RESEARCH ARTICLE

Area of Nasal Triangle in an Adult Human Dry Skull: An Anatomical Study

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Abstract

Background: The nose is a piriform aperture on the face having roots and a tip or base. Root is continuous above with the forehead. The nose is one of the most prominent parts of the face which comprises of bony and cartilaginous portions. The bony part is formed by nasal bone, frontal bone, and maxilla. The cartilaginous part is mainly formed by septal, major alar, lateral cartilage, and a few minor cartilages. Present study was carried out with objectives of determining important measurements like distance between right and left infraorbital foramina to nasion, distance between right and left infraorbital foramina and nasal height. Then findings are used to determine nasal index.

Methods: All twenty-five dry adult human skulls are collected from the Department of Anatomy, School of Basic Science, and Chitwan Medical College for study. Gender and ethnicity of scapula were undefined. The ethical clearance was taken from IRC-CMC (Ref: CMC-IRC/079/080-050). All damaged skulls and small skulls of pediatric age group are excluded. Nasal index was calculated by using formula nasal index = nasal width / nasal height X 100. Photographs were taken. Statistical analysis was done using SPSS 20 version software and analyzed as frequency and distribution. Total twenty-five of skulls were measured.

Results: Among the twenty-five human dry skulls, with one damaged skull is excluded, study showed that right sided mean distance between nasion and right sided infraorbital foramen and left sided mean distance between nasion and left sided infraorbital foramen were 40.57 ± 3.71 mm and 39.53 ± 4.77 mm respectively. The mean distance between right and left infraorbital foramen, mean nasal height, and mean nasal index were 46.80 ± 8.52 mm, 16.98 ± 3.008 mm and 47.74 ± 10.90 respectively mm.

Conclusion: The data obtained from the present study may be useful when repairing the nose, for facial reconstructive surgeries and in forensic investigation.

Key Words: *Nasal index; Nasal height; Nasal width; Nasal type*

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Introduction

Anthropometry is the measurement of man that provides scientific methods and techniques for taking various measurements and observation on living man and skeleton. It represents the typical and traditional tool of physical anthropology. Anthropology may conveniently subdivide into following sections: a) somatometry b) osteometry c) craniometry. Somatometry is measurement of the living body including head and face. Osteometry is measurement of skeletal long and short bones. Craniometry is measurement of skeletal brain cavity and face [1].

Bone can be classified on the basis of morphology, development, region, arrangement of matrix. Therefore, the bone of the skull can be classified as flat, axial bone. The skull can be divided into two parts: the neurocranium and viscerocranium. Neurocranium forms a protective case around the brain. Viscerocranium forms the skeleton of face. The dimensions of nasal triangle are determined by using the bony landmarks of facial skeleton [2].

The external nose is the visible portion that projects from the face; its skeleton is mainly cartilaginous. Noses vary considerably in size and shape, mainly because of differences in these cartilages. The dorsum of the nose extends from the root of the nose to the apex (tip) of the nose. The inferior surface of the nose is pierced by two piriform (L. pear-shaped) openings, the nares (nostrils, anteriornasal apertures), which are bound laterally by the alae (wings) of the nose. The superior bony part of the nose, including its root, is covered by thin skin [3].

The nasion is an important landmark of skull. It is the meeting of some skull sutures including internasal suture, frontonasal suture on each side and frontal suture. The frontal suture usually disappears within the first two years of life [4].

Different parameters are measurable in the nose like nasal height, breadth, nasofrontal angle, nasofacial angle, nasolabial angle etc. These parameters vary with respect to gender, race, ethnicity, and environmental factors. The nasal index is a regional and racial-sensitive anthropometric index. The nasal index was calculated by dividing nasal width and nasal height, multiplied by 100 [5].

On the basis of nasal index, the nose can be categorized into five types [5].

