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NASAL MORPHOMETRY AMONG MEDICAL STUDENTS OF PAKISTAN: GENDER AND ETHNIC INSIGHTS

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ABSTRACT

Background: The human nasal morphometric study offers important insights into anatomical variances caused by environmental, ethnic, and genetic variables. Even individuals of the same race differ in morphometric parameters, such as height, length, thickness, and width of different body parts.
Objective: The purpose of this study is to evaluate the nasal morphometric measures of Pakistani medical students.
Methods: This cross-sectional study used stratified random sampling with an estimated sample size 424 to evaluate nasal height, breadth, and index among Pakistani medical students. Trained researchers took three measurements using digital calipers to ensure accuracy. SPSS was used to analyze the data using t-tests and ANOVA to find differences by gender and other variables. Participant confidentiality was guaranteed by informed consent and ethical approval.
Results: According to the study, males had higher nasal height, width, and index than females, indicating significant gender differences in nasal morphology. Participants primarily had mesorrhine nasal types, according to the total nasal index (65.4 ± 4.2). These results emphasize the significance of gender-specific factors in clinical and surgical procedures.
Conclusion: This study concluded that there were notable gender disparities in the nasal morphology of the medical students, with male students exhibiting higher nasal height, width, and index. Therefore, the morphine nasal type has highlighted the significance of geographical and gender-specific data for anthropological and therapeutic applications.

Keywords: Anatomy, Anthropometric Measures, Clinical Applications, Mesorrhine, Nasal Morphometry.

INTRODUCTION

The human nose has aesthetic and cultural value and is essential for respiratory and olfactory processes [1]. Forensic anthropology, medical device creation, and plastic surgery all depend on morphometric nose measurements [2]. Ethnicity is a major predictor of nasal dimension variations, which are impacted by both hereditary and environmental factors [3]. The skeletal framework, composed of bone and cartilage, gives the external nose its pyramidal form. The root of the nose is the top angle where the nose and forehead are continuous. The triangular base features two apertures known as the anterior nostrils or nares. The vestibule of the nose, which is the skin-lined portion of the nasal cavities, is reached by the two nostrils. The nasal septum behind and the columella in front separate the nasal cavity into left and right cavities. The free angle of the nose below, known as the tip of the nose, creates its apex. The dorsum connects it to the nose. The bridge refers to the top portion of the dorsum [4]. The external nose enhances a person's individuality and beauty [5].

Black people have broad, flat noses (Platyrrhine), oriental people have noses with intermediate proportions (Mesorrhine), and white people have thin, long, high noses (Leptorrhine) [6]. Based on the medial longitudinal axis's inclination, nostrils were divided into seven categories. Direct clinical measures (morphometry), photography (photogrammetry), lateral radiographs (cephalometry), and more recently, three-dimensional (3D) scans and digitizers, can all be used to assess the nose [7].

The nose serves several essential purposes. As the first line of defense against inhaled allergens, it filters, warms, and moistens the air breathed. It also functions as a sensory olfactory organ and influences speech production resonance [8]. Due to decreases in the interior dimensions of the nasal cavity and increases in airflow resistance, conditions like deviated septum and turbinate hypertrophy impact nasal geometry, nasal patency, and nose physiology [9].

Anthropologists and medical professionals have tried for ages to understand the idea of face beauty objectively. Renaissance painters highlighted that symmetrical and harmonious proportions are the foundation of face attractiveness. As neoclassical canons, their mathematical descriptions have endured and are still applied in reconstructive facial surgeries today [10]. A person's nose shape serves as a hallmark that identifies their sex, age, race, and ethnicity. Age, sex, and ethnic origin all affect anthropometric characteristics, and several writers have tried to record normative values that may be used as a guide. Because the nose is the focal point of the face, its size, shape, and proportions contribute to its attractiveness or handsomeness [1]. Surgeons doing nose reconstruction and aesthetic repair must be aware of the distinct proportions, shape, and anatomy of the human nose [11].

