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Nasal anthropometry among the Hindu population of West Bengal

S. Manna

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Souvik Manna, Anthropological Survey of India, EN – 7-9, Sector – V, Salt Lake City, Kolkata – 700091, West Bengal, India. Email: msouvik05@gmail.com

ABSTRACT

Nasal Anthropometry is the science of calculating the dimensions of the human nose. The size and form of the nose are influenced by factors such as age, sex, race, environment, and geography. The nasal dimensions hold great promise for guiding aesthetic and reconstructive surgery, forensic investigations, and the study of human variation. The present study was done to characterize the morphological classification of nasal architecture and to examine any potential sexual dimorphism. The study involved 80 healthy Hindu Bengali individuals (comprising 50 males and 30 females) between the ages of 18-70 years. Nasal height, nasal breadth, nasal depth, and nasal bridge length were measured using a sliding caliper, and standard formulas were used to calculate Nasal Indices. Data were entered in Microsoft Excel 2019 version and analyzed by using IBM-SPSS 26.0 Windows version. Statistical significance was considered at $P < 0.05$. The mean nasal length (Male = 4.91 ± 0.39 cm; Female = 4.56 ± 0.47 cm), mean nasal breadth (Male = 3.79 ± 0.34 cm; Female = 3.31 ± 0.21 cm), mean nasal depth (Male = 1.81 ± 0.30 cm; Female = 1.55 ± 0.21 cm), mean nasal bridge length (Male = 4.39 ± 0.41 cm; Female = 3.88 ± 0.43 cm) and mean nasal index (Male = 77.58 ± 8.65; Female = 73.42 ± 8.92) are significantly higher in males than females. It is concluded that all the measured parameters exhibited sexual dimorphism. Mesorrhine is the dominant nose type found in both males and females based on the nasal index.

Keywords: *Nasal Anthropometry, Nasal Height, Nasal Breadth, Nasal Index, Mesorrhine, Sexual Dimorphism, Forensic Science*

INTRODUCTION

Biological (physical) anthropology has been defined as the study of man's biological behaviour in time and space. Anthropometry – the measurement of man – provides scientific methods and techniques for taking various measurements and observations on the living man and the skeleton. Anthropometry represents a typical and traditional tool of biological (physical) anthropology (Singh and Bhasin, 2004). Many studies have highlighted the use of anthropometric measures as a method for examining variance in human populations and as a crucial tool in forensic science for crime detection (Eliakim-Ikechukwu et al., 2012).

The nose holds a pivotal place in facial architecture, making nasal parameters, particularly the form and size, important (Kulkarni et al., 2019). Age, sex, race, environmental factors, and geographic location all have an effect on a person's physical characteristics, including the size and shape of their nose (Omotoso et al., 2019). The study of measuring the proportion, size, and shape of the human nose is known as nasal anthropometry (Eliakim-Ikechukwu et al., 2012). Physical anthropology and forensic medicine both benefit from understanding nasal anthropometry because it is one of the methods used to determine a person's race and sex (Esomonu et al., 2013; Omotoso et al., 2019). In both inter- and intra-racial morphological classification and categorization, the nasal parameters are helpful (Kpela et al., 2019).

Due to natural selection in the course of human evolution, narrower noses are prevalent in cold and dry climates that are better at warming the cold air before it enters the lungs. Contrarily, wider noses are prevalent in warm and moist climates as this help to breathe in big amounts of warm and wet air without suffering any damage to the respiratory system (Hall and Hall, 1995; Sarkar, 2014). The nasal dimensions produced have a tremendous potential to inform clinical decisions, public health policies, relevant in cosmetic and reconstructive surgery, forensic investigations, as well as studying human diversity (Eliakim-Ikechukwu et al., 2012). It also helps in the determination of the degree of congenital deformities and traumatic injuries (Radha and Srinivasan 2019).

