



# Comparison of Nasal Index Between Northwestern Nigeria and Northern Iranian Populations: An Anthropometric Study

Akanji Omotosho Dhulqarnain<sup>1,2</sup> · Tahmineh Mokhtari<sup>3</sup> · Tayebeh Rastegar<sup>2</sup> · Ibrahim Mohammed<sup>1,2</sup> · Sahar Ijaz<sup>1,2</sup> · Gholamreza Hassanzadeh<sup>2,3</sup>

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## Abstract

**Purpose** The nasal index has a great value in anthropological studies, because it is one of the anthropometric indices acknowledged in nasal surgery as well as management. Anthropometric studies are very important area for craniofacial surgery and syndromology. The aim of this research was to compare the nasal characteristics between northwestern Nigerian and Iranian populations and compare them with other studies.

**Methods** The nasal breadths and heights were measured from 400 individuals with 200 participants from Hausa ethnic group of northwestern Nigeria and 200 participants from Northern Tehran, Iran. Nasal index (NI) was calculated and analyzed statistically.

**Results** There were significant difference in the nasal breadth ( $P = 0.0001$ ), height ( $P = 0.0001$ ) and NI ( $P = 0.0001$ ) of sex groups in both Iranian and Nigeria population. The distribution of the nasal shapes for Iranian population is 127 leptorrhine (31.9%), 62 mesorrhine (15.6%) and nine platyrrhine (2.3%), while Nigeria population has 120 mesorrhine (30.2%), 75 leptorrhine (18.8%) and five platyrrhine (1.3%). This shows that Nigeria Hausa population has predominantly mesorrhine nose shape, while Northern Iranians are leptorrhine.

**Conclusion** The NI of males is higher than females in both population and this study can be of clinical and surgical interest in Rhinology. We recommend further studies to compare the NI of Nigeria and Iranian population of different ethnic groups and with other countries.

**Keywords** Anthropometry · Nasal index · Iranians · Nigerians

## Introduction

Variation in human is of great importance to scientists for effective diagnoses and treatment of diseases and to classify human based on race and ethnicity. This is attributed to many factors including genetic mutation and law of natural selection. Over the years, anthropometry has been an important tool in studying variations in human. The knowledge of anthropometry has proven to be useful in studying variations in human. Throughout the world, there are remarkable differences in facial morphology in different races [1]. Therefore, facial anthropometric study is a useful tool in facial reconstructive surgery, forensic analysis and in genetic counseling [2–4].

Many researchers have indicated the use of nasal anthropometry to categorize human into different races [5]. Aside variations in races, it has been reported that individuals of varying ethnic groups, age, sex and culture also exhibit differences in nasal anthropometry parameters [6, 7].

Nasal anthropometry is the measurements of the size, proportion and shape of human nose [8]. In human, the part of the nose that projects forward from the face is the external nose [9] and is variable in shape. Nasal index is a useful tool in anthropology to differentiate sexual [10], ethnic and racial changes and is now an important tool used

✉ Gholamreza Hassanzadeh  
hassanzadeh@tums.ac.ir

<sup>1</sup> International Campus, Tehran University of Medical Science, Tehran, Iran

<sup>2</sup> Department of Anatomy, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran

<sup>3</sup> Legal Medicine Research Centre, Legal Medicine Organisation, Tehran, Iran

in forensic science [6, 11]. The shape is determined by the nasal septum and ethmoid bone. The nasal septum majorly consists of cartilage that partitions the nostrils. Because of the ethnic differences, human nose appears in different sizes and shapes [12] which is dependent upon the environmental climatic condition [13]. Narrow noses are naturally present in dry and cold climates while broad noses thrive in moist and warm regions as result of natural selection in human evolution [14]. Thus, nasal index corresponds with nasal size, oxygen utilization, average temperature and humidity in different regions [15].

The human nose are 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 [5].

Nasal index is an important parameter in anthropometry in determining the sex and race to which an individual belongs to [6, 11, 16]. It is denoted by the ratio of the width to the height of the nose expressed in percentage [17].