Type of nose	Nasal index value	Nature
Hyper Leptorrhine	≤ 54.9	Very long and narrow nose
Leptorrhine	55 to 66.9	Long and narrow nose
Mesorrhine	70 to 84.9	Moderate nose
Plastyrhine	85 to 99.9	Broad nose
Hyperplatyrrinne	>100	Very broad nose

Nasal parameters are also important for aesthetic and reconstructive surgery and genetic counseling in different sexes. Such study can be a crucial not only for identifying gender but also for facial cosmetics or rhinoplasty surgeons. The study findings can be beneficial for forensic experts, physical anthropologists, and future researchers. The aim of the present study is to determine the anthropometric data regarding parameters of nasal triangle in Nepalese population.

Material and Methods

A descriptive, cross-sectional study was conducted on twenty-four dry adult human skulls available at the basic science block in Chitwan Medical College between September to November 2022. Measurements were taken

in mm with the help of digital vernier caliper (Precision Tool Corporation, Pune, Maharashtra, India: 150 mm / 6 inch; Stainless Steel Hardened Model). Prior approval of Institutional Ethics committee was taken before commencement of study (Ref: CMC-IRC/079/080-050). The dimensions of nasal triangle were determined by performing three different measurements: distance between right and left infraorbital foramina to nasion and distance between right and left infraorbital foramina. Nasal index was calculated after measurement of nasal height and nasal width (distance between right and left infraorbital foramen. The gender and ethnicity of skull was undetermined. Measurements were taken in mm with the help of Digital Vernier Caliper. All measurements were taken by the same investigator with the help of the same digital vernier caliper. All measurement was taken three times to avoid observational biasness and calculated mean of them is recorded as data. Measurement was performed at same time period from 10 am to 12 noon to avoid diurnal variation. The bony landmarks were well marked before measurements. The damaged skull, small skull of pediatric age group and skull having anomalies were excluded from measurement. These skulls belong to the Department of Anatomy, School of Basic Science, Kailashnagar, Chitwan Medical College, Bharatpur-5 Chitwan Nepal. The obtained data was analyzed statistically using SPSS 20 version software.

Instruments: Digital Vernier Caliper, Lead Pencil, Pen, Color marker (Figure 1).

Figure 1) *Photograph showing digital vernier caliper.*

Method: The skull was placed on table and all points were marked and errors in the measurement were minimized

Measurements to be taken: (Figures 2 -5)

Figure 2) *Photograph showing measurement of distance between the right infraorbital foramen and nasion.*

Figure 3) *Photograph showing measurement of distance between two infraorbital foramina.*

Figure 4) *Photograph showing measurement of distance between left infraorbital foramen and nasion.*

Figure 5) *Photograph showing measurement of nasal height.*

Results

Among the twenty-five human dry skulls, one damaged skull is excluded from the study. The right sided mean distance between nasion and right sided infraorbital foramen and left sided mean distance between nasion and left sided infraorbital foramen are 40.57 ± 3.71 mm and 39.53 ± 4.77 mm respectively as shown in table 1.

The mean distance between nasion and left infraorbital foramen is 39.53 ± 4.77 mm as shown in table 2.

The mean distance between right and left infraorbital foramen is 46.80 ± 8.52 mm as shown in table 3.

The mean nasal height is 16.98 ± 3.008 mm as shown in table 4.

The mean nasal index is 47.74 ± 10.90 mm i.e., Hyper Leptorrhine as shown in table 5.

A negative correlation was observed between the distance between right and left infraorbital foramen and nasal index. No significant correlation was observed between nasal height and nasal index as shown in table 6.

TABLE 1

Descriptive statistics of distance between nasion and right sided infraorbital foramen (n=25).

	Mean (mm)	Maximum	Minimum
Right sided distance between nasion and right sided infraorbital foramen	40.57 ± 3.71	49.91	37.07

TABLE 2

Descriptive statistics of distance between nasion and left sided infraorbital foramen (n=25).

	Mean (mm)	Maximum	Minimum
Left sided distance between nasion and right sided infraorbital foramen	39.53 ± 4.77	47.32	33.08

TABLE 3

Descriptive statistics showing distance between right and left infraorbital foramen (n=25).

	Mean (mm)	Maximum	Minimum
Distance between right and left infraorbital foramen	46.80 ± 8.52	60.64	46.8

TABLE 4

Descriptive statistics showing nasal height (n=25).