Nasal index exhibits sexual dimorphism (Zhang et al., 1990; Ray et al., 2016; Singla et al., 2020). While nasal analysis is the first step a rhinoplastic surgeon takes to alter the size or shape of the nose for a desired aesthetic impact, the nasal index is clinically useful (Paul et. al., 2015). International security organizations have successfully embraced the morphological classification of the face and nose. With the rise in crime and terrorist threats, nasal morphometry is becoming a more important facial identification tool. (Ray et al., 2016).

Martin and Saller (1957) divided the human nose into five categories on the basis of the nasal index i.e., Hyperleptorrhine (very narrow nose), Leptorrhine (long and narrow nose), Mesorrhine (moderate shape), Platyrrhine (broad and short nose) and Hyperplatyrrhine (very broad/wide nose).

Therefore, there is a constant need for anthropometric research on human populations from all age groups, sexes, communities, and places across the world. Hence, this study was conducted among some Hindu Bengali individuals of West Bengal to assess nasal morphometrics to establish any potential sexual dimorphism and characterize their morphological classification.

MATERIALS AND METHODS

The present cross-sectional study was conducted on 80 healthy adult Hindu Bengali individuals in the Birbhum district of the state of West Bengal. The study population consisted of 50 males and 30 females between the ages of 18–70 years old. Verbal consent was obtained from all the participants prior to conducting the study. Participants with facial abnormalities, nasal deformities, or a history of facial reconstruction surgery were excluded from the study.

A sliding caliper was used for taking nasal measurements in centimeters. All the participants were made to sit in a relaxed position and allowed to have their heads rest in the eye-ear plane. Additionally, the participants were asked to refrain from smiling or altering their facial expressions while the measurements were being taken. By appropriately finding the landmarks on the participants' faces, all the measurements were taken. According to Singh and Bhasin (2004), anthropometric landmarks, measurements, and nasal indices were taken into consideration.

Anthropometric measurements taken included Nasal Height (*n*‑ *sn*), Nasal Breadth (*al*‑ *al*), Nasal Depth (*prn-sn*), Nasal Bridge Length (*n*‑ *prn*). Besides nasal index and elevation of nose index were also calculated.

Table 1: Nasal Index-based Classification of Human Nose (According to Martin and Saller, 1957)

Categories	Nasal shape	Nasal Index
Hyperleptorrhine	Very narrow	≤ 54.9
Leptorrhine	Long and narrow	55-69.9
Mesorrhine	Moderate shape	70-84.9
Platyrrhine	Broad and short	85-99.9
Hyperplatyrrhine	Very broad/wide	≥ 100

All the data were entered in Microsoft Excel 2019 version and analyzed by using IBM-SPSS 26.0 Windows version. Descriptive statistics were used to obtain the range, mean, standard deviation, standard error of mean and percentage distribution of the data. Independent t-test was applied to calculate 2-tailed p-values for comparing means between the variables of males and females. P values < 0.05 were considered statistically significant.

RESULTS

Table 2 and Figure 1 show that mean nasal height (cm) is 4.91 ± 0.39 in males and 4.56 ± 0.47 in females and the difference is statistically significant ($p < 0.05$). Mean nasal breadth (cm) is significantly ($p < 0.05$) higher in males (3.79 ± 0.34) than in females (3.31 ± 0.21). Mean values of nasal depth (cm) for males and females are is 1.81 ± 0.30 and 1.55 ± 0.21 respectively and this difference is statistically significant ($p < 0.05$). Similarly, males have a significantly ($p < 0.05$) higher (4.39 ± 0.41) mean value of nasal bridge length (cm) than females (3.88 ± 0.43).

Table 3 and Figure 2 show that mean nasal index is significantly higher ($p < 0.05$) in males (77.58 ± 8.65) than in females (73.42 ± 8.92). While males have a comparatively greater (48.02 ± 7.98) elevation of nose index than females (47.24 ± 7.68) but this difference is not statistically significant ($p > 0.05$).

