# Anthropometric Comparison of Nasal Parameters between Male and Female of Gwalior Region.

S. K. Sharma[1], Massarat Jehan[2], Raj Laxmi Sharma[3], Sudhir Saxena[4], Akhilesh Trivedi[5], Vipendra Bhadkaria[5].

[1]*Associate professor (HOD), Dept of Anatomy, Gajra Raja Medical College, Gwalior (MP) India*
[2]*Post Graduate Student, Dept of Anatomy, Gajra Raja Medical College, Gwalior (MP) India.*
[3]*Associate professor, Dept of Pathology, Gajra Raja Medical College, Gwalior (MP) India.*
[4]*Associate professor, Dept of Anatomy, Gajra Raja Medical College, Gwalior (MP) India.*
[5]*Assistant professor, Dept of Anatomy, Gajra Raja Medical College, Gwalior (MP) India.*

***Abstract:***
***Introduction:*** *Nasal index is a sensitive anthropometric index. It also exhibits sexual differences and it has become a useful tool in Forensic Medicine and reconstructive surgery. It is an important anthropometric parameter for classifying the race and sex of an individual whose identity is unknown.*
***Aim:*** *The present study was undertaken to provide baseline data of the nasal ergonomics for male and female of Hindu community of Gwalior region.*
***Material and Method:*** *A random sample of males of 19 to 45 years age group was chosen for examination. Nasal length, nasal breadth, nasal height and nasal depth were measured with the help of Digital Vernier Caliper. Nasal index (NI) were calculated as NB/NH×100. The data was analyzed statistically using Unpaired Student t-test.*
***Result:*** *Our results are comparable with other studies with mean NI ± SD of 80.59±9.122 in male which was significantly higher (p<0.05) than that of females who has NI ± SD of 77.29±8.472. Except for nasal depth, the other nasal parameters shows sexual dimorphism.*
***Conclusion:*** *Based on the mean NI, the predominant nose type is Mesorrhine in 63.73% of male and female (Hindu community) of Gwalior region. This study provides a baseline data for people of Gwalior region which will be valuable in nasal anthropometry for clinical practice, in reconstructive surgery, rhinoplasty and in forensic science. This study should be subjected to further investigation.*
***Key words:*** *Nasal Index, Nasal Anthropometry, Rhinoplasty, Mesorrhine.*

## I.    Introduction

The nose is one of the best clues to racial origin[1]. Facial anthropometry has become an important tool used in genetic counseling, reconstructive surgery and forensic investigation[2]. Nasal Index (NI) exhibits sexual differences[3] and it has become a useful tool in Forensic Science[4].

The NI is very useful in anthropology and it is one of the clinical anthropometric parameters recognized in nasal surgical and medical management[5,6]. NI is related to regional and climatic differences[7,8]. Various studies have indicated racial and ethnic differences in nasal index amongst different populations[2,9,10]. Nasal index measurements is one of the methods anthropologists have used to differentiate living race and subspecies of man.[11]

On the basis of nasal height and breadth index, Martin and Sallar (1957)[12] divided noses into the following categories:

| Categories | Size of nose | Nasal index | |
|---|---|---|---|
| | | On Living head | On Skull |
| **Hyperleptorrhine** | Long Narrow Nose | 40 to 54.9 | --- |
| **Leptorrhine** | Moderately Narrow Nose | <70 | <47 |
| **Mesorrhine** | Moderate Or Medium Size | 70 to 84.9 | 47 to 50.9 |
| **Platyrrhine** | Moderately Wide Nose | 85 to 99.9 | 51 to 57.9 |
| **Hyperplatyrrhine** | Very Wide Nose | 100 or more | 58 or more |

The present study was designed to provide baseline data of certain nasal anthropometric measurements for male and female of Hindu community of Gwalior region, to determine the sexual difference and a normative data of nasal index and to classify their nose type and the comparison of the data with other studies, so that it would be further useful as an essential tool to the researchers, clinicians, rhinoplastic and facial reconstructive surgeons and forensic experts related to this field.