	Mean (mm)	Maximum	Minimum
Distance between right and left infraorbital foramen	16.98 ± 3.008	29.47	21.62

TABLE 5

Descriptive statistics showing nasal index(n=25).

	Mean (mm)	Maximum	Minimum
Nasal index	47.74 ± 10.90	73.44	32.52

TABLE 6

Correlation between nasal height and distance between right and left infraorbital foramen with nasal index (n=25).

		Nasal index
Distance between right and left infraorbital foramen	Pearson coefficient	-0.806
Nasal height	Pearson coefficient	0.327

Discussion

The present study deals with measurements like distance between right and left infraorbital foramina to nasion, distance between right and left infraorbital foramina and nasal height of dry twenty-five (one damaged skull excluded) adult skulls of Nepalese origin. Similar studies have been conducted by different researchers in other races and groups of population. The findings of the present study were compared with those of other studies.

In the study by Neupane et.al conducted among one hundred and eighty-four 184 total medical students, 114 (61.9%) were Nepalese and 70 (38.1%) were Indian. In the Nepalese cohort, mean nasal height for male students was 4.58 ± 0.37 cm which was higher than females (4.39 ± 0.34 cm). The mean nasal index was higher among males in students of both the countries. The mesorrhine was most common type of morphology found among all students. The findings were in contrary to the present research because of the difference in research methodology and living human candidates being of different nationality [5].

Sah *et al.,* conducted a study on one hundred participants of young age group 17-45 years of Madhesi origin. The study showed that mean

value of nasal height for male and female is 52.59 ± 1.89 and 50.27 ± 2.16 mm and the nasal width for male and female is 37.64 ± 1.72 mm and 35.42 ± 2.04 mm and the value of mean nasal index for both the sexes are 71.59 ± 2.31and 70.58 ± 3.04 respectively. The dominant type of the nasal index in both the sexes are the mesorrhine type and the leptorrhine type as well. The difference in findings with present research could be due to defined age a group (17-45 years) of equal proportion of gender of only madeshi origin [6].

Koirala *et al.,* studied Nasal index of 500 males and 500 females aged between 25-45 year the Nepalese Tharu and Mongoloid population. The findings were different from the present study due to being the mixed or unidentified race, gender and undetermined age group [7].

Ray *et al.,* conducted a study on three hundred students of age group 18-30 years which showed Mean nasal index was 73.98 ± 1.9 i.e., mesorhinne. The mean nasal height was 3.625 ± 0.155 cm. The findings are inconsistent with the present study due to the defined age group and specified gender as well as difference geographical distribution and topography [8].

Shrestha *et al.,* conducted a study among one hundred and forty dental students of Kantipur

Dental College showed that mesorhinne type is common. The mean nasal index of total population was 81.34 ± 14.88 mm i.e., mesorhinne type. The findings were in contrary to the present study due to defined age young group and variations in research methodology [9].

Shah *et al.,* performed a comparative study between adult one hundred male Santhals and one hundred Bengalis in Santhals and Bengalis of Bangladesh. The findings are in variation with present study due to the variation of ethnicity, race, and greater sample size [10].

Radha *et al.,* conducted studied among South Indian population of 17-23 years age of both genders. The result showed that the mean height and breadth of nose in males were 55.75 mm and 37.26 mm and for females were 53.89 mm and 34.59 mm. Nasal index was found to be 67.0 for males and for 64.8 females. Most common nasal type was found to be Leptorrhine followed by Mesorrhine type [11].

Hegazy *et al.,* conducted a study on nasal index of Egyptians. Mean nasal index was investigated to be 68.01 mm that falls under leptorhinne type. The differences in findings are due to the variation in race, ethnicity and greater sample populations [12].

Adveral *et al.,* conducted a study on area of nasal triangle of two hundred and forty-two Brazilian dry human skulls. The study showed that distance between infraorbital foramen is 53.0 to 56.0 mm (mean 53.00 mm) in male and 50.7 to 56.0 mm (mean 53.7 mm) in female; distance between right Infraorbital fossa and nasion ranged from 44.1 mm to 49.00 mm and left infraorbital foramen to nasion ranged from 44.00 mm to 48.00 mm. The findings are in proximity with present study due to the similar research methodology, measurement methods

and equipment used for measurements [13].