Table 4 and Figure 3 show that the majority (70.00%) of the males have Mesorrhine type of nose followed by Leptorrhine (16.00%), Platyrrhine (10.00 %) and Hyperplatyrrhine (4.00%). Table 5 and Figure 4 show that the dominant type of nose in the female population is Mesorrhine (66.67%). Only 1 female has a very narrow nose i.e., Hyperleptorrhine.

Table 2: Statistical Analysis of Nasal Measurements of Males and Females among Hindu Bengali Population:

Nasal Measurements	Sex	N	Min	Max	Mean ± S. D	S.E.M	t value	p value (2-tailed)
Nasal Height (cm)	Male	50	4.2	6	4.91 ± 0.39	0.055	3.61	0.001*
	Female	30	3.9	6.5	4.56 ± 0.47	0.085		
Nasal Breadth (cm)	Male	50	3.2	4.6	3.79 ± 0.34	0.048	6.923	0.00*
	Female	30	2.9	3.7	3.31 ± 0.21	0.038		
Nasal Depth (cm)	Male	50	1.2	3.2	1.81 ± 0.30	0.042	4.088	0.0001*
	Female	30	1.1	2	1.55 ± 0.21	0.038		
Nasal Bridge Length (cm)	Male	50	3.5	5.3	4.39 ± 0.41	0.059	5.222	0.000001*
	Female	30	3	4.5	3.88 ± 0.43	0.788		

Degree of freedom = 78; *$p < 0.05$

Figure 1: Graphical Representation of Mean Values of Nasal Measurements

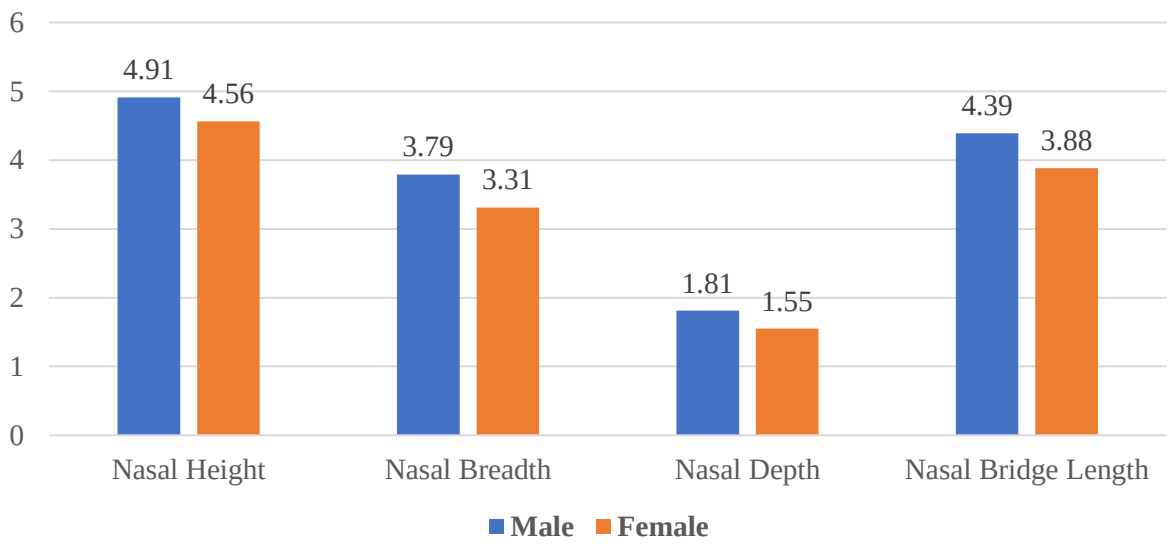


Table 3: Statistical Analysis of Nasal Indices of Male and Female among Hindu Bengali Population:

Nasal Indices	Sex	N	Min	Max	Mean ± S. D	S.E.M	t value	p value (2-tailed)
Nasal Index	Male	50	64.28	100	77.58 ± 8.65	1.222	2.059	0.043*
	Female	30	47.69	89.74	73.42 ± 8.92	1.628		
Elevation of Nose Index	Male	50	29.26	80	48.02 ± 7.98	1.128	0.43	0.668
	Female	30	32.35	66.66	47.24 ± 7.68	1.403		

