



Determination of Sexual Dimorphism among the South Indian and North Indian Populations Using Nasal Index – An Anthropometric Analysis

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ABSTRACT

Anthropometry is the measurement of human body parts and is used in anthropological studies for categorizing individuals to determine race and nationality. The nasal index is a delicate anthropometric index. The nasal index is very useful for discriminating racial and sexual differences. It is also useful in solving undetermined cases. There are mainly three types of noses in the population; Leptorrhine, Mesorrhine, and Platyrrhine. The study aims to determine the sexual dimorphism among the South Indian and North Indian populations using nasal index. The objectives of the study are to compare the nasal indices of male and female individuals from both populations and to identify the different nasal categories between South Indian and North Indian populations by using a digital vernier caliper. Total of 200 samples were taken out of which 100 samples were from South India and 100 samples were from North India. The population may contain people from 18 to 87 years of age group from both the population. Nasal breadth and nasal height were measured with the help of a Digital vernier caliper. Nasal index (NI) was calculated using the formula $NB/NH \times 100$. The data was analyzed statistically. The results showed that sexual dimorphism was present among both populations. The present study estimated the predominant

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nose type to be Mesorrhine in the South Indian population(72.75mm) and Leptorrhine in the North Indian population(69.58mm). The nasal index of the South Indian population was significantly higher than the North Indian population which confirms the existence of sexual differences in nasal parameters possibly due to factors like genetic, hormonal, nutritional, and other related factors. This study provides baseline data for people of North and South India which will be valuable in nasal anthropometry for clinical practice, in reconstructive surgery, rhinoplasty, and in forensic anthropology.

1. INTRODUCTION

Forensic anthropologists constitute the implementation of physical anthropology knowledge and methodology for forensic cases. The target is generally to help to identify the unidentified human remains. It also requires the implementation of anthropometries to the determination of cadavers in certain cases. Somatometric measurement is part of anthropometry it can be explained as systematic. It is a technique for estimating living organisms such as the head and face. The measurement is of various types such as length estimation, subcutaneous fat estimation, and weight estimation. Most measurements are constructed from one landmark to another. Somatometric measurements are utilized to differentiate various materials and populations in different regions of the world. The correlation between the shape and function of different parts of the human body can also be analyzed with the support of somatometry.

Somatometry produces an idea of the general anatomy of the population. These help to identify certain physiological functions, vital capacity, basal metabolism, etc. Somatometry is also very famous in the field of industry valuable contributions to distributing the fundamental facts required for various designs such as Clothing, shoes, personal belongings, etc. The Bertillon system was innovated by the French Criminal Scholar Alphonse Bertillon in 1879, the Bertillon system is utilized to determine standing height, sitting height, the distance between enlarged fingertips and arms, a head, right ear, left foot, finger, and forearm. In addition, normal personal traits such as eye color, scars, and malformations were noted. This framework was utilized to recognize offenders in the late 19th century but soon became more dependable and uncomplicated to document fingerprints.

In the 20th century, the importance of anthropometry to the study of various races was restored by various highly-developed techniques for identifying racial disparities. Nowadays anthropometry has got admission



in medical sciences, especially in Forensic Medicine. Some studies documented that bio-geographical, topographical as well and botanical components, nationality, sex, and age have effects on body proportions mostly in the head and neck region. Anthropometry gives a well-organized method and strategy for taking several dimensions in different geographic regions and races. Regional and environmental circumstances help identify the shape of the nose which may differ across distinct races and environments. Human physical variability has been a domain of significant fascination for scientists for a very long time and anthropometry developed as an excellent technological method for measuring human body proportions. The nose is a strobilae structure situated in the midline of the mid-face and connected to the facial skeleton. Morphometric differences in facial features are always present among different races in world geographic collections, and differences in nose type are remarkable in classification between races. The face and the nose are the main physiognomic appearances in humans. The face and nose arise from frontonasal prominences, nasal prominences, and maxillary and mandibular prominences and the final features of the face rely on particularly the differences in the measurement and posture of these facial parts. The growth and enlargement of humans are altered by many elements containing geographical, geological, biological factors, etc.

Anthropometry is defined as the dimension of the human body. The term “Anthropometry” is derived from the Greek word “Anthropos” which means human and “Metron” means measure. It is explained as the part of morphometry that agrees with the study of several characteristics of the human body parts. It is an ancient technique of physical anthropology. It is utilized for recognition and for the motivation of grasping human physical dissimilarities in paleoanthropology and in various efforts to coordinate physical with racial characteristics. Anthropometry involves the organized proportions of the human body parts, at first the proportional illustration of body size and shape. The anthropometric record became very helpful for professors as frequently utilized techniques and living standards were not helpful or sufficient for dealing with questions that focused on them. Anthropometry gives systematic procedures and techniques for recording several dimensions and attention to the living man and the skeleton. Anthropometric studies are a fundamental part of craniofacial surgery and syndromology.

Sexual dimorphism defines the difference between males and females of the same species. They show differences in their color, shape, structure, etc. It mainly happens by the reason of inheritance of the same or any other sexual pattern in the form of genetic material. The difference may be due to adaptation for sexual selection, protection, etc. This happens not only in animals or birds but also in humans also, every species in the world can happen sexual dimorphism. They exhibit different morphological structures. Humans show sexual dimorphism by changes in color, shape, size, weight, height, etc.



The nose is the beauty describing traits of the face of a person since they vary from each other and are affected by age, sex, climate, ethnicity, and region. Race, ethnicity, and sex can be forecasted from the shape of the nose to a large size, facial anthropometry has become a critical method in forensic medicine. The external nose is a part of the human nose that projects anteriorly from the face. The shape of the external nose is incompatible with and is interconnected to the ethmoid bone as well as the septum which is made up of cartilage and discrete nostrils apart. The nose is widely admissible as one of the signs of racial origin. Its dimension is fixed on the same theory as those of the skull. The significance of the nose is so considerable that one might label it “Nasal science”. The nasal analysis is the first step a surgeon takes before conducting rhinoplasty to alter the shape of the nose. Various races grasp several anthropometric views that involve: Africa, Asia, Australia, Europe, and Pacific Indo – Africans, etc. All races have their abnormalities and these vary remarkably when mentioned in several anthropometric guidelines.

