

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



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## 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.<sup>1,2</sup> 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.<sup>3</sup> 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.<sup>4</sup> Facial anthropometric measurements are of great

significance in 2D or 3D computerized facial models.<sup>5</sup> 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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(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.

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.<sup>6</sup>

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.<sup>7,8</sup>
- Gnathion: the lowest point on the lower border of the chin in the midline<sup>6</sup>
- Zygion- the most prominent point on the zygomatic arch<sup>9</sup>

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

Facial height (FH) - linear distance between nasion to gnathion.<sup>10</sup>

Facial width (FW) - linear distance between two zygomatic prominences.<sup>10</sup>

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

From these measurements, facial index<sup>10</sup> 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<sup>11</sup> as follows:

Facial Types	Common name	FI
Hypereuryprosopic	Very broad face	<79.9
Euryprosopic	Broad face	80–84.9
Mesoprosopic	Round face	85–89.9
Leptoprosopic	Long face	90–95
Hyperleptoprosopic	Very long face	>95

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**

Parameters	n	Minimum	Maximum	Mean	SD	SEM
FH (cm)	200	8.35	12.32	10.56	0.68	0.048
FW (cm)	200	8.35	12.57	10.63	0.68	0.048
FI	200	79.5	124.55	99.58	7.63	0.53

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

**Table 2: Gender differences of facial parameters**

Parameters	Gender	Descriptive Statistics					Independent t-test		
		Min	Max	Mean	SD	SEM	t	df	p-value
FH (cm)	Male	8.64	11.61	10.83	0.64	0.064	6.158	198	0.000*
	Female	8.35	12.32	10.28	0.64	0.064			
FW (cm)	Male	8.35	12.57	10.82	0.64	0.064	4.080	198	0.000*
	Female	8.89	12.13	10.44	0.67	0.064			
FI	Male	79.5	115.56	100.3	7.4	0.74	1.394	198	0.165
	Female	84.23	124.55	98.8	7.7	0.78			

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

## 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.

Author	Year of study	Population	Study subjects	Predominant facial phenotype
Baurah T et al. <sup>12</sup>	2006	Tai-Phake, Assam	104 adult Tai-Phake males, aged between 21 to 55 years	Hyperleptoprosopic
Ghosh S et al. <sup>13</sup>	2007	Bankura district, West Bengal	800 adult Santhals (400 males and 400 females) of 13-85 years age	Hypereuryprosopic in females and euryprosopic in males
Shetti VR et al. <sup>14</sup>	2011	Malaysia and India	100 Indians (66 males and 34 females) of 18-22 years age	Mesoprosopic face for both Indian males and females
Kanan U et al. <sup>15</sup>	2012	Gujarat	Gujarati males of 18-25 years age	Euryprosopic followed by hypereuryprosopic
Doni RPK et al. <sup>16</sup>	2013	Kanchipuram, South India	100 males of 18-23 years age	Hyperleptoprosopic
Prasanna LC et al. <sup>17</sup>	2013	South India and North India	100 males and 100 females of >18 years age	South Indian males were leptoprosopic to mesoprosopic type while females were euryprosopic in nature. North Indian males and females were noted to be hyperleptoprosopic
Kumar M et al. <sup>18</sup>	2013	Haryana	300 males and 300 females of 18-40 years age	Mesoprosopic
Kumari KL et al. <sup>19</sup>	2015	Vishakapatnam, Andhra Pradesh	170 males and 110 females of 26-49 years age	Males were predominantly mesoprosopic and females were euryprosopic
Shah T et al. <sup>20</sup>	2015	Gujarat and Non-Gujarat	901 Gujarati (676 males, 225 females) and 300 Non-Gujarati (200 males, 100 females) of 20-50 years age	Hypereuryprosopic face was predominant in both sexes of Gujarati and Non-Gujarati subjects which was followed by euryprosopic phenotype.
Kataria DS et al. <sup>21</sup>	2015	North India	200maes and 200 females of 18-25 years	Mesoprosopic
Devi TB et al. <sup>22</sup>	2016	Meitei tribe, Manipur	100 males of 20-60 years age	Mesoprosopic to leptoprosopic
Ranjana G et al. <sup>23</sup>	2016	Gond tribe of Uttar Batsar, Chhattisgarh	100 males and 100 females of 18-45 years age	Hyperleptoprosopic
Trivedi H et al. <sup>9</sup>	2017	India	563 males and 437 females of 18-40 years	Euryprosopic
Radha K et al. <sup>24</sup>	2020	South India (Andhra Pradesh, Karnataka, Kerala)	90 males and 110 females of 18-25 years	Hyperleptoprosopic
Current Study	2020	Western Uttar Pradesh	101 males and 99 females of 18-25 years	Hyperleptoprosopic in both males and females