Degree of freedom = 78; *p < 0.05

Figure 2: Graphical Representation of Mean Values of Nasal Indices

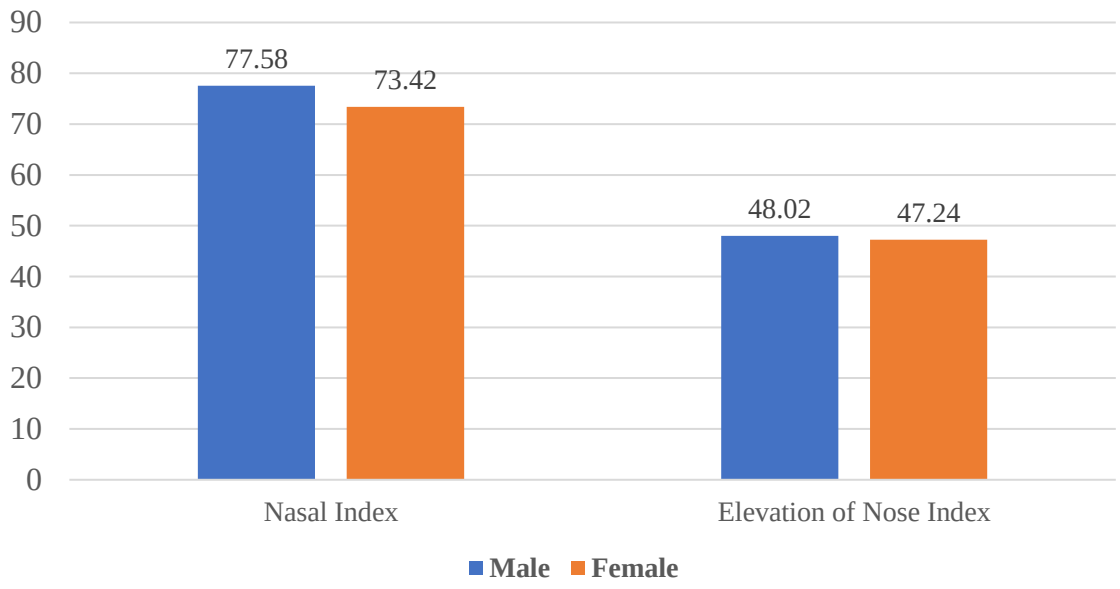


Table 4: Distribution of Nose Type among Male Hindu Bengali Population:

Categories	Nasal shape	Nasal Index	N	%
Hyperleptorrhine	Very narrow	≤ 54.9	0	0.00
Leptorrhine	Long and narrow	55-69.9	8	16.00
Mesorrhine	Moderate shape	70-84.9	35	70.00
Platyrrhine	Broad and short	85-99.9	5	10.00
Hyperplatyrrhine	Very broad/wide	≥ 100	2	4.00
TOTAL			50	100.00