The branch of anthropometry that agrees with the shape and size of the human nose across various populations is defined as “Nasal Anthropometry”. Nasal Anthropometry is the dimensions of size, proportion, and shape of the human nose. In living individuals, the height is the distance from the nasion to the sub nasal and the width of the nose is estimated from the right ala or nasal wing to the left ala or nasal wing in anatomical position. On a living body nasal index is taken as width in coordination to the height of the nose. On the skeleton, height is calculated from the nasion to a level just at the bottom of the nasal spine. The width of the skull is the maximum distance on the nasal sinuses. Nasal index is the most frequent nasal variable which alters based on regional and climatic conditions. Nasal parameters generally the shape and size become critical as the nose occupies a central position in facial architecture. The nasal profile and anatomy are therefore one of the establishing facts that distinguish various races. The anatomical difference in nasal anatomy between genders cannot be over-high lightened particularly in cosmetic rhinoplasty because feminization of maturation of the opposite sex nose might not give the desired beautiful impacts.

The Nasal Index is also helpful in the examination and categorization of fossil residues as well as the study of living populations. A rhinoplastic surgeon takes to alter the size or shape of the nose for a desired attractive effect. The nasal Index dimension in healthy individuals is also helpful for dysmorphologists in the ancient detection of some dysmorphic disorders like cleft lip and palate which are interconnected with nose ailment. Generally, the Nasal Index of living humans and the skeleton never correlate with each other. A large part of Caucasians has the Leptorrhine type of nose distinguished as long and narrow. The Indo – Aryans are like European people with a fine nose. Jingo people of China have Messorhine noses. Indo – Africans as well as Afro – America have Platyrrhine.



The shape of the nose is thought to be a single attribute of the ethnic origin of an individual as such the nasal anthropometric traits studies can furnish practical details to the rhinoplastic surgeon particularly when nasal reconstruction is kind for an individual who wants to alter this nasal anatomy to that of other race. The data association of nasal anthropometry of several race-related groups is therefore very functional when arrangements such as aesthetic nasal surgery and cosmetology. It represents the nasal width as the outlook of the nasal height. Longer narrower noses are accommodated in cold and dry climates while broader noses seen in warmer and humidify climates may outcome of natural selection in human progression. The nasal index usually relies on the climatic conditions. The distance of the widest elongation of the nose is normally observed as Nasal Width and the Nasal Height is from the lower border of the nasal bone to the anterior nasal spine perpendicular to the nasal width. Based on nasal index the human nose can be mainly grouped into five categories.

Long-term environmental elements decide the shape of the nose and it varies among various nationalities and races. The nasal anthropometric data is favorable in the estimation of racial differences, forensic investigations, and aesthetic and reconstructive surgeries. The Indian population throws back an extensive variety in terms of culture, language, ethnicity, and genetic background. The ancient century anthropological studies widely categorized Indo - Aryan predominance in the North Indian region and Aryo-Dravidian type in North Eastern states and Dravidian dominances in the Southern region. The Indian population is a combination of Negrito, Mongoloid, Caucasoid, and Australoid races even though a clear distinction endures between North and South Indian populations in genetic and physical elements.

The nasal index is calculated with the support of a digital vernier caliper. It is an accurate apparatus that can be utilized to calculate internal and external distances exceedingly perfectly. Ancient sorts of these types of estimating apparatus had to read by glancing precisely at the royal or metric scale and there was a necessity for very good eyesight to read the small sliding scale. Non-mechanically operated vernier calipers can still be bought and remain famous become they are much inexpensive than the digital version. The digital version needs a small battery as the non-mechanical type does not want any power source. Digital calipers are peaceful to realize the exact calculation, which distinctly exhibits and can also be held on the inch/mm button the measurement can be read as metric or imperial. A vernier caliper is a certain kind of caliper with two scales consisting of a vernier scale. A vernier scale is an auxiliary scale that is present alongside the instrument's principle scale that provides you with the possibility of a higher intention. Some vernier scales permit a calculation resolution as accurate as 0.01mm. Digital vernier calipers take linear measurements comparably to analog-style vernier calipers. The only dissimilarity is the insertion of an LCD screen that exhibits calculations mechanically – no user explanation is needed. Digital vernier-type calipers allow high–



intention dimensions for the width or diameter of objects. Final calculations are exhibited on easy-to-read LCD screens.

The French Mathematician Pierre Vernier innovated the Digital Vernier Caliper in the 17th century. The scale generally pointed in millimeters or inches runs parallel to the length of the apparatus. Each of the scale's smaller addition is called a "division". The moveable jaw is pointed with additional divisions and it slides along a scale that has a little elongation called the vernier scale. A more accurate reading of the calculation can be acquired by employing the vernier scale. Vernier caliper's role is established on the sliding action of two scales one of which is predetermined and the other of which is movable

2. METHODOLOGY

The samples chosen for the study include, North Indian Population (Punjab, Uttar Pradesh, Madhya Pradesh, Jharkhand, Bihar, Rajasthan, Odisha, Chhattisgarh) and South Indian Population (Tamil Nadu, Andhra Pradesh, Kerala). A total of 200 samples were collected out of which 100 samples were from South India and other 100 samples from North India. The sample contained 50 males and 50 females within the age range of 18 to 90 years. The sample design is cross-sectional study, it is an observational study that analyzes data from a population or representative subset at a specific point in time or over a short period. The samples included those healthy individuals without any facial deformities and above anomalies with an age range above 18 years and excluded ones are individuals with congenital anomalies and with a history of any facial surgeries and individuals who are below the age of 18 years. Data collection was done with the consent of participants. A consent form is the principle part of research which helps the researchers conduct the study without any legal obligations. It is the right of participants to make an informed decision to be involved in the study. A digital vernier caliper was used to measure all the parameters of the nose with an accuracy of 0.01mm. All the measurements were taken by seating the participants in a relaxed position with the head in its anatomical position. Informed consent was obtained from the subjects by explaining the study before taking the consent. After the consent form was signed by the participants the nasal measurements were taken.

NASAL PARAMETERS:

- Nasal height – measured from nasion to nasospinale
- Nasal breadth – measured from right ala to left ala
- Nasal index – measured by the formula $NB/NH \times 100$

The nasal index can be calculated as follows:



$$\text{NASAL INDEX} = \frac{\text{NASAL BREADTH}}{\text{NASAL HEIGHT}} \times 100$$

LANDMARKS:

- ⇒ Nasion: Middle point of the nasofrontal suture
- ⇒ Nasospinale: The point where a line touching the lower margin of the nasal aperture crosses the mid-sagittal plane
- ⇒ Ala: The expanded outer wall of cartilage on each side of the nose

NASAL INDEX CATEGORY:

Hyperleptorrhine (40-54.9), Leptorrhine (<70), Mesorrhine (70-85), Platyrrhine (>85) and Hyper platyrrhine (100 or more).

