

ANTHROPOMETRIC STUDY OF NASAL INDEX OF EGYPTIANS

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ABSTRACT

Background: The nasal index determination is one of the most commonly used anthropometric parameters in classifying human races. There are few reports in medical literature concerning nasal index that specifically address particular Egyptian populations. The objective of this study was to determine the normal parameters of external nose (width, height and nasal index) in Egyptians.

Methods: The study was conducted randomly on healthy Egyptian subjects of both sexes. Nasal height and width were measured using vernier caliper. Then, nasal index was determined for each subject. The obtained data were subjected to statistical analysis.

Results: A total of 290 subjects, 144 males and 146 females, aged 1 month– 65 years, were enrolled in the study. The study showed the existence of sexual dimorphism in nasal morphology, appearing after the age 20 years. The mean nasal index in the investigated adults was 68.01; in males and females was 71.46 and 64.56, respectively.

Conclusions: The dominant nasal type in Egyptians was in-between mesorrhine “medium” and leptorrhine “narrow” nose. Forensic and anthropological research, as well as cosmetic and reconstructive surgery may benefit from age- and sex- based data of the study.

KEYWORDS: Anthropometry, anatomy, nasal breadth, nasal height, nasal index, sexual dimorphism, nasal type.

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Access this Article online

Quick Response code



DOI: 10.16965/ijar.2014.544

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 22 Nov 2014

Peer Review: 22 Nov 2014 Published (O):31 Dec 2014

Accepted: 09 Dec 2014 Published (P):31 Dec 2014

INTRODUCTION

The nasal index (NI), expressed as the percentage ratio of breadth and height of the nose, is one of the most commonly used anthropometric parameters in classifying human races [1-5]. Nasal proportions, together with other physical characteristics, such as skin color and hair texture are used to identify the different ‘races’ [4]. Not only the race but also sex of an individual or group whose identity is unknown, might be determined using the nasal index [6]. Moreover, the nasal proportions are important in aesthetic and reconstructive surgery [4]. Knowledge of the unique shape, anatomy and dimensions of the

nose is very useful for surgeons undertaking its repair and reconstruction [2]. The rhinoplasty surgeon should be able to define the ethnic background and should have knowledge of the specific anatomy and the appropriate techniques to obtain a satisfying result. A good surgical result means also that the “new” nose blends in harmoniously with the ethnic facial features [7]. Normative data are indispensable for precise determination of the degree of congenital or post-traumatic facial deviations from the normal [8]. Despite the parameters of NI are needed for each ethnic group, there is no available study measuring the nasal index in Egyptian population.

Also, to our knowledge, the available data investigating the age-related changes in the nasal index within the same population groups are limited.

The objectives of this study were (1) to establish norms for the nasal index of Egyptians, (2) to find out whether there is a statistically significant difference between sexes within the same age group, (3) to record the age-related changes in nasal index.

SUBJECTS AND METHODS

Subjects: A total number of 290 healthy subjects were included this study. All adult participants were volunteers; and parents of children included were consented. They were selected at random from the local communities; and study was carried out in the anatomy and ENT departments, faculty of medicine, Zagazig University. All individuals included in this study were inhabitants of Sharkia governorate and East Delta region of Egypt. Subjects who had congenital anomalies, previous surgery or trauma of the nose or cleft lips were excluded from the study.

Measurements: Nasal height (NH) and nasal breadth (NB) were taken on each subject following standard methods [9]. Anatomical landmarks used in measuring of the NH were the *nasion* "the midpoint of the nasofrontal suture" and the *subnasale* in the midline "the junction between the lower border of the nasal septum and the cutaneous portion of the upper lip". The NH was measured with a sliding vernier caliper, from the nasion to the subnasale. The breadth (NB) which is the maximum breadth of nose was measured at right angle to the nasal height from ala to ala (Figure 1). The procedure of measurement used in the study was non-invasive and do not provoke pain. All measurements were taken with subject in a relaxed mood. To reduce technical error of the measurements, each measurement was taken thrice and average was recorded. All measurements were taken to the nearest 1.0 mm.