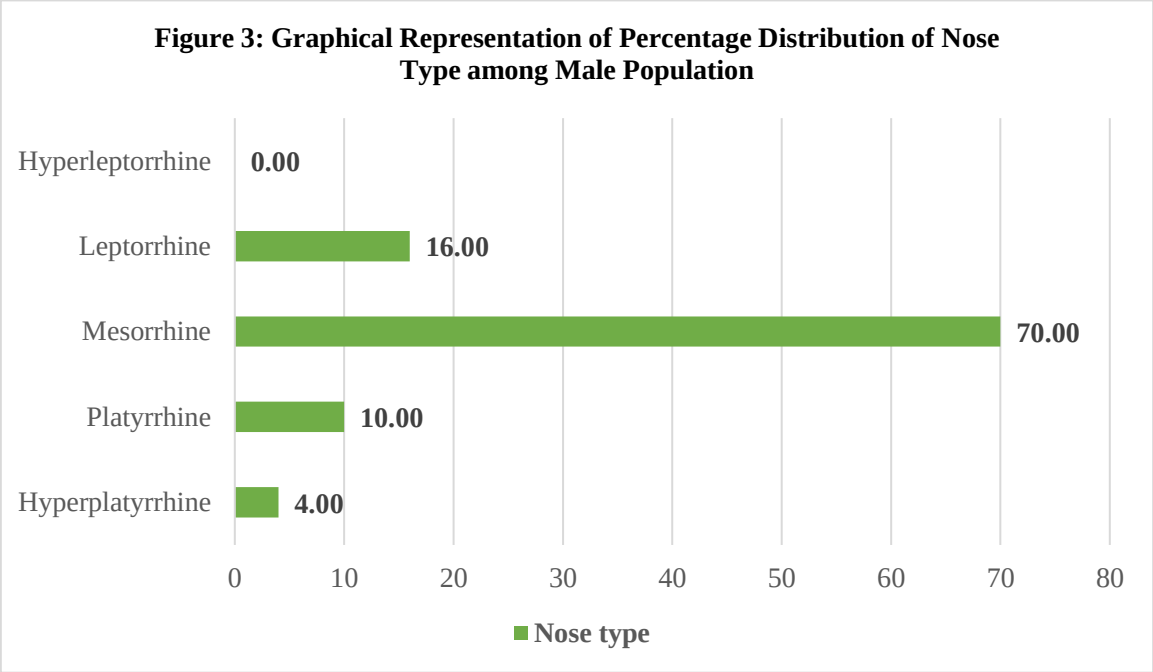
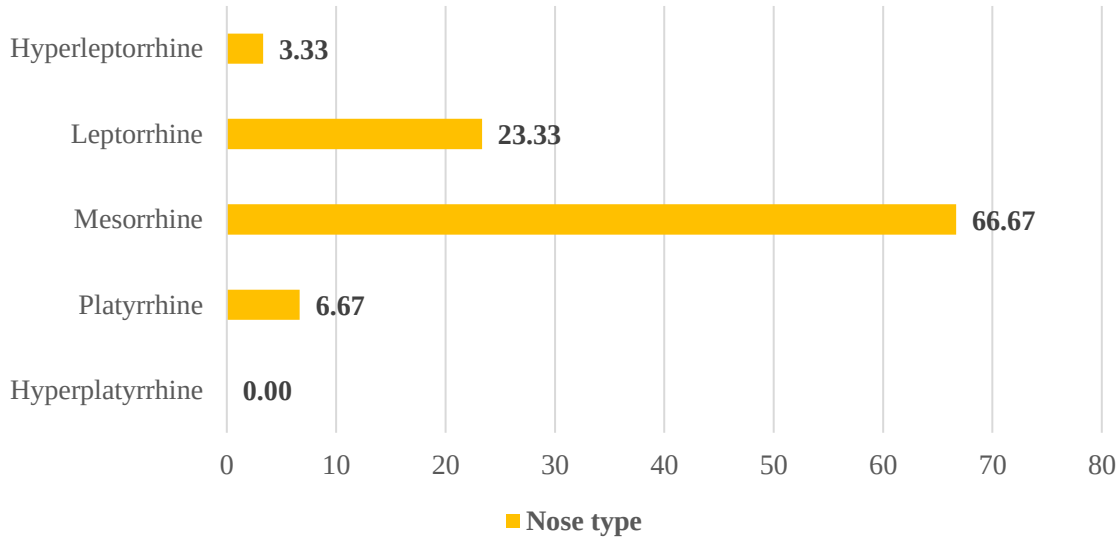


Table 5: Distribution of Nose Type among Female Hindu Bengali Population:

Categories	Nasal shape	Nasal Index	N	%
Hyperleptorrhine	Very narrow	≤ 54.9	1	3.33
Leptorrhine	Long and narrow	55-69.9	7	23.33
Mesorrhine	Moderate shape	70-84.9	20	66.67
Platyrrhine	Broad and short	85-99.9	2	6.67
Hyperplatyrrhine	Very broad/wide	≥ 100	0	0.00
TOTAL			30	100.00

Figure 4: Graphical Representation of Percentage Distribution of Nose Type among Female Population



DISCUSSION

One of the distinguishing characteristics of the human face is the nose, which aids in identifying a person's sex, age, and race. Sexual dimorphism, a condition where the two sexes of the same species exhibit different characteristics beyond the differences in their sexual organs (Kpela et al., 2019). The results of the present investigation showed that all nasal anthropometric variables in the male participants were substantially greater than those in the female participants, which implies that sexual dimorphism is present in nasal parameters. There is a dominance of the Mesorrhine nose type in both sexes. The findings of this study are consistent with those of numerous other studies (Table 7) comparing the nasal parameters of males and females. Most of the scholars have come to the conclusion that the analyzed measurements contain sexual dimorphism. In the various studies mentioned below, all the measurements that were in millimeters have been converted to centimeters for ease of comparison with the present study.

According to the result of Oladipo et al. (2008) study on Yoruba tribe of Nigeria, the males have higher (90.02 ± 1.616) mean nasal index than females (83.58 ± 1.896) which showed sexual dimorphism. Platyrrhine and Mesorrhine nose types are prevalent in males and females. In that study, mean nasal height is higher in females (4.47 ± 0.137 cm), and mean nasal breadth is higher in males (3.83 ± 0.188 cm). Hence, sexual dimorphism exists in the parameters.

Sharma et al. (2014) found in the Hindu community of the Gwalior region that mean nasal index is higher in males (80.59 ± 9.122) than females (77.29 ± 8.472) with the Mesorrhine nose type prevalence among both males and females. Mean nasal height and breadth are higher in males than in females. So, sexual dimorphism is there. Similarly, Than et al. (2018) also observed sexual dimorphism in Malay population of Ipoh having Mesorrhine type of nose in both sexes with greater male mean nasal height and breadth than that of females.

Agarwal et al. (2016) pointed out that people of northern India have a prevalence of Leptorrhine type of nose in both sexes with males having a higher mean nasal index than females. Mean nasal height and breadth are higher in males than in females. Correspondingly, according to the study of Radha et al. (2019), there is a predominance of Leptorrhine nose type in both sexes with a greater mean nasal index in males (67.05 ± 9.53) than in females (64.84 ± 9.52) among people of south India. Mean nasal height and breadth are higher in males than in females. So, the nasal parameters are sexually dimorphic in both studies.

Omotoso et al. (2019) found in Bini people that Platyrrhine is a prevalent nose type among both sexes with greater mean nasal height, breadth, and index in males than females which showed sexual dimorphism. On the other hand, Singhla et al. (2020) found the majority of males have Mesorrhine type of nose and females have Leptorrhine type of nose in the Jaunsari tribe of Dehradun with sexual dimorphism in terms of mean nasal height, breadth and index which are higher in males than females.

On the contrary, Marini et al. (2020) reported that mean nasal index is higher in females (78.46 ± 7.97) than males (77.87 ± 10.8) which showed Males have Platyrrhine and females have Mesorrhine types of noses among Dayak Kenyah population of Indonesia. On the other hand, mean nasal heights and breadth are higher in males than in females. Sah et al. (2021) also found sexual dimorphism in nasal index with males (71.59 ± 2.31) have a higher value than females (70.58 ± 3.04) and Mesorrhine is the dominant nose shape in both the sexes among Madhesis of Nepal.