Badam *et al.,* and Patil *et al.,* conducted a studied one hundred skull radiologically. In both studies, the nasion was used as a reference point in order to establish and compare results between the sexes. In this study, the findings are greater in male than female [13,14]. These studies help to make comparisons between the radiological findings of these study with the findings of present study [14,15].

KC *et al.,* researched on Nasal Parameters and Facial Index in Medical one hundred and fifty-six Undergraduates (both Indian and Nepalese) at Lumbini Medical College. The study showed that the nasal index in male 76.25 ± 7.75, female 75.70 ± 8.05); nasal height 4.91 ± 0.35 cm in male and 4.58 ± 02 cm in female. The variation was observed in contrary to study as result of age group and mixed population of two countries [16].

Above mentioned articles [4-11,13] can be used to make a comparison between the radiological findings of them with the present research.

Conclusion

The finding present study is in close proximity with the findings of other study conducted earlier, due to similar geographical distribution topography, dietary pattern and habits, similar research methodology. The findings of research could be important for aesthetic and reconstructive surgery and genetic counseling in different sexes. Such study is crucial not only for identifying gender but also for facial cosmetics or rhinoplasty surgeons, forensic experts, physical anthropologists, and future researchers.

References

1. Singh IP, Bhasin MK. A laboratory manual on biological anthropology. (1stedn), Kamla Raj Enterprises, New Delhi, India. 2006.

2. Standring S. Gray's Anatomy: Anatomical basis of clinical practice. (41stedn), Elsevier, London. 2016.

3. Moore KL. Clinically oriented anatomy. (6thedn), Walter Kluwer Health / Lippincott Williams and Wilkins, Philadelphia. 2010.

4. Hegazy AA. Skull sutures as anatomical landmarks. The Sutures of the Skull. 2021;pp:129-46.

5. Neupane B, Iyer K, Sigdel B. Role of nasal parameters in gender determination among medical students. J-GMC-N. 2021;14:118-21.

6. Sah Sk, Tamang MK, Chaudhary D, et al. Anthropometric study of nasal index among the youth of Madheshis community of Nepal. Int J Human Anat. 2021;2:28-32.

7. Koirala S, Shah S, Khanal L. Nasal index of the Tharu and Mongoloid population of Nepal: a cross sectional study. ROMJ. 2014;3.

8. Ray S, Saha K, Kumar A. Anthropometric study of nasal index among the population of western Uttar Pradesh region. Int J Sci Stud. 2016;4:65-70.

9. Shrestha R, Manandhar B, Upadhyay HP, et al. Mean nasal index of dental students of a dental college in Nepal. JNMA. 2019;57:88-91.

10. Shah MRI, Anwar S, Mondal DK, et al. Anthropometry of the nose: a comparative study between adult male Santhals and Bengalis in Bangladesh. Mediscope. 2015;2:28-32.

11. Radha K, Srinivasan KR. Nasal index: A cross sectional study among south Indian population. Indian J Clin Anat Physiol. 2019;6:201-4.

12. Hegazy AA. Anthropometric study of nasal index of Egyptians. Int J Anat Res. 2014;2:761-7.

13. Aragao JA, Silveira MPM, Cisneiros de Oliveira LC, et al. Determination of sexual dimorphism from the area of the triangle. MOJ Anat Physiol. 2017;3:79-82.

14. Badam R, Manjunath M, Rani M. Determination of sex by discriminant function analysis of lateral radiographic cephalometry. J Indian Acad Oral Med Radiol. 2011;23:179-83.

15. Patil KR, Mody RN. Determination of sex by discriminant function analysis and stature by regression analysis: a lateral cephalometric study. Forensic Sci Int. 2005;147:175-80.

16. KC S, Shrestha S, Bhattarai L. Nasal parameters and facial index in medical undergraduates: a cross sectional study. J Lumbini Med Coll. 2022;7:81-7.