Statistical Analysis: First, the number of males and females was calculated. Then, each gender group was arranged into 6 age groups; the first group included ages from 1-12 months "infancy";

the second: > 1-5 years "age when the skull growth is at its peak" [10]; the third: > 5-12 years (school-age children); the fourth: > 12-20 years "adolescents"; the fifth: > 20-45 years "young adults" and the last age group: > 45-65 years "old adults". This was followed by determining the mean age (\pm SD) of individuals for each group.

Second, the nasal index was calculated according to the following formula used in previous studies [1-5]:

Nasal index (NI) = nasal breadth (NB) / nasal height (NH) x 100.

Third, the nose was classified according to its NI as leptorrhine – narrow (NI: below 70), mesorrhine– medium (NI: 70-85) or platyrrhine– broad (NI: above 85) (Figure 2) [11].

Finally, the obtained data were scrutinized, tabulated, and statistically analyzed, using maximum and minimum values, range (R), mean (m), difference between means of two groups (MD), standard deviation (SD), and 95% confidence intervals (CI) of mean. The existence of significant differences between the means for the gender and the age groups was analyzed using independent Student's t-test. A *P* value <0.05 was considered to be statistically significant.

Fig. 1: Measurement of values determining nasal index; A) Nasal breadth, B) Nasal height.

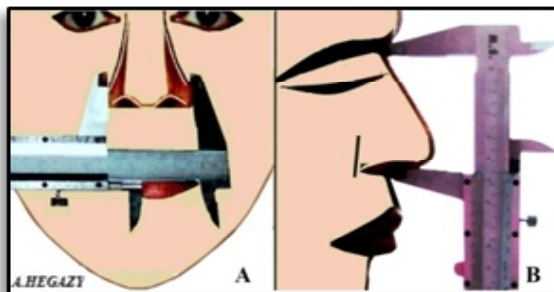
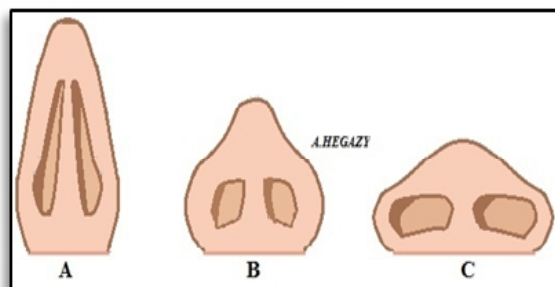


Fig. 2: Main nose types based on the shape of the nasal base: A) Leptorrhine type (long and narrow, e.g. Caucasian), B) Mesorrhine type (medium, e.g. Asian), C) Platyrrhine type (broad and flat, e.g. African "Negroid").



RESULTS

Ages and Numbers: There were 144 males (M) and 146 females (F). Their ages ranged from 1 month to 65 years. Table 1 shows the age groups and the number of subjects in each group, with the mean of their ages.

Nasal Breadth: There were significant differences in the nasal breadth between male and female subjects, starting in the fourth age group (>12-20), *P* value 0.0030. The differences became extremely significant in the following age groups (>20-65y), *P* value <0.0001. In the first three age groups (1m -12 y); there was no significant difference in both sexes (Table 2, Figure 3A).

Nasal Length: The nasal length values were

closely similar in childhood up to the age 12 y.

Then, a slight increase occurred in the values of males more than that of females. Despite this increase, the difference remained statistically insignificant (Table 3, Figure 3B).

Nasal Index: Nasal index showed no statistically significant difference between both sexes, except after the age of 20 years. Nasal index mean in the first year of life was above 85, classified as platyrrhine– broad nose. Then, it decreased in the second age group (> 1-5y) to become 70, classified as mesorrhine– medium nose. In the age groups (> 20y), the difference was extremely significant; mean in males 71.46 (mesorrhine– medium nose) and in females 64.56 (leptorrhine – narrow nose), (*P* value <0.0001) (Table 4, Figure 3C).

Group	Age (year)	All subjects		Males		Females	
		No.	Mean	No.	Mean	No.	Mean
First	0.08-1	36	0.6	19	0.7	17	0.5
Second	> 1-5	37	3.6	18	3.7	19	3.5
Third	> 5-12	40	9	24	9	16	9
Fourth	> 12-20	37	16.8	15	16.5	22	17
Fifth	> 20-45	101	30	48	31	53	29
Sixth	> 45-65	39	54.5	20	56	19	53
Total	0.08-65	290	21.8	144	21.8	146	21.7

Table 1: Profile of subjects.

