

Photogrammetric-Based Analysis of Facial and Nasal Indices: A Cross-sectional Study among the Igbo ethnic group of Nigeria.

Abstract

Background: facial and nasal index have great value in forensic identification and all specialty concerns with the treatment of the face. The study aims to evaluate the facial and nasal index of the Igbo ethnic group of Nigeria.

Methods: 300 (150 males and 150 females) subjects of Igbo origin volunteered for the study. Each subject's frontal and lateral view photographs were taken in the Natural Head Position and analyzed using Pro-Image Facial Software Version 2 to evaluate the facial width, facial height, nasal width, and nasal height. Facial and nasal indices were calculated and used to obtain the facial, and nasal. Data was analyzed with IBM SPSS (version 26)

Results: The study showed that the mean values of the facial and nasal indices for females were 70.35 ± 6.61 and 105.48 ± 12.97 while males had 68.47 ± 6.04 , and 86.21 ± 10.82 respectively. 96.2% and 94.7% of males and females have hypereuiprosopic facial type; platyrrhine type of nose was dominant in both sexes. There was a significant gender difference in the facial index ($P = 0.048$), nasal index ($P = 0.00$), and nasal type ($P = 0.00$).

Conclusion: This study will be useful to clinical anatomists and forensic anthropologists.

Keywords: Forensic, Nasal index, Igbo, Facial index and Nigeria

1.0 INTRODUCTION

Anthropometric study via photogrammetry has been appreciated in various disciplines such as forensics, anthropology, clinical, and even population studies [1]. These have quantified some body parameters to evaluate different proportions of the body. The facial index bears a direct relationship with the facial height and width of an individual and is important in facial reconstruction and identification [2]. Anatomists, plastic surgeons, maxillofacial surgeons, and anthropologists utilize this index even in the age estimation of an individual [3]. It is a further criterion that has been used for the classification of human face into hypereuryprosopic face (very broad face, range: <79.9), euryprosopic face (broad face, range: 80-84.9), mesoprosopic face (round face, range: 85-89.9), leptoprosopic face (long face, range: 90-94.9) and hyperleptoprosopic face (very long face, range: >95 [4]. Nevertheless, as earlier quoted by Kanan et al., [5], Two persons are never alike in their measurable characters and hence the study of intra- and interpopulation variations among different morphological characters has long been an interest. The study further evaluates the nasal index of the Igbo's.

The knowledge of nasal is also employed in forensic science and physical anthropology [6] and has also served as criteria for nasal classification into Leptorrhine with a Nasal Index of 69.90 or less, Mesorrhine with a Nasal index between 70 and 84.90 and Platyrrhine (broad nose) with a nasal index of 85 and above [7].

Different areas of Nigeria have different facial, and nasal types. The leptoprosopic face is the most common in the African population, according to Torres-Rrestrepo et al. [8]. Among Igbos, Ewunonu et al. [9] have also shown a leptoprosopic face; however, Eliakim-Ikechukwu et al. [10] have shown hypereuryprosopic faces among Igbos and Yorubas. There have also been variations of nasal type among different populations [7, 11, 12].

These variations in anthropometric parameters in different ethnicities and races have motivated this study's interest bearing in mind that various factors could contribute to the variation. These factors include; environmental changes, diet, genetics, and even lifestyle. However, for the findings and deduction about a population to remain current and relevant, there is a need for continuous evaluation of the anthropometric parameters towards a populational study. The study aims to evaluate the facial and nasal index of the Igbo ethnic group of Nigeria.