In living individuals, the height is the distance from the nasion (point of intersection of the internasal suture with the frontal bone) to the subnasal (intersection of the nasal septum with the upper lip) and the width of the nose is measured from the right ala or nasal wing to the left ala or nasal wing in anatomical position. Based on nasal index, the human nose can be grouped in to five categories as described in Table 1 [11, 18].

Many researches on nasal index have been conducted among diverse ethnic groups in different countries. From these studies, individuals within the same ethnic groups in the same climatic condition have the same nose type [19]. The aim of this study is to compare the nasal index of northwestern Nigerian male and female population and Northern Iranian male and female population.

## Materials and Methods

This study is cross-sectional study carried out in north-western part of Nigeria on 200 volunteered participants (100 males, 100 females) and 200 adult individuals of Northern Iran (100 males and 100 females). Participants from 16 to 60 years of age were selected and informed consent form was obtained from all participants. None of the participants had history of physical deformities, nose or facial surgery and trauma and without any history of facial defects like cleft of lip or palate. A data gathering form with information including age, ethnicity, gender and other useful personal bio-data were filled for each subject. Nasal widths and heights were measured with the aid of manual spreading venire caliper by a single observer to avoid errors using the standard method described by Anas and saleh [19]. Here, individual participant was seated in a relaxed position with his or her head positioned anatomically (face anteriorly) and measurements taken. Nasal width was measured and recorded as a straight distance from right ala to left ala and nasal height measured as the distance from the nasion to the sub-nasale (Fig. 1).The nasal index was calculated as follows: Nasal index = nasal width/nasal height × 100 [17]. Based on nasal height, breadth and nasal index, Martin and Sallar [20] categorized noses as described in Table 1.

Statistical analysis was done on the data obtained. Basic descriptive statistics and independent sample t test were carried out by a computerized statistical analysis software—SPSS (Statistical Package for Social Sciences and Microsoft Excel Windows 2007). The *P* value of less than 0.001 was considered statistically significant.

## Results

The results of the statistical analysis with respect to the measurement of nasal variables of nasal width, nasal heights and nasal index of males and females in the two studied regions are given in Tables 2, 3, 4 and 5. In this study, 100 males (25%) and 100 females (25%) from Iranian population and 100 males (25%) and 100 females (25%) from Nigerian population were evaluated for the

**Table 1** Nasal classification based on nasal index

Categories	Size of nose	Nasal Index	
		On living head	On Skull
Hyperleptorrhine	Long narrow nose	40–54.9	–
Leptorrhine	Moderately narrow nose	Less than 70	Less than 47
Mesorrhine	Moderate or medium size	70–84.9	47–50.9
Platyrrhine	Moderately wide nose	85–99.9	51–57.9
Hyperplatyrrhine	Very wide nose	100 or more	58 or more

**Fig. 1** Measurement of nasal width and height



**Table 2** Statistical analysis of nasal parameters in Iranian and Nigeria Populations

	Populations		P value
	Iranians	Nigerians	
Width (mm)			
Mean	34.89	39.15	0.0001
SD	3.92	4.27	
Min	25.00	30.10	
Max	49.30	53.70	
Height (mm)			
Mean	51.81	54.56	0.0001
SD	4.31	4.76	
Min	42.10	42.00	
Max	62.40	66.50	
Nasal Index			
Mean	68	72	0.0001
SD	8	7	
Min	49	54	
Max	95	91	

nasal index. The descriptive analysis of data is given in Table 2, 3, 4 and 5.

There was a significant difference in the nasal width ( $P = 0.0001$ ), height ( $P = 0.0001$ ) and nasal index ( $P = 0.0001$ ) of sex groups as given in Table 3.