## II.      Materials & Methods

**Study Design:** Cross sectional study .

**Selection criteria:**  A random sample of 204 subjects, with 102 males and 102 females in the age group of 19-45 years were selected. This age group were selected, as age negligibly affect the facial parameters in subject above 18years of age. The selected subject were from Hindu community of Gwalior region, whose ancestors were the residents of their respective region for at least two generations.

**Exclusion criteria:** Subjects 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.

**Measurement procedure:** All the measurement were taken with the subject sitting on a chair in a well-illuminated room, in a relaxed condition with the head in the anatomical position. The facial muscles were relaxed in order not to alter the size of the nose. Five relevant nasal surface landmarks were selected with shortest distance between two points of the nose were taken with a Digital Vernier Caliper with accuracy of 0.01 mm. The landmarks were:
1. Nasion - the point on the root of the nose where the mid-sagittal place cuts the naso-frontal  suture.
2. Subnasale - the point at which the nasal septum merges with the upper cutaneous lip in the mid-sagittal plane.
3. Pronasale - the point at the tip of nose.
4. Alare - the point at the most prominent side wall of the nose.

To reduce technical error of the measurements, each measurement was taken thrice and average taken.

The measurement was done by one observer to prevent inter-observer error. The measurements were:
- Nasal Length (NL) – measured from nasion to pronasale (Fig.1)
- Nasal Height (NH) – measured from nasion to subnasale (Fig.2)
- Nasal Breadth (NB) –maximum breadth at right angle to the nasal height from ala to ala (Fig.3)
- Nasal Depth (ND) – from pronasale to subnasale (Fig.4)



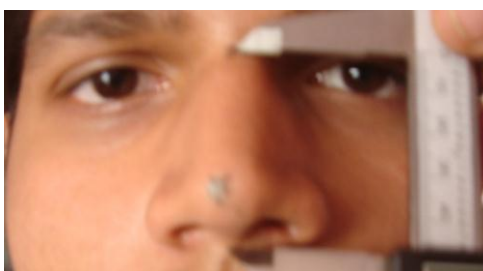Fig.1: Showing measurement of  nasal length (upper point= nasion; lower point= pronasale)



Fig.2: Showing measurement of  nasal height (upper point= nasion; lower point= subnasale)



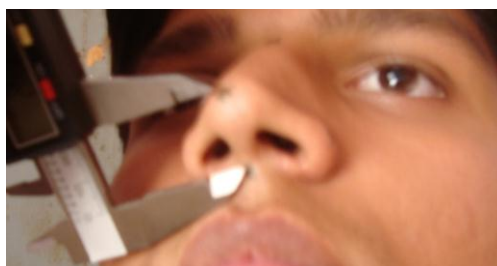Fig.3: Showing measurement of  Nasal breadth (from right ala to left ala)

Fig.4: Showing measurement of Nasal depth (upper point= pronasale; lower point= subnasale)

The nasal indices were calculated separately for male and female group as → NB/NH x 100.
The data was computed, tabulated and statistically analyzed using Graph Pad Prism and Microsoft Excel Windows 2007 software. The data obtained were compared with the results of other population in literature.

## III.    Results
The results of this study were presented in tabular forms (Table 1-3). The dimensions of the nasal parameters obtained in the study are shown in Table 1. Except for nasal depth, the other nasal parameters i.e. mean nasal length, breadth and height in males were significantly higher than those in females ($p < 0.0001$) of Hindu community of Gwalior region.