- Hyperleptorrhine – long narrow nose
- Leptorrhine – moderately narrow nose
- Messorhine - moderately or medium size nose
- Platyrrhine – moderately wide nose
- Hyper Platyrrhine – very wide nose

Based on nasal index the human nose can be classified mainly into three types. Because of ethnic differences human noses appear in different sizes and shapes which are dependent upon the environmental climatic conditions. Narrow noses are naturally present in dry and cold climates while broad noses thrive in moist and warm regions as a result of natural selection in human evolution. The human nose is grouped into six as a result of morphological appearance, the straight or Greek nose without curves, the hawk nose which is very sharp, thin and complex, the turn-up nose or celestial which extends continuously from the eyes to the lips, the aquiline or Roman nose which is like a hook and convex in shape, the Nubian nose with wide nostrils, thick and broad at the middle, wide at the end but a little bit narrow at the top and the snub nose which is short and not sharp.

The primary data collection method was used and it is a quantitative analysis. Primary data collection is the process of gathering data directly from a first-hand source. In other words, data collected by the organization that expects to use it. Methods include surveys, interviews, observation, and focus groups.

Primary data include two categories quantitative data and qualitative data. Quantitative data is data that can be measured. Qualitative data that cannot be measured or quantified. Mean, standard deviation, minimum, and maximum range of nasal height, nasal breadth, and nasal index of males and females from both populations separately were to be calculated for both populations. Statistical significance has to be measured to cross-verify the alternate hypothesis

The statistical analysis part of the study was done with the help of Microsoft Excel software. The p-value less than 0.05 is considered statistically significant and greater than 0.05 is not statistically significant. A p-value less than 0.05 is typically considered to be statistically significant, in which case the null hypothesis should be rejected. A p-value greater than 0.05 means that deviation from the null hypothesis is not statistically significant and the null hypothesis is not rejected

S.NO	NASAL PARAMETERS	TOTAL POPULATION
1.	NASAL HEIGHT	98.87
2.	NASAL BREADTH	68.47
3.	NASAL INDEX	139.178

Nasal parameters of the North Indian population

S.NO	NASAL PARAMETERS	TOTAL POPULATION
1.	NASAL HEIGHT	94.852
2.	NASAL BREADTH	68.618
3.	NASAL INDEX	145.5

Nasal parameters of the South Indian population

3. OBSERVATION AND RESULTS

The purpose of the study is to determine the sexual dimorphism among South Indian and North Indian populations by using a nasal index. Human beings are unique in terms of their physical growth and development which means that related measurements can be used to identify individuals based on physical variability. The normal human nose is distinguished by common inter-individual nasal morphological variations. These variations such as nasal cycle, nasal vestibule phenotypes, and nasal index can influence the objective description of a normal nasal airflow profile. Variations in nasal morphology are also thought to have been due to human adaptation to diverse climatic environments. Changes in nasal shape reflect the conditions for respiration in an environment as adaptations were made to provide more efficient conditions to maximize respiration. These differences in human noses due to geographic adaptations are often characterized by nasal index. Nasal index is defined as the ratio between the width and height of the anterior nose. The purpose of the present study is to use computational modeling to investigate additional relationships between nasal morphological variations between nasal morphological variations due to interracial differences and gender.

The nasal parameters such as nasal height, nasal breadth, and nasal index were measured. The nasal height is measured from nasion to nasospinale and nasal breadth is measured from right ala to left ala. The nasal index is measured by using the formula $NB/NH \times 100$. The nasal height and nasal breadth are taken with the help of a digital vernier caliper with an accuracy of 0.01mm. All the data have already been tabulated above.

The data collected from males and females were statistically analyzed separately from both populations. The result of the statistical analysis concerning the measurement of nasal parameters such as nasal height, nasal breadth, and nasal index of males and females of both populations were measured. The mean, median, minimal, and maximal width, height, and nasal index in males were higher than the females. The descriptive data analysis is given below.

S.NO	NASAL PARAMETERS AND STATISTICAL ANALYSIS	SOUTH MALE	SOUTH FEMALE	NORTH MALE	NORTH FEMALE
	NASAL HEIGHT (mm)				
1	MEAN	48.222	46.63	51.078	47.792
2	STANDARD DEVAITION	4.36	3.11	4.74	3.47

3	MIN	34.2	36.1	43.4	36.3
4	MAX	58.7	53.7	70	53.7
	NASAL BREADTH (mm)				
1	MEAN	35.712	32.906	35.65	32.82
2	STANDARD DEVIATION	2.76	3.28	3.54	2.75
3	MIN	31.1	26.8	28	27.6
4	MAX	42.4	39.8	43.3	41.7
	NASAL INDEX (mm)				
1	MEAN	74.588	70.912	70.0982	69.08
2	STANDARD DEVIATION	8.86	9.41	8.78	8.61
3	MIN	61.2	52.6	52.7	52.3
4	MAX	104.9	105.8	95.8	93.6

Statistical analysis of nasal parameters of males and females among South India and North Indian population

S.NO	NASAL PARAMETERS AND STATISTICAL ANALYSIS	NORTH INDIA	SOUTH INDIA
	NASAL HEIGHT (mm)		
1	MEAN	49.435	47.426

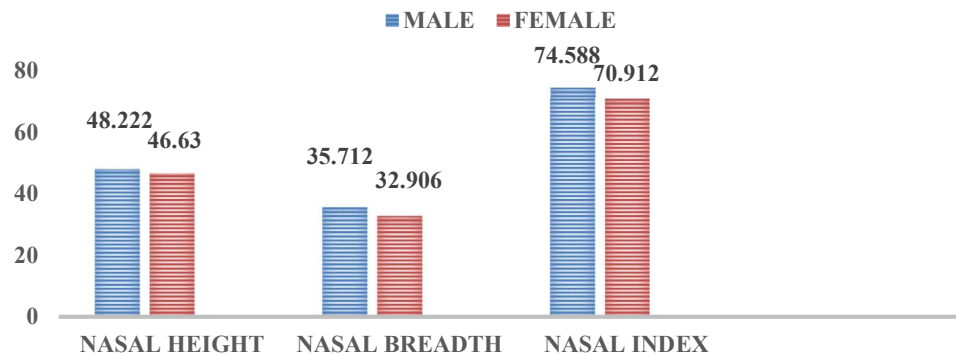
2	STANDARD DEVIATION	4.45	3.86
3	MIN	36.3	34.2
4	MAX	70	58.7
	NASAL BREADTH (mm)		
1	MEAN	34.23	34.309
2	STANDARD DEVIATION	3.46	3.33
3	MIN	27.6	26.8
4	MAX	43.3	42.4
	NASAL INDEX (mm)		
1	MEAN	69.58	72.75
2	STANDARD DEVIATION	8.67	9.282
3	MIN	52.3	52.6
4	MAX	95.8	105.8

Statistical analysis of nasal parameters of South India and North Indian population