Table 2: Statistical analysis of nasal breadth (NB) values.

Age	Males (mm)			Females (mm)			MD	SE	95% CI	P value
	M	SD±	R	M	SD±	R				
First	21.421	2.496	17.5-27	21.559	4.33	17-28	-0.138	1.162	-2.500 to 2.224	0.9063
Second	22.56	1.76	18-26	24.05	3.98	18-34	-1.5	1.021	-3.57 to 0.58	0.1516
Third	27.54	3.12	22-34	27.38	3.12	24-34	0.17	1.007	-1.87 to 2.20	0.8694
Fourth	32.2	3.49	25-38	29.32	2.01	25-32	2.88	0.904	1.05 to 4.72	0.003
Fifth	34.44	3.13	25-41	30.7	3.6	21-40	3.74	0.675	2.40 to 5.08	<0.0001
Sixth	35.55	2.56	32-40	31.84	2.99	26-39	3.71	0.890	1.90 to 5.51	0.0002
Total	30.007	6.1	17.5-41	28.346	4.804	17-40	1.661	0.644	0.393 to 2.929	0.0104
Total > 20y	34.76	3	25-41	31	3.47	21-40	3.76	0.550	2.68 to 4.85	<0.0001

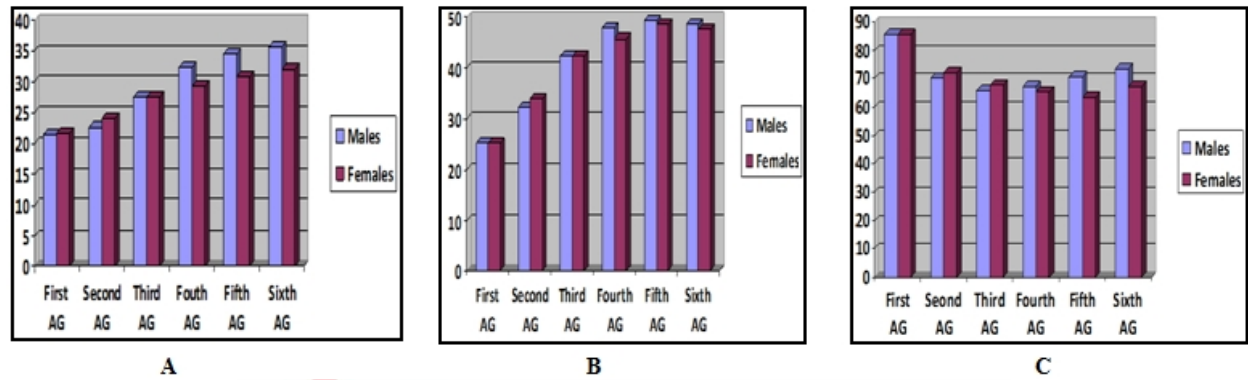
Table 3: Statistical analysis of nasal length (NL) values.

Age	Males (mm)			Females (mm)			MD	SE	95% CI	P value
	M	SD±	R	M	SD±	R				
First	25.21	3.34	19-30	25.24	5.31	19-33	-0.02	1.462	-3.00 to 2.95	0.9866
Second	32.17	2.31	28-38	33.95	7.72	24-52	-1.78	1.896	-5.63 to 2.07	0.3542
Third	42.25	4.79	35-57	42.19	4.45	35-48	0.06	1.504	-2.98 to 3.11	0.9671
Fourth	47.87	3.56	40-53	45.68	5	35-57	2.18	1.500	-0.86 to 5.23	0.1542
Fifth	49.15	2.88	42-58	48.53	3.93	36-57	0.62	0.692	-0.76 to 1.99	0.3742
Sixth	48.85	4.91	40-59	47.42	3.17	44-54	1.43	1.332	-1.27 to 4.13	0.2901
Total	42.54	9.46	19-59	42.65	9.25	19-57	-0.11	1.099	-2.27 to 2.05	0.9210
Total > 20y	49.06	3.56	42-59	48.24	3.75	36-57	0.82	0.619	-0.40 to 2.05	0.1862

Table 4: Statistical analysis of nasal index (NI) values.

