

## Anthropometric Study of the Nose of 600 North Indian Adults (A study done for forensic identification)

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**Abstracts:** Background: This study was conducted on 600 Adults (300 males and 300 females) of North Indian origin in age group of 18 to 40 years. Method: Prior informed written consent was obtained from the subjects. Exclusion and inclusion criteria for the subjects were predefined. The aim of this study was to document the mean morphometric standards for nose and face of North Indian population which could be of importance in clinical practice and forensic identification. Nasal height, length, breadth, depth, facial length and breadth were measured using a sliding and spreading caliper. Result: Sexual dimorphism was observed in most parameters of nasal region with all linear measurements being more in Males. Males also had a higher nasal index. Mesorrhine type of nose was found in both sexes. Females had mesoprosopic face whereas males had leptoprosopic face. [Chhabra N et al NJIRM 2012; 3(5) : 62-68]

**Key Words:** Anthropometric Study, Nose, North Indian, Adults

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**Introduction:** Beauty is the harmony and proportion of elements .A proportionate and beautiful nose adds to the beauty of face. The nose with its central position in the face, outlined by the sharp contours of the forehead, cheeks and jaws is widely believed to influence decisively the observer's visual impression of the face.<sup>1</sup> When people get older the nasal skin will become thinner and cartilage framework can be seen, also the tip of the nose relatively drops.<sup>2</sup>

Variables that determine the shape size and length of the nose include genetic factors, race, tribal and environmental climatic conditions. The narrower noses are favored in cold and dry climates whereas broader noses in warmer, moist ones as a consequence of natural selection in human evolution.<sup>3</sup> The white race has a narrow, long, high nose (leptorrhine), blacks have wide flat noses (Platyrhine) and the Orientals have nose with intermediate measurements (Mesorrhine). The nose may be evaluated by direct clinical measurements (morphometry), by photography (photogrammetry), lateral radiography (cephalometry) or more recently three-dimensional (3D) scans and digitizers.<sup>4</sup> The variations in the form of nose are greater than those found in the cranium and much greater than the body variations as a whole.<sup>5</sup>

There are various categories of nose on the basis of nasal height, nasal breadth and nasal index. Nasal index is an ethnicity sensitive

anthropometric index; it is one of the most important anthropometric parameters for suggesting the race and sex of an individual whose identity is unknown. It also exhibits sexual differences. And it has become a useful tool in Forensic Science. The importance of nasal morphometric parameters is recognized in surgical and medical management.<sup>6</sup>

**Materials And Methods:** The present study was based on the morphometry of nose of North Indian population. 600 Adults (300 Males and 300 Females) were taken for the study. A written consent of all the subjects was obtained after explaining the contents of the study to them. Only Subjects between 18-40 yrs and of North Western States were taken and were chosen by Simple Random method. They were from MM University Students, Staff members and people residing in Campus and were not chosen on the basis of bodily structure and proportions. All the measurements were taken with the subject sitting in chair in a relaxed condition and head in the anatomical position. The subject was advised not to change his/her position while measurements were being taken. A sliding and spreading caliper was used for the measurement. The land marks were marked on the body by skin marking pencil. Those who had trauma of the nose, prior plastic or reconstructive surgery of the face or cleft lips and other congenital facial malformations were excluded from the study. Subjects below 18 and above 40 yrs were also excluded from the study.

The measurements were taken thrice to ensure accuracy. The present study was modeled upon the methods of Singh and Bhasin<sup>7,8</sup>. The measurements were statistically analyzed (arithmetic mean & standard deviation was calculated) and tabulated.

Fig -1 Showing the instruments used for taking linear measurements



Digital Sliding Caliper

**Somatometric Landmarks:** NASION (n). It is the point on the nasal root intersected by mid sagittal plane. Nasal root is not the depression of the nose but at the naso-frontal suture which can be felt by slightly probing the root of the nose. PRONASALE (Prn). It is the most anteriorly placed point on the tip of the nose when the head is held in mid sagittal plane. ALARE (Al). It is the most laterally placed point on the nasal wing. SUBNASALE (Sn). It is the point where the lower margin of the nasal septum meets the integument of the lip. GNATHION (Gn). It is the lowest point on the lower margin of the lower jaw intersected by the mid-sagittal plane. This point can be palpated on the lower jaw from behind and slightly anterior to chin. ZYGION (Zy). It is the most laterally placed point on the zygomatic arch.