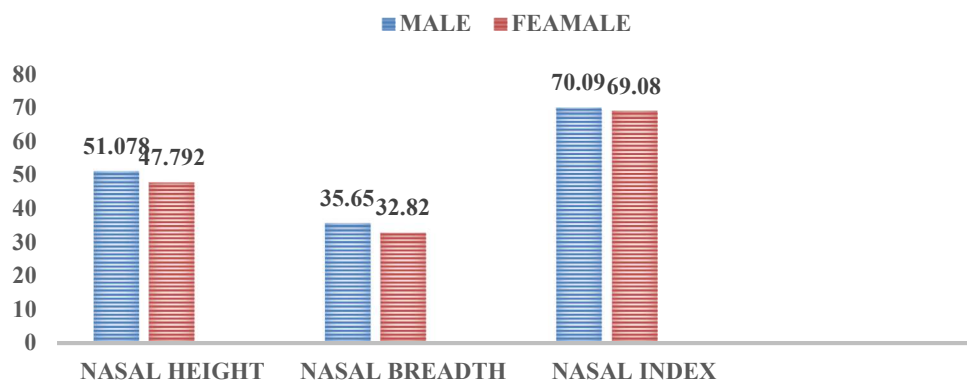
The mean value of nasal height for males and females of the South Indian population was found to be 48.222 +/- 4.36 mm and 46.63 +/- 3.11 mm respectively. The mean value of nasal breadth for males and females of the South Indian population was found to be 35.712 +/- 2.76 mm and 32.906 +/- 3.28 mm respectively and the mean value of the nasal index for males and females of the South Indian population was found to be 74.588 +/- 8.86 mm and 70.912 +/- 9.41 mm respectively. The mean value of nasal height for



males and females of the North Indian population was found to be 51.078 ± 4.74 mm and 47.792 ± 3.47 mm respectively. The mean value of nasal breadth for males and females of the North Indian population was found to be 35.65 ± 3.54 mm and 32.82 ± 2.75 mm respectively. The mean nasal index for males and females of the North Indian population was found to be 70.0982 ± 8.78 mm and 69.08 ± 8.61 mm respectively. The mean value of nasal height for the North Indian and South Indian populations was found to be 49.435 ± 4.45 mm and 47.426 ± 3.86 mm respectively. The mean value of nasal breadth for the North Indian and South Indian populations was found to be 34.23 ± 3.46 mm and 34.309 ± 3.33 mm respectively. The mean value of the nasal index for the North Indian and South Indian populations was found to be 69.58 ± 8.67 mm and 70.75 ± 9.382 mm respectively.

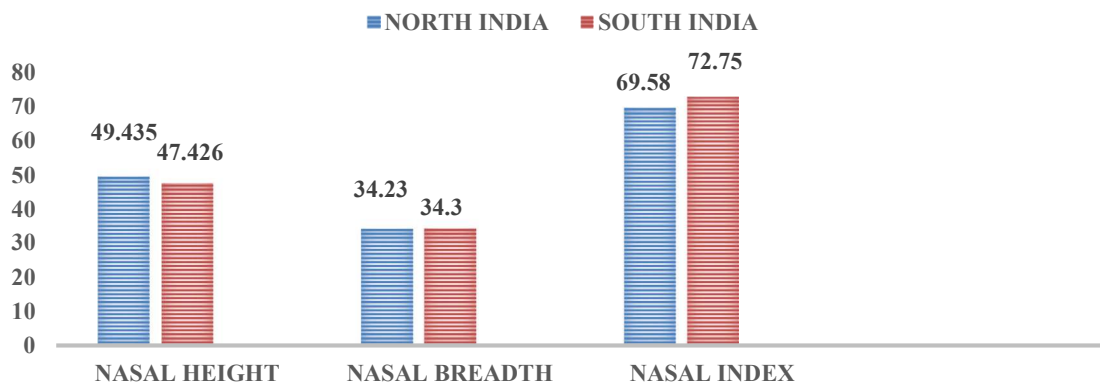


Showing the mean value of Nasal Height, Nasal Breadth, and Nasal Index of Males and Females in South India





Showing the mean value of Nasal Height, Nasal Breadth, and Nasal Index of Males and Females in North India



Showing the mean value of Nasal Height, Nasal Breadth, and Nasal Index of South Indian and North Indian population

The mean value of nasal parameters in South India is higher in males compared to females and in North India, nasal parameters are higher in males as compared to females. The mean value of nasal height is higher in the North Indian population as compared to the South Indian population and the mean value of nasal breadth and nasal index are higher in South India as compared to the North Indian population.

P value	of nasal		
	NASAL HEIGHT (M, F)	NASAL BREADTH (M.F)	NASAL INDEX (M, F)
	P- VALUE (NORTH)	0.0001	1.83
P-VALUE (SOUTH)	0.01	3.08	0.01

parameters of males and females population from North India and South India

NASAL HEIGHT (S, N)	NASAL BREADTH (S, N)	NASAL INDEX (S, N)
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P-VALUE	0.0004	0.43	0.005
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P value of nasal parameters from the total population

The p-value for the nasal height of males and females of the North Indian population showed statistical significance. While the nasal breadth and nasal index of males and females from the North Indian population were not statistically significant. The p- p-value of nasal height and nasal index of males and females from the South Indian population showed statistically significant results while the nasal breadth of males and females from the South Indian population were not statistically significant. The p-value of nasal height and nasal index of both the North and South Indian population were statistically significant and the nasal breadth of both populations were not statistically significant. Mesorrhine was found to be predominant for the males in both populations while females showed Leptorrhine type of nose in both populations. The frequency of Mesorrhine nasal type was higher for the South Indian population when compared with the North Indian Population. Similarly, the frequency of Leptorrhine type of nose was higher for the North Indian population when compared with the South Indian Population The findings have been tabulated below for reference.

S.NO	NASAL INDEX TYPES	RANGE	MALE		FEMALE	
			FREQUENCY	%	FREQUENCY	%
1	HYPERLEPTORRHINE	40 – 54.9	0	0%	1	2%
2	LEPTORRHINE	55 – 69.9	17	34%	24	48%
3	MESORRHINE	70 – 84.9	29	58%	22	44%
4	PLATYRRHINE	85 – 99.9	3	6%	2	4%
5	HYPERPLATYRRHINE	≥ 100	1	2%	1	2%

Percentage distribution of nasal characteristics among males and females in the South Indian population



S.NO	NASAL INDEX TYPES	RANGE	MALE		FEMALE	
			FREQUENCY	%	FREQUENCY	%
1	HYPERLEPTORRHINE	40 – 54.9	1	2%	1	2%
2	LEPTORRHINE	55 – 69.9	21	42%	27	54%
3	MESORRHINE	70 – 84.9	25	50%	20	40%
4	PLATYRRHINE	85 – 99.9	3	6%	2	4%
5	HYPERPLATYRRHINE	≥ 100	0	0%	0	0%