Table 7: Comparison of Nasal Parameters of Different Populations:

Population	Author(s) and year	Sex	Nasal height	Nasal breadth	Nasal index	Nose type
Yoruba tribe of Nigeria (Age= 18-45 years)	Oladipo et al., 2008	M (n=500)	4.26 ± 0.133 cm	3.83 ± 0.188 cm	90.02 ± 1.616	Platyrrhine
		F (n=500)	4.47 ± 0.137 cm	3.74 ± 0.147 cm	83.58 ± 1.896	Mesorrhine
Hindu community of Gwalior region (Age= 19-45 years)	Sharma et al., 2014	M (n=102)	4.901 ± 0.45 cm	3.917 ± 0.24 cm	80.59 ± 9.122	Mesorrhine
		F (n=102)	4.53 ± 0.287 cm	3.48 ± 0.289 cm	77.29 ± 8.472	Mesorrhine
People of Northern India (Age=18-25 years)	Agarwal et al., 2016	M (n=46)	4.84 ± 0.549 cm	3.30 ± 0.466 cm	67.79 ± 9.03	Leptorrhine
		F (n=54)	4.71 ± 0.698 cm	2.85 ± 0.557 cm	60.44 ± 11.09	Leptorrhine
Malay of Ipoh (Age= 19-30 years)	Than et al., 2018	M (n=40)	5.22 ± 0.53 cm	3.97 ± 0.3 cm	76.7 ± 9.1	Mesorrhine
		F (n=40)	5.04 ± 0.97 cm	3.67 ± 0.32 cm	74.6 ± 10.9	Mesorrhine
People of South India (Age= 17-23 years)	Radha et al., 2019	M (n=100)	5.57 ± 0.728 cm	3.72 ± 0.527 cm	67.05 ± 9.53	Leptorrhine
		F (n=103)	5.38 ± 0.592 cm	3.45 ± 0.413 cm	64.84 ± 9.52	Leptorrhine
Bini (Age= 5-12 years)	Omotoso et al., 2019	M (n=250)	4.58 ± 0.66 cm	4.05 ± 0.83 cm	90.25 ± 2.55	Platyrrhine
		F (n=250)	4.33 ± 0.55 cm	3.88 ± 0.7 cm	88.65 ± 2.77	Platyrrhine
Jaunsari tribe of Dehradun	Singhla et al., 2020	M (n=100)	5.22 ± 0.469 cm	3.68 ± 0.265 cm	71.03 ± 8.18	Mesorrhine
		F (n=100)	5.01 ± 0.583 cm	3.33 ± 0.256 cm	67.21 ± 8.47	Leptorrhine
Dayak Kenyah of Indonesia (Age= 18-45 years)	Marini et al., 2020	M (n=15)	5.13 ± 0.392 cm	3.96 ± 0.364 cm	77.87 ± 10.8	Platyrrhine
		F (n=35)	4.93 ± 0.397 cm	3.86 ± 0.340 cm	78.46 ± 7.97	Mesorrhine

Madhesis of Nepal (Age= 17-45 years)	Sah et al., 2021	M (n=50)	5.25 ± 0.189 cm	3.76 ± 0.172 cm	71.59 ± 2.31	Mesorrhine
		F (n=50)	5.02 ± 0.216 cm	3.54 ± 0.204 cm	70.58 ± 3.04	Mesorrhine
Hindu Bengali of Birbhum district of West Bengal	Present study	M (n=50)	4.91 ± 0.39 cm	3.79 ± 0.34 cm	77.58 ± 8.65	Mesorrhine
		F (n=30)	4.56 ± 0.47 cm	3.31 ± 0.21 cm	73.42 ± 8.92	Mesorrhine

Conclusion

The findings of the present study indicate that sexual dimorphism exists in all the nasal parameters that were taken into consideration. Males have significantly larger nasal parameters than females in terms of nasal height, nasal breadth, nasal depth, nasal bridge length, and nasal index. Mesorrhine is the predominant type of nose in both sexes. The outcomes of this research point to the nasal measurements and indices as the potential anthropometric parameters for identifying sex and race which may have positive repercussions for anthropology, forensic science, evolutionary studies, and cosmetic and reconstructive rhinoplastic surgery.

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