**Somatometric Measurements And Indices.** Nasal length (N-Prn): It measures the straight distance between nasion (n) and pronasale (Prn). Nasal Height (N-Sn): It measures the straight distance between nasion (n) and subnasale (Sn). Nasal breadth (Al - Al): It measures the straight distance between two alare (Al) i.e. the most laterally placed points on the nasal wings. Nasal depth (Sn-Prn): It measures the projective distance between the tip of the nose and the hindmost point on the nasal septum. This measurement is taken by fixing

the moveable arm of the sliding caliper on the reverse side. Maximum Face length (N-Gn): It measures the distance between nasion and gnathion. Maximum Face Breadth (Zy-Zy): It is taken as the bizygomatic breadth.

**Nasal Index:** It is a ratio of the greatest width of the nasal aperture to the height of the nasal skeleton multiplied by 100.

$$\text{Nasal Index: - } \frac{\text{Nasal Breadth} \times 100}{\text{Nasal Height}}$$

- < 69.9                      Leptorrhine (fine nose)
- 70.0-84.9                Mesorrhine
- >85.0.                     Platyrrhine (broad nose)

**Prosopic Index:** - It is defined as the ratio of the maximum facial length to maximum facial width.

$$\frac{\text{Maximum Face Length} \times 100}{\text{Maximum Face Breadth}}$$

- <79.9                      Hypereuriprosopic
- 80.0-84.9                Euriprosopic
- 85.0-89.9                Mesoprosopic
- 90.0-94.9                Leptoprosopic
- >95                        Hyperleptoprosopic

**Nose-face width Index:** -

$$\frac{\text{Width of the nose} \times 100}{\text{Maximum face breadth}}$$

$$\text{Nasofacial Index: - } \frac{\text{Nose height} \times 100}{\text{Maximum face length}}$$

$$\text{Elevation of Nose Index: - } \frac{\text{Nasal Depth} \times 100}{\text{Nasal Breadth}}$$

**Observation:** The results of the study are presented in tabular form. Frequency of anthropological parameters obtained is shown in Table 1. The dimensions of the nasal parameters obtained in the study together with the statistically analyzed values for both males and females are shown in Table 2. Table 3 & 4 shows the

comparison of nasal parameters and indices obtained in the study with Caucasians.

**Nasal Measurements** On analyzing the nose it was observed that males had greater nasal heights than females. The mean height of the nose was 50.81mm. The mean nasal height in males was 51.32 mm and in females was 50.30mm. There was significant difference in the measurement between the two sexes ( $p < 0.001$ ).

The mean length of the nose found in the study group was 45.90 mm. The mean total length in

**Table 1:**

**Frequency of anthropological parameters**

Anthropological Parameters	Males n=300	Females n=300
Nose Phenotypes:		
Leptorrhine <69.9	59 (19.6%)	144(48%)
Mesorrhine 70-84.9	187(62.3%)	145 (48.3%)
Platyrrhine >85	54(18%)	11(3.6%)
Facial Phenotypes :		
Hyperuriprosopic <79.9	9(3%)	20(6.6%)
Euriprosopic 80-84.9	29(9.6%)	73(24.3%)
Mesoprosopic 85- 89.9	90(30%)	83 (27.6%)
Leptoprosopic 90-94.9	96(32%)	73 (24.33%)
Hyperleptoprosopic >95	76(25.3%)	51(17%)
Proportion Indices:		
Nasofacial Index :		
Short 37-44.9	142(47.3%)	99(33%)
Intermediate 45-52.9	144(48%)	197 (65.66%)
Long 53-60.0	14(4.6%)	4 (1.33%)
Nose-face width Index :		
Narrow 23-27.9	33(11%)	124 (41.33%)