The nose types for Iranian and Nigeria population based on the nasal index (Table 4) and its distribution in this study were as follows: in Iranian population: 127 leptorrhine (31.9%), 62 mesorrhine (15.6%) and 9 platyrrhine (2.3%) and in Nigerian population: 120 mesorrhine (30.2%), 75 leptorrhine (18.8%) and 5 platyrrhine (1.3%) types. The distribution of nose types in the sex groups is illustrated in Table 5. The most nasal shape frequency is related to leptorrhine in both Iranian male and female, while the mesorrhine type is predominant in Nigeria male.

However, there is no significant difference in leptorrhine and mesorrhine in Nigerian female group.

## 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 [21]. Researchers believed 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 term 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 Iranian and Nigerian population. Based on nasal index, the human nose can be classified into three: leptorrhine or fine nose with nasal index of 69.9 or less, distinguished by the least prominent ala lobule with a well-defined nasal tip; mesorrhine or medium nose with nasal index of 70.0–84.9 characterized by a less prominent lobule and a more defined nasal tip and platyrrhine or broad nose with nasal index of 85 and above with a very prominent ala lobule with a rounded nasal tip [22].

The nose type can affect the psychological and social functioning of a person [23]. Therefore, nose surgery is a common and crucial surgical procedures in plastic surgery, because it alters the shape and size of the nose and plays a major role for 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 be adopted for different nose types and shapes. Rhinoplasty is always dependent on a well-detailed preoperative analysis, and nasal index plays a central role in this analysis. It is also very important in forensic research and to study variations among living populations [24]. In the preoperative analysis for nose reconstructive surgery, it is necessary to consider the nose features and parameters for a particular ethnic or racial group for the final facial appearance to correlate with the facial proportions in that particular group. Different researches have shown the high ethnic and racial sensitivity of nasal index and significant differences in nasal indices among different populations. Leptorrhine nose type with a nasal index of 69.9 or less characterizes the Caucasian race, African nose are majorly known to be platyrrhine type with nasal index of 85.00 and higher, whereas the Indo-Aryan or Caucasoids ancestry possess mesorrhine nose type [25]. Several researches have revealed that the mean, median, minimal and maximal width, height and the NI in males are higher than the females.

**Table 3** Descriptive statistical analysis of nasal index of males and females in Iranian and Nigeria population

	Sex				P value
	Iranian males	Iranian females	Nigerian males	Nigerian female	
Width (mm)					
Mean	37.23	32.55	41.33	36.97	0.0001
SD	3.41	2.87	3.85	3.48	
Min	27.00	25.00	31.50	30.10	
Max	49.30	43.80	53.70	49.10	
Height (mm)					
Mean	54.19	49.43	55.93	53.18	0.0001
SD	3.97	3.18	3.86	5.18	
Min	42.10	43.00	46.10	42.00	
Max	62.40	57.50	65.50	66.50	
Nasal index					
Mean	69	66	74	70	0.0001
SD	8	8	7	7	
Min	49	49	56	54	
Max	94	95	89	91	

SD standard deviation, Min minimum, Max maximum

**Table 4** Frequency (percentage) of nose shapes of Iranian and Nigeria populations

Shape	Populations				P value
	Iranians		Nigerians		
	N	%	N	%	
Leptorrhine	127	31.9	75	18.8	0.0001
Mesorrhine	62	15.6	120	30.2	
Platyrrhine	9	2.3	5	1.3	

The ethnic and racial morphometric variations in the nasal complex throughout the world population have been the center of focus [10, 26–30]. Enough information is not available in the literature on the comparison between

African and Asian populations. We therefore, compared our results with the studies available in the literature. Ten nasal anthropometric measurements were compared with the results outlined by Farkas et al. [28] for Turkish population, Ofodile and Bokhari [31], African, Afro-Caucasian, Caucasian and Afro-Indian, Ochi and Ohashi [26], Chinese population, Xueting et al. [10] for Han nationality, Japanese population, Aung et al. [27], Canadian-Caucasian adults, Borman et al. [30] and Afro-American population, Ofodile et al. [32].

