and mean FW in males and females was 110.4 mm and 113.1 mm respectively. Mean FH was more in males compared to female whereas FW was more in females.

The present study showed the mean FI higher than the previous studies done by Trivedi H et al.,\(^9\) Kumar M et al.,\(^1^8\) Kataria DS et al.,\(^2^1\) and Radha K et al.\(^2^4\) However, sexual dimorphism in mean FI was not statistically significant in this study.

Mean prosopic index value of 99.58 ± 7.63 (Table 1) in this study represents hyperleptoprosopic facial phenotype.

In the current study hyperleptoprosopic facial phenotype is found to be predominant in overall study (71.5%), as well as in males (75.2%) and females (67.7%) (Table 3 and Figure 1).

Leptoprosopic phenotype is found to be next in predominance in overall study (14.5%).

But on comparison, second predominant phenotype in males is found to be leptoprosopic (16.8%) whereas in females second predominant phenotype is mesoprosopic (18.2%).

Next in dominance is mesoprosopic facial type in males (12.5%) and leptoprosopic type in females (12.1%).

Euryprosopic type of face is found to be least common in this study (1% in males, 2% in females and 3% in overall cases). Phenotypic differences calculated on the basis of FI are not significant statistically between male and female subjects (P = 0.512) (Table 3; Figure 1).

Our study is in agreement with the previous studies conducted by Prasanna LC et al.,\(^1^7\) in 2013 and Ranjana G et al\(^2^3\) in 2016. Prasanna I.C et al.,\(^1^7\) compared facial indices of North and South Indian adults of 18-45 years age. They found that hyperleptoprosopic face was predominant in both sexes of North Indians. Similarly, Ranjana G et

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![Figure 1: Graph showing the percentage of study subjects with different facial phenotypes](image)

### Table 3: Number and percentage of different facial phenotypes in males, females and total study subjects

<table>
<thead>
<tr>
<th>Facial type</th>
<th>Males</th>
<th>Percent</th>
<th>Females</th>
<th>Percent</th>
<th>Total</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euryprosopic</td>
<td>1</td>
<td>1.0</td>
<td>2</td>
<td>2.0</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>Mesoprosopic</td>
<td>7</td>
<td>6.9</td>
<td>18</td>
<td>18.2</td>
<td>25</td>
<td>12.5</td>
</tr>
<tr>
<td>Leptoprosopic</td>
<td>17</td>
<td>16.8</td>
<td>12</td>
<td>12.1</td>
<td>29</td>
<td>14.5</td>
</tr>
<tr>
<td>Hyperleptoprosopic</td>
<td>76</td>
<td>75.2</td>
<td>67</td>
<td>67.7</td>
<td>143</td>
<td>71.5</td>
</tr>
</tbody>
</table>
al., found hyperleptoprosopic face to be the commonest phenotype in both males and females of Gond tribes of Uttar Batsar, Chattisgarh.

However, Kataria DS et al., in their study conducted in the year 2015 on FI of 400 North Indian students (200 males and 200 females) reported that mesoprosopic face was the commonest phenotype among male and female North Indians.

These findings from different authors emphasize the importance of region specific studies of facial morphology. These parameters are crucial for reconstructive surgeries.

CONCLUSION

In the present study, the most common phenotype is hyperleptoprosopic in both males and females. Next predominant facial type is leptomprosopic in males and mesoprosopic in females. No cases of hyperleuropyrrhoprosopic facial type was observed in this study. This data can be used as a reference for facial reconstructive and therapeutic surgeries as well as Forensic studies in this study population. This study can also be used for conducting comparative studies on facial dimensions in other regions of Uttar Pradesh as well as in other parts of the country.

List of abbreviations
1. SPSS- Statistical Package for the Social Sciences
2. FH- Facial Height
3. FW- Facial Width
4. FI- Facial Index

REFERENCES


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Author’s contribution:
SVV-Concept and design of the study, data collection and analysis; DK- Review of literature and manuscript preparation; NKA- Critical appraisal of the manuscript.

Work attributed to:
Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh, India.

Orcid ID:
Dr. Shanmukha Varalakshmi Vangara- https://orcid.org/0000-0002-2065-017X
Dr. Dhananjay Kumar- https://orcid.org/0000-0002-1460-656X
Dr. Neel Kamal Arora- https://orcid.org/0000-0003-5576-5304

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