Intermediate 28-33.9	206(68.6%)	170 (56.66%)
Wide 34-39.9	61(20.33%)	6(2%)
Elevation of Nose Index :		
Mild 28-40.9	164(54.66 %)	77(25.66 %)
Moderate 41-53.9	133(44.33 %)	216(72%)
Severe 54-64.9	3(1%)	7(2.33%)

males was 46.55mm and in females was 45.26mm. There was significant difference in the measurements between the two sexes. ( $p < 0.001$ ). The mean depth (nasal tip protrusion) of the nose found in the study was 15.96mm. The mean of the nasal tip protrusion in the males was 16.12 mm and in female's was 15.80 mm. There was significant difference in the measurement between the two sexes ( $p < 0.05$ ) with males having a greater nasal projection than the female populations. The mean width of nose was 37.63 mm. The mean width of nose was 39.48mm in males and 35.79mm in females. There was significant difference in measurement between the two sexes. ( $p < 0.001$ )

**Facial Measurements:** Two measurements were made in the facial region. Facial Height measured as linear distance between nasion and gnathion (n-gn) and Facial Breadth measured as the distance between two zygions (zy-zy). The mean of morphological facial height was 110.84 mm. In males the mean morphological face height was 112.84mm and in females it was 108.84mm. Sexual dimorphism was found to be statistically significant. ( $p < 0.001$ ). The mean bizygomatic breadth in the study population was 123.15mm with a mean value of 124.70mm for males and 121.51mm for females with significant differences between the two sexes. ( $p < 0.001$ )

**Nasal Index:** To have a better understanding of the proportion and ratio of different parts of the nose, nasal and facial indices relevant to the nasal morphology were calculated. The mean nasal

index in our study was 74.83 with mean nasal index of 77.39 and 72.28 in males and females respectively. Males had a higher nasal index than the females. There was significant statistical difference between the two sexes. ( $p < 0.001$ ). The most common type of nose in the study population

was of Mesorrhine type in both sexes and rarest type was Platyrrhine.

Prosopic Index: Normally various facial types are encountered in every population so a certain number of people have thin, broad or small faces. The Prosopic index changes over time and the

**Table 2 Anthropometric nasal measurements**

Parameters	Mean	Males (mean $\pm$ SD)	Females(mean $\pm$ SD)	p value
Nasal Height (mm)	50.81	51.32 $\pm$ 3.87	50.30 $\pm$ 3.26	$p < 0.001^{***}$
Nasal Length (mm)	45.90	46.55 $\pm$ 3.90	45.26 $\pm$ 3.42	$p < 0.001^{***}$
Nasal Depth (mm)	15.96	16.12 $\pm$ 1.88	15.8 $\pm$ 1.66	$p < 0.05^*$
Nasal Breadth (mm)	37.63	39.48 $\pm$ 2.77	35.79 $\pm$ 2.41	$p < 0.001^{***}$
Face Length (mm)	110.84	112.84 $\pm$ 6.23	108.84 $\pm$ 5.21	$p < 0.001^{***}$
Face Breadth (mm)	123.15	124.7 $\pm$ 7.61	121.51 $\pm$ 7.35	$p < 0.001^{***}$
Nasal Index	74.83	77.39 $\pm$ 8.13	72.28 $\pm$ 15.99	$p < 0.001^{***}$
Prosopic Index	90.13	90.68 $\pm$ 5.29	89.59 $\pm$ 6.69	$p < 0.05^*$
Nose-face width Index	30.83	31.77 $\pm$ 2.88	29.94 $\pm$ 7.95	$p < 0.001^{***}$
Nasofacial Index	46.06	45.56 $\pm$ 3.76	46.56 $\pm$ 6.11	$p < 0.05^*$
Elevation of Nasal Index	43.28	40.98 $\pm$ 5.45	45.58 $\pm$ 20.24	$p < 0.05^*$