**Table 1. Descriptive statistics of different nasal parameters** (No. of males=102 and females=102)

| | Nasal Length | | Nasal Height | | Nasal Breadth | | Nasal Depth | |
|---|---|---|---|---|---|---|---|---|
| | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** | **Male** | **female** |
| **Mean (cm)** | 46.44 | 42.71 | 49.01 | 45.31 | 39.17 | 34.86 | 16.65 | 16.16 |
| **SD** | 3.847 | 3.647 | 4.517 | 2.878 | 2.490 | 2.892 | 2.482 | 2.451 |
| **SEM** | 0.3809 | 0.3612 | 0.4473 | 0.2850 | 0.2465 | 0.2863 | 0.2457 | 0.2427 |
| Coefficient of variation | 8.28% | 8.54% | 9.22% | 6.35% | 6.36% | 8.29% | 14.90% | 15.17% |
| P value (two-tailed) | *** | | *** | | *** | | 0.1511= ns | |
| t value | t=7.112 | | t=6.974 | | t=11.40 | | t=1.441 | |

SD = standard deviation; SEM= standard error of mean; ***= P<0.0001; ns=not significant

Descriptive statistics in Table 2, shows that the mean NI ($\pm$ SD) of male was $80.59 \pm 9.122$ and $77.29 \pm 8.472$ for females, both of which falls under the category of **Mesorrhine** type of nose. This also shows that males of Gwalior region have a significantly higher NI than females ($p < 0.05$). This confirm the existence of sexual difference in nasal parameters between male and female of Gwalior region.

**Table 2. Descriptive statistics of Nasal Index of Male and Female of Gwalior region**

| Unpaired Student t- test | Nasal Index (NI) | |
|---|---|---|
| | **Male** | **Female** |
| Minimum | 64.31 | 61.84 |
| Maximum | 104.6 | 102.5 |
| **Mean** | **80.59** | **77.29** |
| **SD** | **9.122** | **8.472** |
| **SEM** | **0.9032** | **0.8389** |
| Coefficient of variation | 11.32% | 10.96% |
| P value (two-tailed) | 0.0079** (significant = P < 0.05) | |
| t value | t=2.682 | |
| Difference between means | 3.306 ± 1.233 | |
| 95% confidence interval | 0.8896 to 5.722 | |
| R squared | 0.03438 | |
| **Average mean (M+F)** | 78.94 | |

The distribution of the nose type in Hindu community of Gwalior region were shown in Table 3. Overall the most dominant nose type was Mesorrhine with 63.73% and the least was Leptorrhine type with 14.71% .

**Table 3. Frequency (percentage) of nose types in male and female of Gwalior region**

| Nose type | Males (n) | Females (n) | All n (%) |
|---|---|---|---|
| Leptorrhine | 12 | 18 | 30 (14.71) |
| Mesorrhine | **58** | **72** | **130 (63.73)** |
| Platyrrhine | 32 | 12 | 44 (21.57) |
| **All** | 102 | 102 | **204 (100%)** |

## IV. Discussion

The present study established that the predominant nose type to be Mesorrhine based on the mean NI of 80.59 ± 9.122 and 77.29 ± 8.472 for male and female respectively. The existence of sexual difference in nasal parameters between male and female is possibly due to many etiological factors as genetic, hormonal, nutrition and other related factors. The comparative study of our results with other literatures has been shown in Table 4-8.

The statistics of nasal length estimated by different authors on different races were compared with our study in Table no. 4. Our result were comparative to those of other studies.

**Table 4 - Comparison of Nasal Length of different populations**

| Population | Author | Males | | Females | |
|---|---|---|---|---|---|
| | | Sample size | Mean+S.D. | Sample size | Mean+S.D. |
| Bheel-Meena (Rajasthan) | Gangrade[13] (2012) | 500 | 45.9 | 500 | 43.9 |
| Brahmins (Punjab) | Kaushal[14] (2013) | 100 | 47.59±4.24 | 100 | 44.09±3.79 |
| Majhabi-Sikhs (Punjab) | Kaushal[14] (2013) | 100 | 44.64±4.73 | 100 | 41.41±2.21 |
| Muslims (Punjab) | Kaushal[14] (2013) | 100 | 45.88±4.62 | 100 | 39.36±4.21 |
| Bekwara (Nigeria) | Esomonu[15] (2013) | 50 | 38.4 ± 2.9 | 50 | 39.1 ± 2.9 |
| Ibibio (Nigeria) | Eliakim-Ikechukwu[16] (2013) | 100 | 48.1 ± 0.4 | 100 | 44.7 ± 0.4 |
| Yakurr (Nigeria) | Eliakim-Ikechukwu[16] (2013) | 100 | 51.6 ± 0.4 | 100 | 37.7 ± 0.5 |
| Hindus(Gwalior region) | Present study | 102 | 46.44±3.847 | 102 | 42.71±3.647 |

Table 5 shows the comparative study of nasal height of different populations in literature. These results were also comparable to our study.