Percentage distribution of nasal characteristics among males and females in the North Indian population

S.NO	NASAL INDEX TYPES	RANGE	SOUTH INDIA		NORTH INDIA	
			FREQUENCY	%	FREQUENCY	%
1	HYPERLEPTORRHINE	40 – 54.9	1	1%	2	2%
2	LEPTORRHINE	55 – 69.9	41	41%	48	48%
3	MESORRHINE	70 – 84.9	51	51%	45	45%
4	PLATYRRHINE	85 – 99.9	5	5%	5	5%
5	HYPERPLATYRRHINE	≥ 100	2	2%	0	0%

Percentage distribution of nasal characteristics among males and females in the total North Indian and South Indian population

The nasal index types for the South Indian and North Indian population based on the characteristics and its distribution were as follows: In South India male population have 29 Mesorrhine(58%), 17



Leptorrhine(34%), 3 Platyrrhine(6%) and in female population have 24 Leptorrhine(48%), 22 Mesorrhine(44%), 2 platyrrhine(4%) and in North India male population have 25 Mesorrhine(50%), 21 Leptorrhine, 3 Platyrrhine(6%) and female population have 27 Leptorrhine(54%), 20 Mesorrhine(40%), 2 Platyrrhine(4%). The percentage distribution of nasal characteristics in the total South Indian population is 51 Mesorrhine (51%) and in North Indian population has 48 Leptorrhine (48%). The percentage distribution of nasal types is mentioned in the below chart.

The common occurrence of nasal type in both population for the females was found to be Leptorrhine and for males was Mesorrhine type. The Mesorrhine type of nose is most predominant in the South Indian population followed by the Leptorrhine type of nose and the Leptorrhine type of nose is most predominant in the North Indian population followed by Mesorrhine. This shows that the South Indian population has a higher chance of occurrence of Mesorrhine nose shape, while North Indians have Leptorrhine nose shape. The main purpose of the study was to analyze the presence or absence of sexual dimorphism and also to provide baseline data for anthropologists, and aesthetic and reconstruction surgeons. The results of the study showed that sexual dimorphism was present in males and females of both populations. Males have a higher nasal index than females in both populations. The most common type of nose is Mesorrhine in the South Indian population and the Leptorrhine type of nose is in the North Indian population. The knowledge of nasal anthropometry is useful in forensic medicine and physical anthropology as one of the tools used in the identification of different races, ethnicities, and genders of an individual.

In this study, the dominant nasal type for North Indian males was Mesorrhine, 25 individuals while 21 people were Leptorrhine. North Indian females are also dominantly Leptorrhine 27 individuals while 20 people were Mesorrhine and had traces of Platyrrhine. So, it can be concluded that the dominant nose type in the North Indian population is Leptorrhine. On the other hand, the dominant nose type in South Indian males is Mesorrhine, 29 individuals and females are Leptorrhine, 24 individuals. So, it can be concluded that the dominant nose type in the South Indian population is Mesorrhine. This research agrees with different studies on the relevance of nasal and facial dimensions in the analysis of gender-based variation among different groups and races of the human population. The present study estimated the predominant nose type to be Mesorrhine in the South Indian population(72.75mm) and Leptorrhine in the North Indian population(69.58mm). The nasal index of the South Indian population is significantly higher than the North Indian population which confirms the existence of sexual differences in nasal parameters possibly due to genetic, hormonal, nutritional, 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 baseline data among South Indian and North Indian populations which will be valuable in nasal



anthropometry for clinical practice, reconstructive surgery and rhinoplasty, and forensic science and therefore needs further investigation.

4. DISCUSSION

The face and the nose are very important physiognomic features in humans and are the main cephalometric parameters to describe human morphology. The variations in the nose are greater than those found in the body as a whole. Researchers believe that there is a relationship between the nose shape and its function. Weather conditions and living environments are important factors in determining the structure of the nose in terms of the width, height, and index and ultimately determine the nose shape which varies for different human ethnic groups and races. In this study, these parameters were measured and evaluated for North Indian and South Indian populations. Based on nasal index the human is classified into mainly five types: Leptorrhine, Mesorrhine, and Platyrrhine. The nose type can affect the psychological and social functioning of a person. Therefore, nose surgery is a common and crucial surgical procedure in plastic surgery, because it changes the shape and size of the nose and plays a major role in improved self-confidence and social functioning. Success in esthetic surgery greatly depends on the knowledge of anatomy and facial esthetics and a unique surgical method must adopted for different nose types and shapes. It is also very important in forensic research and to study variations among living populations. The main purpose of the study was to analyze the presence or absence of sexual dimorphism and also to provide baseline data for anthropologists, and aesthetic and reconstruction surgeons. The results of the study show that sexual dimorphism is present in males and females of both populations. Males have a higher nasal index than females in both populations. The most common type of nose is Mesorrhine in the South Indian population and the Leptorrhine type of nose is in the North Indian population. The knowledge of nasal anthropometry is useful in forensic medicine and physical anthropology as one of the tools used in the identification of different races, ethnicities, and genders of an individual. The nose is a very prominent and important part of the facial skeleton. The nose is made up of bones and cartilage. Nasal anthropometry is an important tool in identifying sexual dimorphism and plurality among different tribes and races. Nasal architecture is the best hint to identify the tribe. The nasal index is one of the indices that is affected by climate usually hot and moist climate is associated with a broad nose whereas a cool and dry climate has a narrow nose. A few researchers state that in hot and humid conditions a low broad nose serves to dissipate heat which affects the shape of the nose. Nasal analysis is very useful for a surgeon before rhinoplasty; therefore, analysis of the ethnic group and their facial features is of utmost importance to have better cosmetic results. The nasal index is $\text{nasal breadth} / \text{nasal height} \times 100$.



The morphometric variations in nasal measurements globally have become the center of investigation for cosmetic and plastic surgeons responsible for the repair and reconstruction of the nose. The nose is often regarded as one of the useful indicators of the race of the individual. The diverse shape of the nose is mainly influenced by the environment and temperatures. The morphological differences in nasal anatomy between genders cannot be overemphasized especially in cosmetic rhinoplasty to achieve the desired aesthetic effect. The nose is very important in racial origin. The nasal index plays a vital role in anthropology and is one of the clinical anthropometric parameters to be considered in nasal surgical and medical management. The nasal index is associated with regional and climatic variations. Many studies have shown the racial and ethnic differences in nasal index between different populations. The classification of the nose into different categories is a function of the nasal index in anthropology as it is applied in differentiating racial and ethnic variations. The nasal index also shows sexual dimorphism which is why it is very important in forensic science, particularly in gender differentiation. The nasal index is very useful in anthropology in distinguishing gender and ethnic differences. Every human being is unique in terms of his or her physique and related measurements. The scientific technique called anthropometry is used to identify individuals based on existing physical variability using body measurements. Physical anthropometry is useful in the identification of the dead as well as the study of living populations. Measurements of the face are now widely used in forensic identification. The nose being one of the protruding parts of the face is variable in its size and shape. The different appearances of the nose are influenced by ethnic influences and the environmental climate conditions.