**Table 3: Comparison of results with those of Farkas et al for Caucasians**

Sr. No.	Parameter	Authors	Males (300) Mean $\pm$ S.D.	Females(300) Mean $\pm$ S.D.	p-value
1.	Nasal Height (n-sn)	Present Study	51.32 $\pm$ 3.87	50.30 $\pm$ 3.26	$< 0.001^{***}$
		Farkas et al	54.8 $\pm$ 3.3	48.8 $\pm$ 3.7	
2.	Nasal Length (n-prn)	Present Study	46.55 $\pm$ 3.90	45.26 $\pm$ 3.42	$< 0.001^{***}$
		Farkas et al	50.0 $\pm$ 3.6	44.7 $\pm$ 3.4	
3.	Nasal Depth (sn-prn)	Present Study	16.12 $\pm$ 1.88	15.8 $\pm$ 1.66	$< 0.05^*$
		Farkas et al	19.5 $\pm$ 1.9	19.7 $\pm$ 1.6	
4.	Nasal Breadth (al-al)	Present Study	39.48 $\pm$ 2.77	35.79 $\pm$ 2.41	$< 0.001^{***}$
		Farkas et al	34.9 $\pm$ 2.1	31.40 $\pm$ 2.0	
5.	Face length (n-gn)	Present Study	112.84 $\pm$ 6.23	108.84 $\pm$ 5.21	$< 0.001^{***}$
		Farkas et al	124.7 $\pm$ 5.7	111.4 $\pm$ 4.8	
6.	Face Breadth (zy-zy)	Present Study	124.7 $\pm$ 7.61	121.51 $\pm$ 7.35	$< 0.001^{***}$
		Farkas et al	139.1 $\pm$ 5.3	130.0 $\pm$ 4.6	

**Table 4: Comparison of different Indices with those of Farkas et al**

Index	Authors	Males(300) Mean $\pm$ S.D.	Females(300) Mean $\pm$ S.D.	p-value
Nasal Index	Present Study	77.39 $\pm$ 8.13	72.28 $\pm$ 15.99	$< 0.001^{***}$
	Farkas et al	65.8 $\pm$ 6.8	61.4 $\pm$ 5.0	
Prosopic Index	Present Study	90.68 $\pm$ 5.29	89.59 $\pm$ 6.69	$< 0.05^*$
	Farkas et al	89.6	86.6 $\pm$ 3.6	
Nose face width Index	Present Study	31.72 $\pm$ 2.88	29.94 $\pm$ 7.95	$< 0.001^{***}$

	Farkas et al	25.30	24.20 ± 1.2	
Nasofacial Index	Present Study	45.56 ± 3.76	46.56 ± 6.11	<0.05*
	Farkas et al	43.70	45.6 ± 2.6	
Elevation of nasal Index	Present Study	40.98 ± 5.45	45.58 ± 20.24	<0.05*
	Farkas et al	59.36	62.2 ± 5.5	

Prosopic index of children is lower than that of adults and while growing up they gain a longer and narrower face. The mean Prosopic index in the study was 90.13 with a mean Prosopic index of 90.68 for males and 89.59 for females. Significant statistical difference was found between the two sexes ( $p < 0.05$ ). Measurements of the face showed that the most common type of face was mesoprosopic in females and leptoprosopic in males. The proportion of the nose to the facial dimensions was determined by calculating various other indices and those assessed were between the nose width and face width, nose height and face height and nasal tip protrusion to nose width.

Nose face width Index: Nose width calculated as percentage of face width. The mean nose face width index in our study was 30.83. The mean nose face width index was 31.77 for males and 29.94 for females. There was significant difference between the two sexes. ( $p < 0.001$ )

The most common nose face width index was of intermediate type.

Nasofacial Index: Nose height calculated as a percentage of face length. The mean nasofacial index in the study was 46.06. The mean nasofacial index was 45.56 for males and 46.56 for females. There was statistically significant difference between the two sexes. ( $p < 0.05$ ).

The most common nasofacial index in both sexes was of intermediate type.

Elevation of nasal index: The mean nasal tip protrusion to nose width index (elevation of nasal index) in our study was 43.28 with a mean of 40.98 in males and 45.58 in females. There was statistically significant difference between the two sexes. ( $p < 0.05$ )