Age	Males			Females			MD	SE	95% CI	P value
	M	SD±	R	M	SD±	R				
First	85.63	6.91	67-92	85.82	7.71	67-95	-0.19	2.436	-5.14 to 4.76	0.9377
Second	70.22	3.12	61-72	72.05	8.59	61-92	-1.83	2.148	-6.19 to 2.53	0.3998
Third	65.58	7.83	52-78	67.63	9.69	54-79	-2.04	2.780	-7.67 to 3.59	0.4672
Fourth	67.47	7.07	55-79	65.23	8.61	47-86	2.24	2.689	-3.22 to 7.70	0.4107
Fifth	70.58	7.58	48-88	63.55	8.21	43-83	7.04	1.577	3.91 to 10.17	<0.0001
Sixth	73.55	10.07	59-89	67.37	6.78	52-80	6.18	2.764	0.58 to 11.78	0.0314
Total	71.78	9.45	48-92	68.45	10.66	43-95	3.33	1.184	1.00 to 5.66	0.0052
Total > 20y	71.46	8.42	48-89	64.56	7.99	43-83	6.9	1.387	4.16 to 9.64	<0.0001

Fig. 3: Graphs showing the differences of mean values in different age groups (AG): A. Nasal width (mm), B. Nasal length (mm), C. Nasal index.



DISCUSSION

Anthropometry is the measurement of living subjects [12]. The use of anthropometry to establish nasal dimensions has been reported by many authors. Anthropometric parameters of the nose vary with age, sex, and ethnic background [13]. Knowledge of these parameters is essential for surgeons undertaking esthetic repair and reconstruction of noses [14]. Accordingly, the present study has established the normative values of nasal index and its parameters in a sample of Egyptian population. Generally, there was a gradual increase in the means of all investigated measures with the age, marked in the young age groups. The current findings agreed that the external nose continues to modify and enlarge beyond the attainment of skeletal maturity [15]. This is manifested by the noticed increase in the nasal dimensions in the fifth age group than that of the fourth group. The older age group (>45-65y) showed a slight decrease in means of nasal length in comparison to the previous one (> 20y -45y). On the other hand, the nasal width continued to slightly increase with age. Zankl et al., [16] in their study using growth curves, agreed that the nose continues to grow throughout life, supporting the frequent (subjective) observation that old people often have large noses. Also, Genecov et al., [17] concluded that the growth and subsequent nasal projection continued in both males and females after skeletal growth had subsided. The variations in the actual nasal dimensions occurring after skeletal maturity might be explained by the reports stating that modifications of the microscopic structure of facial soft tissues, with alterations of cartilages, muscles, skin elasticity and resilience affect the

nasal dimensions, especially those more determined by muscles and cartilages, such as nasal width [15].

The importance of nasal index in anthropological studies has been recognized for a long time. Being based on both bony and cartilaginous landmarks, this index differs from most other anthropological indices [18]. In the present study, nasal index in males was significantly higher than those of females in adults of age groups above 20 years, thus was sexually dimorphic amongst the Egyptians. Hall [19] detected a strong correlation between nasal dimensions and oxygen consumption. She stated that natural selection has fine tuned the size of the fleshy nose to support the amount of air that needs to be processed. Males, who consume relatively more oxygen during their hard activities, would be expected to have relatively broader noses than females of the same population [2,20]. 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 (Table 4). In the first year of life, it was above 85, classified as platyrrhine– broad nose in both males and females. Similar finding was reported stating that the nose of fetuses of Manipuri population at birth is platyrrhine which is round and wide [21].

Boys and men had larger noses than girls and women, appearing from the age above 12 years; a finding in general accord with the previous results [15]. However, the sexual dimorphism in nasal dimensions appears to begin at different ages (at the fifth age group; above the age 20 years). This obviously occurred as a result of the

increase in the NB noticed at this age level. Mean of NB at this age was 34.44 mm in males and 30.70 mm in females, with P value <0.0001 . The present finding supports the previous study of Franciscus and Long [1] in their rejection the argument stating that nasal breadth contributes little to the world-wide variation in the human nasal index. In the first months of life, the NI is similar in boys and girls [22]. The current results showed that gender similarity in NI extends up to the age 12 years.