To analyze anomalies or the effects of aging and disease, or changes due to body growth, as well as ethnic and racial distinctions, it is necessary to determine nose types, nostril models, nasal profiles, and nose angles [12].

This research has focused on morphometric variations across races and ethnic groups. To create baseline morphometric measures, this study focuses on medical students, a group that represents Pakistan's different ethnic origins. These results are intended to close the information gap and guide anthropological and medical practices.

Objectives

The purpose of this study is to evaluate the nasal morphometric measures of Pakistani medical students.

METHODS

To evaluate the nasal morphometric measures of Pakistani medical students, a cross-sectional study was carried out. Students between the ages of 18 and 25 who had no prior history of nasal trauma, surgery, or congenital nasal abnormalities were the study's target population. To guarantee gender representation, a stratified random sample procedure was utilized. With a population percentage of 50%, a 95% confidence interval, and a 5% margin of error, the sample size was determined using Open-Epi (Version 3.01). This yielded a minimum sample size of 385 participants, which was then modified to 424 to account for dropouts. Participants were sat in a conventional anatomical posture while digital calipers were used to take anthropometric measures, such as nasal height (nasion to sub-

nasale), nasal width (widest distance between the alae), and nasal index (width-to-height ratio × 100). Measurements were taken by two experienced researchers, averaged, and repeated three times to ensure accuracy. Descriptive statistics were used to summarize means and ranges, while inferential tests such as ANOVA and t-tests were used to discover significant differences by gender and other characteristics. The data were analyzed using SPSS (Version 26). All subjects gave their informed permission and ethical approval was obtained from the institutional ethical committee, guaranteeing their anonymity and confidentiality throughout the study.

RESULTS

The study participants' demographic information is displayed in Table 1 according to their gender. The sample size was 424, with 212 males and 212 females equally represented. The participants' average age was 21.5 ± 2.0 years, and there was no discernible gender difference (p = 0.412). The biggest ethnic group was Punjabis (40.1%), followed by Sindhis (24.5%), Balochis (9%), Pashtuns (22.6%), and others (3.8%). Across ethnic groupings, no discernible gender disparities were found. Furthermore, 2.4% of individuals had congenital nasal abnormalities, and 4.7% had a history of nasal trauma; neither variable showed statistically significant gender variation as shown in Table 1.

Table 1- Demographic Details of the Participants

Variable	Total (n = 424)	Male (n = 212)	Female (n = 212)	p-value
Age (years)	21.5 ± 2.0	21.7 ± 2.1	21.4 ± 2.0	0.412
Ethnicity				
Punjabi	170 (40.1)	88 (41.5%)	82 (38.7%)	0.56
Sindhi	104 (24.5%)	88 (41.5%)	82 (38.7%)	0.711
Pashtun	96 (22.6%)	49 (23.1%)	47 (22.2%)	0.854
Balochi	38 (9%)	18 (8.5%)	20 (9.4%)	0.778
Other	16 (3.8%)	7 (3.3%)	9 (4.2%)	0.631
Nasal Trauma History				
Yes	20 (4.7%)	12 (5.7%)	8 (3.8%)	0.332
No	404 (95.3%)	200 (94.3%)	204 (96.2%)	0.332
Congenital Nasal Deformities				
Yes	10 (2.4%)	6 (2.8%)	4 (1.9%)	0.531
No	414 (97.6%)	206 (97.2%)	208 (98.1%)	0.531

As shown in Table 2 significant gender differences were seen in all parameters of the nasal morphometric analysis (p < 0.001). Males had a higher mean nasal height (5.4 ± 0.3 cm) than females (5.0 ± 0.3 cm). The mean nasal breadth of males was 3.6 ± 0.3 cm, while that of females was 3.2 ± 0.2 cm. Males had a greater nose index (67.0 ± 3.8), a crucial morphometric ratio, than females (63.8 ± 4.1).