The nasal index calculated using the nasal aperture measurements was higher in males than females in both the South Indian population and North Indian population and the nasal index measurements were higher in the South Indian population than the North Indian population. Nasal index is one of the important anthropometric parameters in forensic science. Several authors have conducted various studies to measure nasal parameters and calculated the nasal index in different races, and populations using dry human skulls or on live subjects. However, measuring parameters on dry skulls by classifying them as male and female skulls by studying various traits and using them for sexual dimorphism is not 100% accurate. Measuring nasal parameters on live subjects may also vary due to different soft tissue thicknesses and may not give the exact value of nasal parameters. Anthropometry is the measurement of living subjects. The use of anthropometry to establish nasal dimensions has been reported by many authors. The importance of nasal index in anthropological studies has been recognized for a long time. Being based on both bony and cartilaginous landmarks, the index differs from most other anthropological studies. There are three main



nasal types they are Leptorrhine, Mesorrhine, and Platyrrhine it was associated with Caucasian, Asian, and African races. This type of classification is still used in the demographics section of many clinical traits.

Human beings are unique in terms of their physical growth and development which means that related measurements can be used to identify individuals based on physical variability. The morphological features of the skull are useful in the identification of dead and living persons. Measurements of facial anatomy including sinuses, nasal cavities, or orbital cavities are now widely used in forensic identification, even if it is necessary to carefully differentiate between different ethnic groups. Face measurements are also made for various health purposes such as in the field of dental applications, cosmetic surgery, orthodontics, and face masks. In particular face analysis and proportions are important for facial plastic surgeons to evaluate the face during the planning stages of facial reconstructive and cosmetic surgery. The human nose is the most protruding part of the face, it is variable in size and shape. Divergence of the nose shape and prominence can be explained by ethnic influences and environmental and climatic conditions. Differences in nose shape and appearance are influenced by ethnic factors and environmental climatic conditions. Regardless of sexual dimorphism, it is predictable that ethnic groups in the same climatic regions should have similarities in their nasal indexes. In any case, the point that is most relevant for forensic investigation is that anthropometric data on the face and nose would be useful for sex determination. The frontonasal prominences, nasal prominences, and maxillary and mandibular prominences play a vital role in the development of the face and nose. The human nose is an essential component of the facial complex. It plays a vital role in facial aesthetics by enhancing the personality of the individual. The nasal cavity filters and conditions the inspired air. It is also an organ for smell perception. Various methods have been reported to study the nose such as morphometric analysis, cephalometry, and photography. 3D scans and digitizers have also been used to study the nose. Among all parts of the body primary attention is given to the face.

Craniofacial anthropometry is important in the evaluation of facial trauma, facial defects, congenital and post-traumatic deformities, and easy identification of certain congenital malformations and diagnosis of hypotelorism. The nose plays a role in both warming and moistening of the inspired air. As such in colder and drier climates the length of the nasal passage is increased and the base is narrowed thus increasing the surface area and the period over which the inspired air is warmed and moistened. For this reason, it was thought that the shape of the nose in different ethnic groups had been adapted to the climate and environment to which they were being exposed. When conducting large population studies rhinologists may find the anthropometric measurements of nasal height, nasal width, and nasal index to be a more relevant discriminator and a better basis for assessment of normal nasal patency in nasolabial surgery. Nasal index is related to regional and climatic differences. Various studies have indicated racial and ethnic differences in



nasal index amongst different populations. Leptorrhine nose type with a nasal index of 69.9 or less characterizes the Caucasian race. African nose is majorly known to be Platyrrhine type with a nasal index of 85 and higher whereas the Indo – Aryan or Caucasoids ancestry possess Mesorrhine type. Several researchers have revealed that the mean, median, minimal, and maximal width, height, and nasal index in males are higher than the females. The study compared nasal height, nasal breadth, and nasal index with different populations.

Twenty nasal anthropometric measurements were compared with the results outlined by s. k. Sharma, et.al for Hindu community of Gwalior region, Akanji Omotosho Dhulqarnain, et.al for North Western Nigeria and Northern Iranians population, Nazim Nasir, et.al for Uttar Pradesh, Bihar, Kerala and Jammu and Kashmir population, Maitreyee M Kulkarni, et.al for Medical college Baroda Gujarat population, Esomonu U.G et.al for Bekwara ethnic group in South Nigeria, Ibrahim Mohammed, et.al for Hausa ethnic population of North Western Nigeria, Ritee Shrestha, et.al for students of dental college in Nepal, Rahul Kotian, et.al for South Indian population, Bhima Neupane, et.al for medical students, Nepal – Nepalese and Indians, Saurabh Sharma, et.al for population from medical college in Bhopal, Madhya Pradesh, Omotoso Dayo Rotimi, et.al for Bini children in Southern Nigeria, Dr. Abdelmonem Hegazy, et.al for Egyptian population, Sudhakar Kumar Ray, et.al for Western Uttar Pradesh region, Roberto Scendoni, et.al for Kosovar population, Dr.K. Srinivasan, et.al for South Indian population, Shameema Gulzar, et.al for young adult Kashmiri Population, Oladipo G.S , et.al for Omoku population of Nigeria, M. Than, et.al for Malay population, Sarun Koirala, et.al for Tharu and Mongoloid population Of Nepal, Dr. Girish V Patel, et.al for South Indian population.

In this study, the mean nasal height for North Indian males is 51.078mm and females is 47.792mm, whereas the mean nasal height of South Indian males is 48.22mm and females is 46.63mm. The mean nasal height value is higher in North Indian males and females as compared to South Indian males and females. The mean nasal breadth for North Indian males is 35.65mm and females is 32.82mm, whereas the mean nasal breadth of South Indian males is 35.712mm and females is 32.906mm. The mean nasal breadth value is higher in South Indian males and females as compared to North Indian males and females. The mean nasal index for North Indian males is 70.0982mm and for females is 69.08mm, whereas the mean nasal index of South Indian males is 74.588mm and females is 70.912mm. The mean nasal index value is higher in South Indian males and females as compared to North Indian males and females. The mean nasal height for the total North Indian population is 47.426mm, the mean nasal breadth is 34.30mm and mean nasal index is 72.75mm and the mean nasal height of the total South Indian population is 49.435mm, the mean nasal breadth is 34.23 and mean nasal index is 69.58mm. The mean nasal height value is higher in the total North



Indian population as compared to the South Indian population, and the mean nasal breadth and nasal index value is higher in the total South Indian population as compared to the North Indian population.