There are three main nasal types; leptorrhine, mesorrhine and platyrrhine, typically associated with Caucasian, Asian and African races respectively. This type of classification is still used in the demographics section of many clinical trials [4]. Referring to this method of classification, it was found that most of Egyptian subjects were considered to have the type of nose lying in the borderline between mesorrhine "medium" nose and leptorrhine "narrow" nose, for males and females respectively. However, other types of nose were found among the investigated sample of population. This appeared from the wide range of values (Table 4), meaning large variety and mixtures of races among Egyptians. Mixing of races renders populations from Latin America and the Mediterranean to have mesorrhine, rather than leptorrhine noses [4,23].

Table 5: A comparison of average nasal indices according to gender and ethnicity.

Author/s	Year	Ethnicity	Female NI	Male NI
Aung et al. [2]	2000	Chinese	81	79
Porter and Olson [3]	2003	African American females	79.7	-
Farkas et al. [8]	2005	Caucasian	64.2	65.5
Uzun et al. [25]	2006	Turkish males	-	59.4
Oladipo et al. [26]	2007	Nigeria -Igbo	90.8	95.9
		Nigeria - Yoruba	88.1	90
		Nigeria- Ijaw	94.2	98.6
Oladipo et al. [27]	2008	Nigeria -Yorubas	83.66	89.85
Oladipo et al. [6]	2009	Nigeria -Adonis	83.77	79.83
		Nigeria- Okrikas	86.46	86.23
Heidari et al. [28]	2009	Iran-Sistan	69.7	-
		Iran -Baluchestan	59.2	-
Staka et al. [29]	2012	Kosovo- Albanian	63.87	67.07
Gangrade and Babel [30]	2012	India- Southern Rajasthan	79.73	83
Esomonu et al. [31]	2013	Nigeria -Cross River State	91.7	99.77
Jovanović et al. [5]	2014	Serbia	66.01	67.56
Koirala et al. [32]	2014	Nepal Mongoloid	75.9	74.6
		Nepal Tharu	82.4	83.8
Current study	2014	Egypt- East Delta	64.56	71.46

Because of the marked nasal growth and subsequent changes in nasal index continue till the age 20 year, it is suggested to do the anthropometric comparison of nasal indices with other ethnic and racial population after that age. This suggestion may be also supported by previous cross-sectional anthropometric studies stating that modifications went on with reduced speed after the 20 years of age [16,24]. The mean nasal index in the investigated adults above age 20 years in this study was 68.01; in males and females was 71.46 and 64.56, respectively. These values are compared with those obtained by previous studies (Table 5).

CONCLUSION

Age and gender have an effect on the nasal index. There is a sexual dimorphism in nasal indices in adult Egyptians. This study provides a normative data of nasal index, which will be an anthropometric tool in differentiating this ethnic group of population.

Strengths and Limitations

The strength of the study is the obtained normative values of breadth and height of nose and determination of nasal index in living subjects throughout the life, including early infancy, adolescence, and young and old adulthood. The reports on age determination from nasal dimension are scarce and hence, it is speculated that the reference ranges and regression equation deducted from the present study could be a promising new aid helping to determine age as well as to detect dimorphism of nose. Thus, this could be useful for anthropologists, forensic experts or surgeons alike. A potential limitation is that the normal values of nasal index obtained in the present study may not be generalized to all Egyptian regions. Further studies are recommended to correlate the normative values of NI with other nasal parameters in different regions of Egypt.

Acknowledgments

The author is grateful to all the subjects who volunteered for the study. I'm also grateful to Dr Ashraf Elhussiny Oda Basha, Dr Ahmed Hasan Alsuidy and Dr. Marwa Abdelraof Khalil, ENT department, Faculty of Medicine, Zagazig Univ-

-versity, for their invaluable assistance and cooperation in selecting, evaluation and consenting the cases enrolled in the study. I thank the Editors of the Journal and the anonymous reviewers.

Conflicts of Interests: None

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How to cite this article:

Hegazy AA. ANTHROPOMETRIC STUDY OF NASAL INDEX OF EGYPTIANS. *Int J Anat Res* 2014;2(4):761-767.

DOI: 10.16965/ijar.2014.544