**Discussion:** The nasal measurements in relation to the facial measurements are better appreciated when compared to corresponding indices for other racial groups and the findings for the Indian and Caucasians subjects showed that even though the individual measurements may vary considerably the facial indices showed similar values. The mean nose height in our study was 51.32mm for males and 50.30mm for females. This was significantly different ( $p < 0.01$ ) when compared with Farkas et al study on Caucasians having nasal length of 54.8 for males and 48.8 for females. The mean length of nose in the present study was 46.55mm for males and 45.26mm for females. There was significant difference ( $p < 0.01$ ) when compared to Caucasian males mean nasal length of 50.0mm, but the mean nasal length of females in present study was quite similar to Caucasian females mean nasal length of 44.7mm. The mean nasal tip protrusion (nasal depth) was 16.12mm for males and 15.8mm for females in the present study. This was significantly smaller than that of Caucasians mean of 19.5mm for males and 19.7mm for females. ( $p < 0.001$ ). The mean nose width in our study was 39.48mm for males and 35.79mm for females. These values are significantly larger than those of Caucasians mean of 34.90mm for males and 31.40mm for females ( $p < 0.001$ ).

**Facial Measurements:** The mean face length in the present study was 112.84mm for males and 108.84mm for females. Statistically significant difference ( $p < 0.05$ ) was observed when compared to face length of 124.7 for Caucasian males and 111.4mm for Caucasian females. The bizygomatic breadth (face breadth) in our study was 124.7mm for males and 121.51mm for females which was significantly different from face breadth of 139.1mm in Caucasian males, and 130.0 in Caucasian females

A nasal index analysis was performed for the males and females using the nasal measurements collected and these indices were also compared with nasal indices previously published for Caucasians. The mean nasal index in our study was 74.83 with mean nasal indices of 77.39 and 72.28 in males and females respectively. This was significantly different from Caucasian mean of 65.8 for males and 61.4 for females representing Leptorrhine type of nose. On the basis of nasal index it can be seen that Adult North Indians have a Mesorrhine type of nose. The Prosopic index found in the study was 90.68 for males and 89.59 for females which is similar to the Prosopic index of 89.6 for Caucasian males and 86.6 of Caucasian females. The mean nose face width index found in the study was 31.77 for males and 29.94 for females. A statistically significant difference ( $p < 0.001$ ) was observed when compared to Caucasians having index of 25.30 for males and 24.20 for females. Nose height – Face height index (Nasofacial index) in our study was 45.56 for males and 46.56 for females. Caucasians had a similar index of 43.70 for males and 45.6 for females. The mean nasal tip protrusion to nose width index (elevation of nasal index) in our study was 40.98 for males and 45.58 for females. It was significantly different ( $p < 0.001$ ) compared to Caucasians who had values of 59.36 for males and 62.2 for females. The ratio between the nasal tip protrusion and the nose width showed that the index value for the Indian nose was much smaller than the Caucasian values.

**Conclusion:** The linear measurements of the nose in our study are smaller than that of the Caucasians except for the width of the nose (al-al) which is more in our study. This can be attributed to the thick flaring alar lobule. The proportion indices for the Indian nose showed that it had less tip protrusion in relation to width of the nose. The nasal index values indicated that Indian and Caucasian subjects were quite different but facial index values were found to be quite similar. These findings indicate that compared to Caucasians the Indian nose for both sexes was wider in relation to nose height and had less tip protrusion in relation to alar width. On the basis of these findings it can

be said that Indian nasal dimensions are significantly different from Caucasians. The difference between the results of present study & Caucasians showed significant variation possibly due to multifactorial etiological factors i.e. environmental, genetic, geographical, nutritional and other related factors which played significant role.

Nasal analysis is the first step in the evaluation of patients who present for cosmetic or reconstructive procedures of the nose. It is an important aspect of the initial encounter, as it helps formulate the goals and desired outcomes of the proposed surgical procedure. For years together the anthropometric measurements for surgical reconstruction were based on basic values for Western population which actually differs for Indians. The astute surgeon recognizes that patients of different ethnic descents differ in facial proportions and makes the appropriate adjustments. These findings should be borne in mind when carrying out aesthetic rhinoplasty for Indian subjects.

This study highlights that the Mesorrhine nose type stands out as the most common feature in both sexes in this part of India. Leptoprosopic type of face was the most common type of face found in males whereas females had Mesoprosopic type as the most common type. A basic groundwork has been laid for analysing the nose and face in the predefined area of study. Additional studies on different endogamous groups may further help us and play a very important anthropometric tool in guiding forensic investigators and clinical surgeons in nasal reconstruction techniques.

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