In this study, the dominant nasal type for North Indian males was Mesorrhine, 25 individuals while 21 people were Leptorrhine. North Indian females are also dominantly Leptorrhine 27 individuals while 20 people were Mesorrhine and had traces of Platyrrhine. So, it can be concluded that the dominant nose type in the North Indian population is Leptorrhine. On the other hand, the dominant nose type in South Indian males is Mesorrhine, 29 individuals and females are Leptorrhine, 24 individuals. So, it can be concluded that the dominant nose type in the South Indian population is Mesorrhine. This research agrees with different studies on the relevance of nasal and facial dimensions in the analysis of gender-based variation among different groups and races of the human population.

There were differences between the nasal parameters of both men and women. The classification of the nose into different categories is a function of the nasal index, in anthropology as it is applied in differentiating racial and ethnic variations. The nasal index also shows sexual dimorphism, which is why it is very important in forensic science, particularly in gender differentiation. The current study states that the nasal index of the North Indian population of males is 70.0982 and females is 69.08 and the South Indian population of males is 74.588 and females is 70.912. The male nasal index was higher than the female nasal index in North India and South India. Similarly in all ethnic groups male has a higher nasal index than females with statistically significant differences that were similar to our findings. The parameters of the external nose are not only in terms of reconstructive and aesthetic rhino surgery but also for forensic medical and other expertise. The nasal index is very useful in anthropology in distinguishing gender and ethnic differences. In the present study nasal index of males was higher than females in the South Indian population it is comparable with the previous study of the role of nasal parameters in gender determination among medical students by Bhima Neupane, et.al also showed that males had higher nasal index than females.

The mean nasal index for males and females in the North Indian population is 70.0982 and 69.08 respectively and the mean nasal index for males and females in the South Indian population is 74.588 and 70.912 respectively. This shows that males of both populations have a significantly higher nasal index value than females. This confirms the existence of sexual differences in nasal parameters between males and females of the population and from that it can be concluded that sexual dimorphism is present among both populations, it can be determined with the help of nasal index. Thus, was sexually dimorphic among the South and North Indian populations. The existence of sexual differences in nasal parameters between males



and females is possible due to many aetiological factors such as genetic, hormonal, nutritional, and other related factors. From the above studies, it is shown that nasal index can be considered as a tool for sex determination which should be necessarily preceded by determination of race. The result of this study showed a correlation with findings from another study of anthropometric evaluation of nasal height, nasal breadth, and nasal index among Bini children in Southern Nigeria Omotoso Dayo Rotimi, et.al also show that males have higher nasal index than females.

Hall, a scientist detected a strong correlation between nasal dimensions and oxygen consumption. Natural selection has fine-tuned the size of the fleshy nose to support the amount of air that needs to be possessed. Males who consume relatively more oxygen during their hard activities would be expected to have relatively broader noses than females of the same population. The nasal index has been found to modify between childhood, adolescence, and young adulthood and even after young adulthood into the sixth decade of life. However, the sexual dimorphism in nasal dimensions appears to begin at different ages. As nasal growth changes with age, it plays a very important part in various fields like orthodontics for diagnosis and treatment planning, forensics, plastic surgery, ENT, etc. The nose is one of the parts of the body which shows very characteristic changes during racial evolution. The nose experiences more growth in vertical dimensions than in anteroposterior dimensions in both males and females in their spurt years. The nasal tip showed very much age-related changes because of loss of muscle tone and increased flaccidity and redundancy. At different ages, different nasal dimensions appear to begin in different sexes. This is an important aspect to consider in the evaluation of nasal changes with age in both genders because at birth the nasal height in boys was significantly larger as compared to girls of the same age group. However, at birth time and in the first few months after the birth. Nasal breadth was similar in both newborn boys and girls and it became larger in boys than in girls in postnatal growth only. The anatomical structure of the nose is supported by cartilage and the rest of the nose is supported by bone. Age-related changes on the nose are not uniform with age, both bone and cartilage become weaker. But the difference is that bone does not move but cartilage moves with time. Hence because of the movement of cartilage, the tip of the nose droops leads to the nasal tip.

Again, ethnic genetic variability plays a more important role than the climatic condition as two ethnic groups living in the same climatic condition show variation in their nasal type. This simply means that despite living in different climatic conditions some ethnic groups have the same nasal type. This study shows that males have a significantly higher nasal index than females. This confirms the existence of sexual dimorphism in nasal parameters among North Indian and South Indian populations. In this present study, South Indian males have a Mesorrhine type of nose, and females have a Leptorrhine type of nose it shows



similarity to the anthropometric study of nasal index among the population of Western Uttar Pradesh by Sudhakar Kumar Ray, et.al. The present study shows similarity to the study on the nasal index in the South Indian population by Dr. Girish V Patel, et.al, the measurements were found to be higher in males than females. The study showed that the South Indian males have a Mesorrhine type of nose and females have a Leptorrhine type of nose, it was the same as in the present study. The study showed even within the same geographical location different nasal indices were observed.

LIMITATIONS OF THE STUDY

The limitation of the study was that not many North Indian and South Indian states were covered due to time constraint. Also, more parameters can be included along with the nasal parameters for better understanding of the variations in the face among populations

5. CONCLUSION

The present study estimated the predominant nose type to be Mesorrhine in the South Indian population(72.75mm) and Leptorrhine in the North Indian population(69.58mm). The nasal index of the South Indian population is significantly higher than the North Indian population which confirms the existence of sexual differences in nasal parameters possibly due to genetic, hormonal, nutritional, 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 baseline data among South Indian and North Indian populations which will be valuable in nasal anthropometry for clinical practice, reconstructive surgery and rhinoplasty, and forensic science and therefore needs further investigation. A multitude of factors influences the size, shape, and length of the nose such as genetics, sex, racial origins, and environmental conditions. This study indicates the significant difference among the nasal indices in males and females. The index relies on both bony and cartilaginous anatomical surface points. Natural selection according to climatic conditions aids in augmenting the efficiency of the nose keeping the inhaled air warm and moist as required for the individual. This study is vital in medical sciences such as cosmetology, facio-maxillary surgeons, anatomists, and anthropologists alike. Such anthropometric data will also facilitate the manufacture of better medical gear and tools.