**Table 5- Comparison of Nasal Height of different populations**

| Population | Author | Male | | Female | |
|---|---|---|---|---|---|
| | | Sample size | Mean+S.D. | Sample size | Mean+S.D. |
| Latvians | Nagle et al[17] (2005) | 39 | 58.7±5.4 | 38 | 56.7±5.7 |
| Ahirwars (M.P.) | Singh and Purkait[18] (2006) | 59 | 43 | 52 | 41 |
| Dangis (M.P.) | Singh and Purkait[18] (2006) | 67 | 46 | 67 | 43 |
| Igbos (Nigeria) | Oluto et al[19] (2009) | 300 | 48.7±0.84 | 300 | 44.6±0.74 |
| Ijaws (Nigeria) | Oladipo et al[20] (2010) | 500 | 40.8±0.25 | 500 | 38.9±0.30 |
| Kosovo Albanian | Staka[21] (2012) | 101 | 55.26 ±3.57 | 103 | 36.90 ± 2.67 |
| Brahmins (Punjab) | Kaushal[14] (2013) | 100 | 53.73±3.27 | 100 | 49.14±3.51 |
| Majhabi-Sikhs (Punjab) | Kaushal[14] (2013) | 100 | 51.31±4.01 | 100 | 48.32±2.46 |
| Muslims (Punjab) | Kaushal[14] (2013) | 100 | 53.24±4.81 | 100 | 46.83±4.45 |
| Bekwara (Nigeria) | Esomonu[15] (2013) | 50 | 42.4±2.5 | 50 | 42.8± 2.7 |
| Hindus(Gwalior region) | Present study | 102 | 49.01±4.517 | 102 | 45.31±2.878 |

The nasal breadth statistics reported by different authors on different races were compared with our study in Table 6. Our result were comparative to those of other studies.

**Table 6 - Comparison of Nasal Breadth of different populations**

| Population | Author | Male | | Female | |
|---|---|---|---|---|---|
| | | Sample size | Mean+S.D. | Sample size | Mean+S.D. |
| Latvians | Nagle et al[17] (2005) | 39 | 35.3+3.2 | 38 | 32.8+2.7 |
| Ahirwars(M.P.) | Singh and Purkait[18] (2006) | 59 | 34 | 52 | 34 |
| Dangis(M.P.) | Singh and Purkait[18] (2006) | 67 | 35 | 67 | 33 |
| Onges(Andaman islands) | Pandey[22] (2006) | 27 | 37.8+0.6 | 26 | 35.0+2.1 |
| Igbos (Nigeria) | Oluto et al[19] (2009) | 300 | 48.7+0.84 | 300 | 44.6+0.74 |
| Limbus (Nepal) | Shrestha[23] (2009) | 99 | 38.05+4.28 | 118 | 37.73+3.70 |
| Rais (Nepal) | Shrestha[23] (2009) | 111 | 38.36+2.58 | 116 | 36.01+2.10 |
| Ijaws (Nigeria) | Oladipo et al[20] (2010) | 500 | 40.6+0.25 | 500 | 37.9+0.25 |
| Bheel-Meena (Rajasthan) | Gangrade[13] (2012) | 500 | 38.1 | 500 | 35 |
| Kosovo Albanian | Staka[21] (2012) | 101 | 36.90 ± 2.67 | 103 | 33.12 ± 2.22 |
| Brahmins (Punjab) | Kaushal[14] (2013) | 100 | 37.47+4.29 | 100 | 34.24+2.73 |
| Majhabi-Sikhs (Punjab) | Kaushal[14] (2013) | 100 | 39.66+4.55 | 100 | 33.36+3.02 |
| Muslims (Punjab) | Kaushal[14] (2013) | 100 | 35.37+3.19 | 100 | 31.99+1.6 |
| Bekwara (Nigeria) | Esomonu[15] (2013) | 50 | 40.1 ± 2.4 | 50 | 39.8 ± 2.1 |
| Ibibio (Nigeria) | Eliakim-Ikechukwu[16] (2013) | 100 | 41.4 ± 4 | 100 | 36.3 ± 0.4 |
| Yakurr (Nigeria) | Eliakim-Ikechukwu[16] (2013) | 100 | 40 ± 0.4 | 100 | 38.2 ± 0.4 |
| Hindus (Gwalior region) | Present study | 102 | 39.17±2.49 | 102 | 34.86±2.892 |