Table 2-Participants' nasal morphometric measurements

Variables	Mean ± SD	Male Mean ± SD	Female Mean ± SD	p-value
Nasal Height (cm)	5.2 ± 0.4	5.4 ± 0.3	5.0 ± 0.3	< 0.001*
Nasal Width (cm)	3.4 ± 0.3	3.6 ± 0.3	3.2 ± 0.2	< 0.001*
Nasal Index	65.4 ± 4.2	67.0 ± 3.8	63.8 ± 4.1	< 0.001*

*p value < 0.01 is considered significant

As shown in Table 3 measurements of nasal morphometry showed clear ethnic disparities. When compared to other groups, Pashtuns had the greatest nasal index because they had the largest mean

nasal height (5.5 ± 0.4 cm) and breadth (3.6 ± 0.3 cm). Sindhis and "others" tended to have somewhat lower nasal indices, although Punjabis and Balochis had comparable nasal dimensions.

Table 3- Distribution of participants according to their ethnic groups

Variables	Punjabi	Sindhi	Pashtun	Balochi	others
Nasal Height (Mean ± SD, cm)	5.3 ± 0.4	5.1 ± 0.3	5.5 ± 0.4	5.2 ± 0.3	5.1 ± 0.3
Nasal Width (Mean ± SD, cm)	3.5 ± 0.3	3.3 ± 0.2	3.6 ± 0.3	3.4 ± 0.3	3.3 ± 0.2
Nasal Index (Mean ± SD)	66.0 ± 4.1	64.7 ± 3.9	3.6 ± 0.3	65.5 ± 4.0	3.3 ± 0.2
p-value	< 0.05*	< 0.05*	< 0.05*	< 0.05*	< 0.05*

*p value < 0.01 is considered significant

The relationship between nasal index categories and geographic regions is seen in Table 4. The majority of participants from Sindh and Northern Punjab were categorized as leptorrhine (mean nasal index < 70). On the other hand, the majority of people from Balochistan, Khyber Pakhtunkhwa, and Southern Punjab were mesorrhine (mean nasal index 70–84.9). Every nasal index regional variation was statistically significant ($p < 0.05$).

Table 4 Association between Nasal Index and Geographic Region

Geographical Location	Mean Nasal Index ± SD	Classification	p-value
Northern Punjab	64.8 ± 4.0	Leptorrhine	<0.05
Southern Punjab	66.2 ± 4.3	Mesorrhine	<0.05
Sindh	64.7 ± 4.6	Leptorrhine	<0.05
Khyber Pakhtunkhwa	67.5 ± 4.6	Mesorrhine	<0.05
Balochistan	65.9 ± 4.1	Mesorrhine	<0.05

As shown in Table 5, significant differences were found between gender-specific nasal morphometric classifications. Of the males, 80.4% were categorized as leptorrhine, compared to just 22.6% of the females. In contrast, females (72.6%) were more likely than males (8.4%) to be classified as mesorrhine. 6.6% of the population was classified as having platyrrhine (nasal index ≥ 85), with a larger percentage in males (100%) than females (4.8%).

Table 5- Nasal Morphometric Classifications according to Gender wise

Type of Nasal Morphometric	Male %	Female %	Total %
Leptorrhine (Nasal Index < 70)	170 (80.4%)	48 (22.6%)	72 (17.0%)
Mesorrhine (Nasal Index 70–84.9)	18 (8.4%)	154 (72.6%)	326 (76.9)
Platyrrhine (Nasal Index ≥ 85)	214 (100%)	10 (4.8%)	28 (6.6%)

DISCUSSION

In terms of both appearance and functionality, the human nose is vital. The purpose of this study on the nasal morphometry of Pakistani medical students was to investigate gender-related variations in nasal dimensions and close the anthropometric data gap for this group.