In conclusion, this study has significant differences in South Indian and North Indian nasal parameters such as nasal height and nasal index, nasal width is not statistically significant. The South Indian population falls under the Mesorrhine type of nose (medium or fine nose) and the North Indian population falls under the Leptorrhine type of nose (broad nose). This study was carried out using the standard anthropometric



method, hence the results are recommended to forensic experts, especially with the recent interest in employing biometrics as a tool in national identification it can also be useful to the plastic surgeon who might want to create those population's type of nose for his patients. Therefore, it is expected that ethnic groups in the same climatic regions regardless of sexual dimorphism should have similarities in their nasal indexes. Anthropometric data of the face and nose obtained would be useful for sex determination, forensic medicine, identifying nasolabial dysmorphology, and reconstructive facial and nasal surgeries. This study suggests that the nose can be a useful anthropometrical tool in the determination of gender in forensic science and the classification of fossil remains. This study concludes that the mean values of the nasal index of South India fall under the Mesorrhine type of nose and North India falls under the Leptorrhine type of nose. The mean nasal index value of males and females in the South Indian population falls under the Mesorrhine type of nose. So, there was not much difference in the nasal index in males and females.

Sex determination is an important primary characteristic of identification. It can be determined using physical anthropometry. The parameters like nasal height, nasal width, and nasal index can be used as predictors to determine gender. The gender differences in these parameters highlight the significance of applying data to an individual in a given population. These parameters can be used as an adjunct method while determining the sex of an unidentified individual. Determination, comparison, and evaluation of nasal parameters not only suggest sexual dimorphism but also provide baseline data for the North Indian and South Indian populations that are valuable in nasal anthropometry for clinical practice, reconstructive surgeries, rhinoplasties, and forensic sciences. The nasal dimension and nasal index demonstrated prominent sexual dimorphism and can be used as a tool for the description of sexual differences in the human population. Age and gender affect the nasal index. There is a sexual dimorphism in nasal indices of South and North Indian populations. This study provides normative data on nasal index which will be an anthropometric tool in differentiating this ethnic group of population.

Sex estimation is essential for completing an individual's biological profile and therefore constitutes an important part of the human identification process in the forensic field. The current anthropometric study found that the nasal parameters necessary for the calculation of nasal index showed the presence of sexual dimorphism in South Indian and North Indian populations. Therefore, conducting a comparative study between different groups would be very interesting in the field of personal identification for forensic purposes. The findings of this study may contribute to satisfactory outcomes in cosmetic and reconstructive surgery, anthropology, and forensic medicine. Even though estimated data should be employed with prudence, data prepared with this method is sufficiently reliable for many purposes. The overall findings of the present study which aim is to determine the sexual dimorphism among South Indian and North Indian



population using nasal index. The probable changes in the population indicate the change in climatic conditions. The findings therefore suggest that genetics play a more important role than natural environmental factors in determining the shape of the human nose. The nose is the most prominent feature of the face and it shows significant variation among different races. This difference is used as a reliable parameter for determining the racial background of an individual. The main nasal type among the North Indian population is Leptorrhine and the South Indian population is Mesorrhine nose type. The result of the study will be of immense use in forensic medicine and anthropology and will also serve as a future framework for estimating the craniofacial dimensions of other Nigerian ethnic groups.

The nose acts as a filter to prevent penetration of toxic particles and gases to the lower respiratory tract, the route of breathing, oral and nasal may be an important determinant of toxicant dose to the lungs. Very large and very small particles are deposited very efficiently in the nose by inertial impaction and diffusion respectively during nasal breathing. The nose effectively conditions inspired air to near body temperature and relative humidity before it enters the lungs. The ability of the nose to condition ambient air in these ways serves as a protective mechanism against toxicity to the lower respiratory tract. The nose is central in the determination of facial aesthetics. The variation in its structural characteristics greatly influences the ultimate endoskeletal positioning at the end of an orthodontic therapy. The development of the nose in the embryo occurs in pre-skeletal and skeletal phases by a well-coordinated and regulated interaction of multiple signaling cascades with the crucial importance of each factor in the entire mechanism. Nasal morphology has a great bearing on the facial appearance of an individual. The nasal region was found to be more reliable in the detection of asymmetry as compared to the mouth or eyes. The genetic basis affects the various aspects of nasal morphology at length along with the clinical relevance of various anatomical variations in nasal morphology. Racial and gender differences were observed in the nasal index. The internal nose develops by the expansion of the nasal cavity with the atrophy of existing tissues and the formation of mesenchymal structures. The factors responsible for the variation in size, shape, and length of the nose could include genetic factors, race, and environmental climatic conditions. The study was carried out in South Indian and North Indian populations.

The mean nasal index of North Indian and South Indian populations was identified. The predominant nose type of the North Indian population falls within the Leptorrhine and the South Indian population falls under the Mesorrhine type of nose which was similar to the findings of the previous studies. The nasal index was found to be significantly higher in males than in females in both populations. The findings of the study may contribute to satisfactory outcomes in cosmetic and reconstructive rhinoplastic surgery, designing of face masks, anthropology, and forensic medicine, especially in identifying the remains of the body. The human



nose is a dominant feature in facial region which differs in anatomy and morphology among racial groups and of the most characteristic differences during the analysis of ethnic and racial differences. The present study demonstrated that there was racial as well as sexual dimorphism in nasal ergonomics. Sex and ethnicity had considerable effects on nasal ergonomics-related anthropometric measurements.

The mean nasal index of the South India and North India has been determined. The North Indian female population nose type was Leptorrhine and the male population was Mesorrhine, while the South Indian female and male population nose type falls under Mesorrhine type of nose. This study provides normative data on a nasal index which will be an anthropometric tool in differentiating these ethnic groups, forensic medicine, reconstructive surgery, and rhinoplastic amongst the ethnic groups under study. The present study measured the average nasal parameters of males and females from South India and North India and compared them with each other and with the results found in the literature. Such regional study parameters will help in clinical practice, forensic medicine, and anthropological study. Anthropometric parameters are dependent on age, race, and sex so this warrants more regional studies should be done for the standardization of the values for the particular races in the world. It helps the physical anthropologists to know the migration pattern of the early civilization. The study concludes the type of nose affects gender when compared between the sexes but the nasal index calculated has little contribution to sexual dimorphism. Mesorrhine noses were found to be the most frequent among the population.

The result of this study revealed a clear ethnic difference in nasal parameters. The mean nasal index of both populations has been determined. This may be due to different etiological factors such as environment, genetic factors, geography, nutrition, and selection of lower age groups. The nasal index results computed in the present study are in agreement with reports on climate-related variation in the human nose suggesting that individuals who evolved from colder and drier climates tended to have smaller nasal index than individuals from warmer and more humid climates. So, this study concludes that sexual dimorphism is present among both South Indian and North Indian populations with the use of nasal index. The mean nasal index is higher in the South Indian population than in the North Indian population. The South Indian population falls under the Mesorrhine type of nose and the North Indian population falls under the Leptorrhine type of nose.

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