Table 7 shows the comparative study of nasal depth of different populations in literature. The results were comparable to our study.

**Table 7 - Comparison of Nasal Depth of different populations**

| Population | Author | Male | | Female | |
|---|---|---|---|---|---|
| | | Sample size | Mean+S.D. | Sample size | Mean+S.D. |
| Brahmins (Punjab) | Kaushal[14] (2013) | 100 | 20.87+3.14 | 100 | 17.72+3.67 |
| Majhabi-Sikhs(Punjab) | Kaushal[14] (2013) | 100 | 18.63+3.26 | 100 | 16.97+3.09 |
| Muslims (Punjab) | Kaushal[14] (2013) | 100 | 16.53+1.65 | 100 | 16.23+1.77 |
| Hindus(Gwalior region) | Present study | 102 | 16.65±2.482 | 102 | 16.16±2.451 |

The NI calculated by different authors on different races were compared along with their nose type in Table 8. It shows that the overall most common nose was Mesorrhine and Platyrrhine type. Our estimated results on Hindu community of Gwalior region were match with those of Singh and Purkait (on Dangis and Ahirwars of Madhya Pradesh), Oladipo et al (on Andoni of Nigeria) and Gangrade (on Bheel- Meena of Rajasthan) studies.

**Table 8 - Comparison of Nasal Index of different populations**

| Population | Author | Male | | | Female | | |
|---|---|---|---|---|---|---|---|
| | | N | Mean±S.D. | Nose type | N | Mean±S.D. | Nose type |
| Onges(Andaman islands) | Pandey[22] (2006) | 27 | 87.43±6.63 | Platyrrhine | 26 | 90.07±7.10 | Platyrrhine |
| Ahirwars (M.P.) | Singh and Purkait[18] (2006) | 59 | 81 | Mesorrhine | 52 | 82.4 | Mesorrhine |
| Dangis (M.P.) | Singh and Purkait[18] (2006) | 67 | 76.5 | Mesorrhine | 67 | 76.5 | Mesorrhine |
| Andoni (Nigeria) | Oladipo et al[24] (2009) | 200 | 79.83 ± 4.19 | Mesorrhine | 200 | 83.77 ± 1.09 | Mesorrhine |
| Okrika (Nigeria) | Oladipo et al[24] (2009) | 200 | 86.23 ±1.72 | Platyrrhine | 200 | 86.46 ± 2.37 | Platyrrhine |
| Hausa (Nigeria) | Anas[25] (2010) | 224 | 70.7 ± 11.3 | Mesorrhine | 161 | 67.2 ± 8.3 | Leptorrhine |
| Yoruba (Nigeria) | Anas[25] (2010) | 100 | 100.9 ± 8.9 | Platyrrhine | 97 | 94.1 ± 8 | Platyrrhine |
| Bini Adolescents (Nigeria) | Eboh[26] (2011) | 100 | 99.13 ± 9.26 | Platyrrhine | 100 | 99.27±11.67 | Platyrrhine |
| Ilorin (Nigerian Africans) | Jimoh et al[27] (2011) | 58 | 90.7 | Platyrrhine | 47 | 88.2 | Platyrrhine |
| Ukwuani (Nigeria) | Eboh, John[28] (2011) | - | 97.47±12.88 | Platyrrhine | - | 98.07 ±8.37 | Platyrrhine |
| Bheel-Meena (Rajasthan) | Gangrade[13] (2012) | 500 | 83 | Mesorrhine | 500 | 79.73 | Mesorrhine |
| Ibo (Nigeria) | Eliakim-Ikechukwu[29] (2012) | 114 | 107.62±1.09 | Platyrrhine | 114 | 98.89±1.30 | Platyrrhine |
| Yoruba (Nigeria) | Eliakim-Ikechukwu[29] (2012) | 78 | 110.30±1.92 | Platyrrhine | 78 | 97.07± 2.11 | Platyrrhine |
| Kosovo Albanian | Staka[21] (2012) | 101 | 67.07 ± 6.67 | Leptorrhine | 103 | 63.87 ± 5.56 | Leptorrhine |