In this study, the mean nasal height for Iranian males is 54.19 mm, Iranian females (49.13 mm), while Nigeria males is higher than that of Iranian males and females with mean value of 55.93 mm (Table 3). Nigeria female has a value of 53.18 mm, higher than the Iranian females (Table 3). Iranian population has a mean nasal height value of 51.81 mm while the Nigeria population has a value of

**Table 5** Frequency (percentage) of nose types in Iranian and Nigerian males and females

	Sex			
	Iranian males	Iranian females	Nigerian males	Nigerian female
Leptorrhine				
N	54	73	25	50
%	13.6	18.3	6.3	12.6
Mesorrhine				
N	40	22	71	49
%	10.1	5.5	17.8	12.3
Platyrrhine				
N	5	4	4	1
%	1.3	1.0	1.0	0.3

54.56 mm (Table 2). Our results for Iranian male and female nasal heights are similar to a research conducted by Fatimah et al on Iranian university students which showed that the mean nasal height for Iranian males and females is  $54.22 \pm 3.97$  and  $49.4 \pm 3.17$  mm, respectively [33]. The mean nasal height value for Iranian population (51.81 mm) is lower than what was obtained in populations from different regions: Slovakia (53.50 mm), Poland (53.70 mm), Germany (52.00 mm), North America (53.00 mm), Bulgarian (54.00 mm), Czech (54.00 mm), Croatian (53.80 mm), Hungary (55.00 mm) Greece (55.50 mm), Azerbaijan (55.90 mm), Slovenia (56.20 mm), Portugal (59.50 mm) [34], Turkish male (56.92 mm) [34], Turkish female (55.20 mm) [35], Caucasian (53.00 mm), Afro-American (52.40 mm), Afro-India (54.70 mm) [35]. This is slightly more than the result from Russian population (51.7 mm) [34]. This shows variations in nasal height among different populations. Omotoso et al classified adult Nigerian Bini ethnic group from Southern Nigeria into four different age groups and obtained the following mean values of nasal heights for male and female: male (44.50 mm), female (43.80 mm) for individuals in the age range of 15–20 years; male (45.70 mm), female (44.20 mm) for 21–25 years of age; male (46.80 mm), female (44.70 mm) for 25–30 years age range and male and female within the age range of 31–35 years old have mean values of 47.20 mm and 45.90 mm, respectively [36]. These results from Omotoso et al. are significantly lower than our mean values of nasal heights for Nigerian males and females from northern-western Nigeria. All these data and our results clearly indicate variations in nasal parameters of individuals in different races and different ethnic groups.

The mean value of the nasal breadth for both Iranian male and female population is 37.23 and 32.55 mm respectively, with 34.89 mm recorded for the mean value of Iranian population which is significantly lower than the mean value for Nigerian population (39.15). The values for the Nigerian males and females nasal breadth are 41.33 mm and 36.97 mm, respectively (Table 3). The nasal breadth for Iranian men and women as determined by Fatimah et al is 37.16 and 32.49 mm, respectively [33], which is similar to our results for Iranian males and females. A study carried out on Russian population revealed a mean nasal breath of 35.8 mm [34], Turkish male—55.26 mm [35], Poland—35.20 mm, Azerbaijan—35.70 mm, Slovenia—35.90 mm, Czech Republic—36.20 mm, Croatia—36.50 mm, Russia—35.80 mm, Portuguese—36.60 mm, Turkish male—36.80, Greece—35.70 mm, Bulgaria—36.00 mm [34], Serbia—36.7 mm [37] which are significantly higher than our mean value of nasal breadth for Iranian population. But our mean value of nasal breadth for Iranian population is higher than the

values obtained for the following regions: Italia—32.1 mm, Slovakia—33.60 mm, Germany—34.00 mm, North America—34.70 mm. Omotoso et al obtained the following mean values of nasal breadth for male and female based on different age groups in Nigeria Southern Bini ethnic groups: 15–20 years age (male 43.20 mm, female 42.0 mm), 21–25 years (male 44.50 mm, female 43.40 mm, 25–30 years (male 45.40 mm, female 43.60 mm) 31–35 years (male 46.4 mm, female 44.20 mm). These results are higher than our mean values of nasal breadth for northwestern Nigeria male and female populations of 41.33 and 36.97 mm, respectively.