According to the findings, there were notable gender variations in nasal morphology, with men having higher nasal height, breadth, and index than females. This result was consistent with a large body of research that has discovered comparable gender-based variations in nasal morphometry among many ethnic groups [13].

In the study, men had greater mean nasal height, breadth, and nasal index (5.4 cm, 3.6 cm, and 67.0, respectively) than females (5.0 cm, 3.2 cm, and 63.8, respectively). The overall sexual dimorphism reported in craniofacial morphology, where men often have more prominent characteristics, such as larger and higher noses, maybe the cause of the observed gender differences [14]. Consistent with research on Asian people [15]. According to this index, the nasal shape falls somewhere in between

the long, narrow noses (leptorrhine) seen in Caucasian groups and the broad, flat noses (platyrrhine) found in African populations [16].

Because of the region's ethnic variety, the morphine type is common among South Asian groups, especially Pakistanis [17]. This can shed light on Pakistani people's morphometric traits, which may help guide clinical procedures like rhinoplasty and nasal surgery.

The study's overall findings on nasal sizes and kinds indicate that, as a sample of Pakistan's ethnic variety, medical students there primarily display traits common to South Asian populations. Understanding the usual nasal anatomy of various groups was crucial for developing more culturally and ethnically acceptable surgical results, which makes these findings important for forensic anthropology as well as reconstructive and cosmetic operations [18].

The significance of comprehending nasal morphometry for a range of clinical and cosmetic applications has been reaffirmed by recent research. For instance, ethnic-specific nasal characteristics were now receiving more attention as a result of the growing usage of virtual reality and 3D scanning technology in nose surgery planning [19]. As demonstrated by studies in rhinoplasty where ethnic nasal characteristics were taken into consideration when planning procedures, reconstructive surgeons must have a thorough understanding of the specific nasal dimensions of various populations to achieve more natural and culturally appropriate outcomes [20].

The study has highlighted significant ethnic variations in nasal morphometry within Pakistani populations. The research has focused on the Punjabi population and reported a mean nasal index of 66.02, categorizing the nose shape predominantly as leptorrhine (narrow-nosed) [21]. The significance of taking ethnic-specific nasal features into account while conducting clinical evaluations and therapies is highlighted by these findings. This work also supports the expanding understanding of the use of anthropometric measures in anthropological and forensic research. To identify people or ascertain their ancestry, forensic anthropologists need to be able to evaluate demographic characteristics from skeletal remains or even facial features. Furthermore, even though the study offers valuable insights into nasal morphometry, it is crucial to remember that more representative and generalized data would be produced with a larger sample that includes a variety of ethnic groups from around Pakistan.

However, the study's single-center design limits the sample's representativeness, which limits its application. Larger, multi-center cohorts should be used in future research to capture a wider variety of geographical variances and ethnic origins. Furthermore, investigating how environmental influences affect nasal shape might improve the comprehension of the topic. With a request for more inclusive research that takes into consideration the population's ethnic and environmental variety, these findings ultimately serve as a fundamental reference for enhancing therapeutic and anthropological applications. This study provides baseline nasal morphometric information for Pakistani medical students, identifying a leptorrhine phenotype and notable gender differences. These results highlight how crucial region-specific morphometric research was to improve forensic, surgical, and therapeutic applications. These results highlight the necessity of taking ethnicity into account while practicing medicine and aesthetics. To improve the knowledge of the topic, future studies should examine how genetic and environmental variables influence nasal shape in a larger sample of people from various ethnic origins.

CONCLUSION

This study highlights notable gender disparities in nasal dimensions and offers insightful information about the nasal morphometry of Pakistani medical students. In line with documented sexual dimorphism in craniofacial traits, male students showed bigger nasal height, breadth, and index than female students. Additionally, the study found that most individuals had a mesorrhine nasal type, which is typical of South Asian ethnicities. These results highlight how crucial it was to take gender and ethnic features into account when doing therapeutic procedures like forensic anthropology and rhinoplasty.

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