| Ikwerre (Nigeria) | Osunwoke[30] (2012) | 250 | 93.8 | Platyrrhine | 250 | 95.8 | Platyrrhine |
| Ogu (Nigeria) | Osunwoke[30] (2012) | 250 | 95.8 | Platyrrhine | 250 | 87.34 | Platyrrhine |
| Brahmins | Kaushal[14] (2013) | 100 | 70.02±9.13 | Mesorrhine | 100 | 69.89±6.04 | Leptorrhine |
| Majhabi-Sikhs | Kaushal[14] (2013) | 100 | 76.51±8.98 | Mesorrhine | 100 | 68.95±6.22 | Leptorrhine |
| Muslims | Kaushal[14] (2013) | 100 | 67.04±8.87 | Leptorrhine | 100 | 69.38±8.09 | Leptorrhine |
| Bekwara (Nigeria) | Esomonu[15](2013) | 50 | 94.65±6.42 | Platyrrhine | 50 | 90.33±6.45 | Platyrrhine |
| Ibibio (Nigeria) | Eliakim Ikechukwu[16] (2013) | 100 | 86.58±1.20 | Platyrrhine | 100 | 81.75±1.14 | Mesorrhine |
| Yakurr (Nigeria) | Eliakim-Ikechukwu[16] (2013) | 100 | 77.76±0.82 | Mesorrhine | 100 | 102.27±1.31 | Platyrrhine |
| Hindus(Gwalior region) | Present study | 102 | 80.59±9.122 | Mesorrhine | 102 | 77.29±8.472 | Mesorrhine |

N= no. of subjects

Afro-American (Ofodile,1995)[31] and Indo-African (Sparks and Jantz, 2002)[32] have platyrrhine nose type. Most Caucasians and also Albanian population (Pittard, Luschan,Tildesley) [33,34,35] have leptorrhine type of nose. Also, Howale[36] (2012) studied 75 Dry skull of Maharashtra region and estimated the NI to be 54.30± 4.19 which suggests it to be Leptorrhine type.

The present study has been able to establish the mean nasal dimensions of males and females of Hindu community of Gwalior region. It also established that as in other populations, the nasal parameters were sexually dimorphic. The result of this study will be useful in forensic medicine, anthropology and rhinoplasty and will also serve as a future framework for estimating the other craniofacial variables in same population.

## V. Conclusion

The present study estimated the predominant nose type to be Mesorrhine in 63.73% of male and female (Hindu community) of Gwalior region, based on the mean NI of 80.59±9.122 and 77.29±8.472 respectively. The NI of male is significantly higher than females (p<0.05) which confirms the existence of sexual difference in nasal parameters possibly due to genetic, hormonal, nutrition and other related factors. This study should be subjected to further investigation because of its relevance to forensic science and clinical anthropometry. This will provide a baseline data of Gwalior population which will be valuable in nasal anthropometry for clinical

practice, in reconstructive surgery and rhinoplasty and in forensic science and therefore needs further investigation.

**Acknowledgement:**
    We would like to express our gratitude to departmental staff and colleagues of department of Anatomy for their help and support and all the students and subjects who participated in this work.

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