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.<sup>25</sup>

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

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.,<sup>9</sup> 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  $90.16 \pm 3.97$ , whereas in females the mean value was  $89.65 \pm 5.16$ . On comparing the data statistically, the difference was found to be significant ( $P < 0.001$ ).

According to Kumar M et al.,<sup>18</sup> mean morphological FH was 11.07cm in males and 10.21cm in females. The bizygomatic breadth in their study was found to be 13.08 cm in males & 12.35cm 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.,<sup>21</sup> in 18-25 years age North Indians, the mean FH in males and females was 11.35 and 10.37cm, whereas the mean FW in males and females was 13.149 and 12.237cm 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.,<sup>24</sup> involving people of South India, found that mean FH in males and females was 111.3mm and 104.2mm and mean FW in males and females was 110.4mm and 113.1mm 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.,<sup>9</sup> Kumar M et al.,<sup>18</sup> Kataria DS et al.,<sup>21</sup> and Radha K et al.<sup>24</sup> However, sexual dimorphism in mean FI was not statistically significant in this study.

Mean prosopic index value of  $99.58 \pm 7.63$  (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.,<sup>17</sup> in 2013 and Ranjana G et al.<sup>23</sup> in 2016. Prasanna LC et al.,<sup>17</sup> compared facial indices of North and South Indian adults of 18-45years age. They found that hyperleptoprosopic face was predominant in both sexes of North Indians. Similarly, Ranjana G et

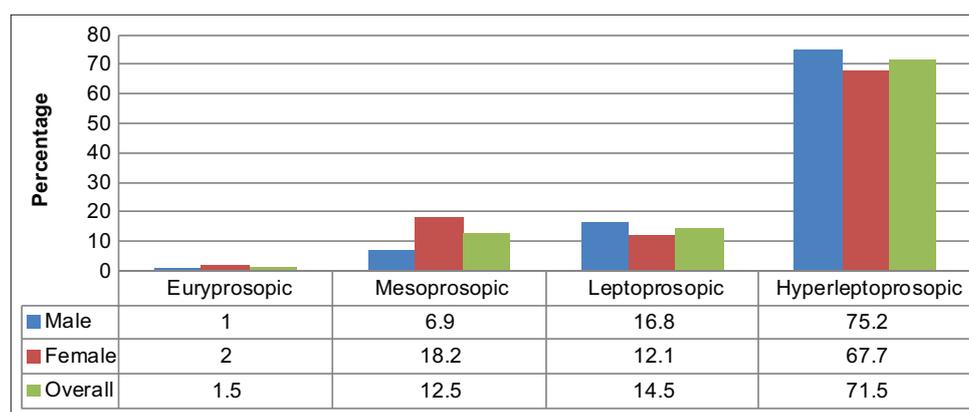


Figure 1: Graph showing the percentage of study subjects with different facial phenotypes

Table 3: Number and percentage of different facial phenotypes in males, females and total study subjects						
Facial type	Males		Females		Total	
	Number	Percent	Number	Percent	Number	Percent
Euryprosopic	1	1.0	2	2.0	3	1.5
Mesoprosopic	7	6.9	18	18.2	25	12.5
Leptoprosopic	17	16.8	12	12.1	29	14.5
Hyperleptoprosopic	76	75.2	67	67.7	143	71.5

al.,<sup>23</sup> 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.,<sup>21</sup> in their study conducted in the year 2015 on FI of 400 North Indian students (200males 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 leptoprosopic in males and mesoprosopic in females. No cases of hypereuryprosopic 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

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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.

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