The mean nasal index obtained for Iranian males and females in this study is 69 and 66, respectively. This is similar to the value of the nasal indices obtained by Fatimah et al for Iranian men and women which are 68.91 and 66.05, respectively [33]. The mean value of nasal index for the Iranian population in this study (68.00) (Table 2) is higher than the populations of different countries: Azerbaijan (64.26), Armenia (63.80), Lebanon (63.30), Damascus (63.26) [24], Montenegrins of Vojvodina-Serbia 62.93 and 60.61 for male and female respectively [38], North America (64.85), Bulgaria (65.00), Germany (62.85), Czech Republic (65.96), Italy (56.85), Hungary (65.80), Poland (64.6), Slovakia (62.35), Portugal (58.35), Turkey (61.45), Egypt (60.55) [34] which all fall within the Leptorrhine nose type. For Nigeria Males and females, we obtained the mean nasal index values of 74.00 and 70.00, respectively (Table 3). This mean value of nasal index for Iranian population is significantly lower than the mean value for Nigeria population (72.00) in this study ( $P < 0.001$ ). The mean nasal index for Nigeria population in this study is similar to the result obtained for ethnic group of Rajasthan, India (70.7) [39], Indo-Aryans (73.25) [40], African American (79.7) [11], Arabs (74.48) [24], India (72.4) and Singaporeans (72.4) [24]. However, this is lower than what was obtained by Omotoso et al (male 97.65 and female 96.99) [36] in a research conducted on adult Bini tribe of Southern Nigeria. This is also low compared to the values obtained for Nigeria Igbo (116.70) [41], Africans (90.00–100.00) [41], India Negroid (Sudroid) (84.10), Indoa Onge males (87.43), India Onge females (90.07) [41]. Anas et al showed that the nasal index for Nigeria Yoruba male and female is 100.9 and 94.1, respectively, while Hausa males and females have mean values of 70.7 and 67.2, respectively [19]. In this study we recorded the mean nasal index of 74 and 70 for Hausa males and females respectively in the northwestern Nigeria. Our results for Nigeria male and female is lower compared to a research performed by Oladipo et al in Southern Nigeria which showed that Nigeria Igbo male as a mean nasal index of 95.5, Igbo female 90.0, Yoruba male



90.0 and Yoruba female 88.1, Ijaw male 98.6, Ijaw female 94.2 [42].

In this our study, the dominant nasal type for Iranian male leptorrhine (54 individual), while 40 people are mesorrhine. Iranian female are also dominantly leptorrhine (73 individuals) with 22 being mesorrhine and traces of platyrrhine. So, it can be concluded that the dominant nose type in Iranian population is leptorrhine according to our research which conform to that carried out by Fatimal et al [33]. On the other hand, the dominant nose type in Nigeria male is mesorrhine (71 individual). This is in accordance with the research conducted by Anas et al. on Hausa ethnic group of Northern Nigeria which shows that Hausa males fall within mesorrhine nose group [19]. However, there is no significant difference between leptorrhine and mesorrhine for Nigeria female in our study. Anas et al. also found that Hausa female is also leptorrhine. But our result contradicts the research of Oladipo et al on major ethnic groups in Southern Nigeria. He found that Yoruba, Igbo, Yoruba and Ijaw fall within the platyrrhine nose type [42]. From this study, it can be concluded that Iranian are predominantly leptorrhine, while northwestern Nigeria males' population are mesorrhine, with female being either leptorrhine or mesorrhine. Although, more research are still needed to confirm this. 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 human population.

#### Compliance with Ethical Standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Research Involving Human Participants and/or Animals** Research involving healthy volunteers.

**Informed Consent** Informed consent form was obtained from all participants.

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