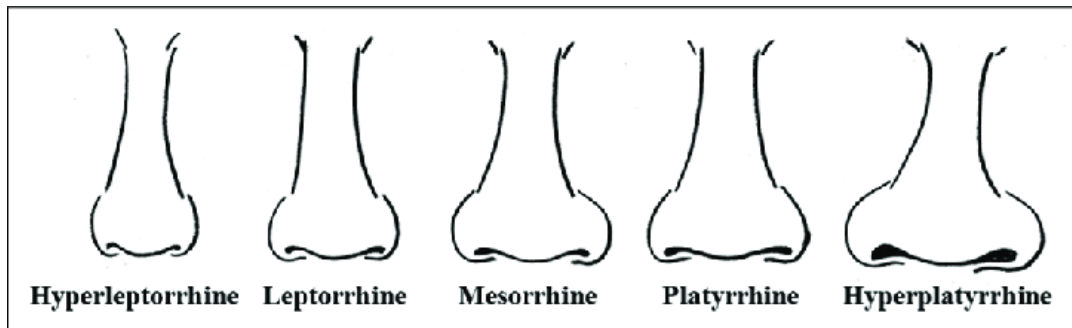


Figure 1, Nasal type

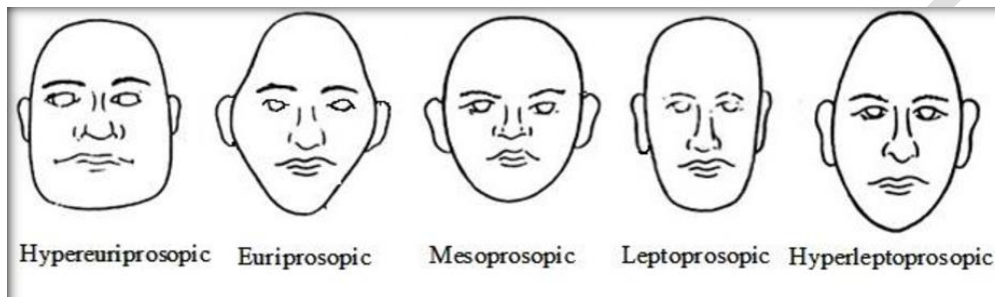


Figure 2, Facial type

2.0 MATERIALS AND METHOD

2.1 Study Design

The study adopted a cross-sectional descriptive study design to generate values of the facial and nasal, indices of males and females of the Igbo ethnic group of Nigeria using anthropometric standards via photogrammetry. The study population comprised subjects drawn from Abia, Anambra, Enugu, Ebonyi, and Imo State of Nigeria, and Imo State University was used as the Study area.

2.2 Sample Techniques and Sample Size

A multistage random sampling technique was adopted in the study to ensure that every respondent has an equal chance of being selected and the sample size was calculated using the Cochran formula of the descriptive survey [13, 14].

$$\text{Sample size} = \frac{Z_{1-\alpha/2}^2 p(1-p)}{d^2}$$

Where, $Z_{1-\alpha/2}$ = Standard normal variate (at 5% type 1 error) = 1.96

p = expected proportion of respondents (28%)

d = absolute error = 0.05

$$\text{Sample Size} = \frac{1.96^2 \times 0.28(1-0.28)}{0.05^2} = 296.75$$

For this study, the sample size was rounded up to 300.

2.3 Study Criteria

The study was limited to only subjects whose parents and grandparents are of Igbo origin and currently residing in Igbo land, Subjects who fit into the designed age interval of 25years to 35years were selected and they must not have any facial deformity or have undergone any facial or head surgery. Subjects who did not meet these stated criteria were excluded from the study.

2.4 Materials/ photographic setup

A consent form followed by a descriptive questionnaire was issued to all respondents and only those who consented to the research were personally interviewed to gather their socio-demographical data and also to evaluate if they met the inclusive criteria. A photographic stand was set with a digital camera placed on a tripod stand for easy adjustment concerning the respondent's height. A 1-centimeter calibrated graph board was placed behind the tripod stand and a mirror was also placed opposite the calibrated graph board to ensure the respondent had an eye-to-eye mirror Image. This is to ensure they are positioned in their Natural Head position (NHP). All respondents were photographed in a calm state with their heads in the natural head position (NHP), with no facial gestures, and the images were saved to a hard drive for picture analysis.

2.5 Photographic analysis

The study made use of a digitalized photo analyzer, the WinImager developed by Oghenemavwe et al. [15] to measure the cutaneous points and determine the value of various landmarks of the face such as facial width (zy-zy) and facial height (gb-op), nasal width (al-al), nasal height (n-sn), The facial, nasal and cephalic index was calculated as

$$\text{facial index} = \frac{\text{face height (zy - zy)}}{\text{face width (gb - mt)}} \times \frac{100}{1}$$

$$\text{nasal index} = \frac{\text{nasal width (al - al)}}{\text{nasal height (n - sn)}} \times \frac{100}{1}$$

The facial and nasal types were obtained from the indices adopting Banister's and Martin and Saller's [16] classification of facial and nasal type.

Table 1, Banister's Classification of Facial Types

Face shape	Facial index
Hypereuryprosopic (very broad face)	<79.
Euryprosopic (broad face)	80–84.9
Mesoprosopic (round face)	85–89.9
Leptoprosopic (long face)	90–94.9
Hyperleptoprosopic (very long face)	>95

Table 2, Martin and Saller classification

Nasal shape	Size of nose	Nasal index
Hyperleptorrhine	Long narrow nose	40–54.9
Leptorrhine	Moderately narrow nose	Less than 70
Mesorrhine	Moderate or medium size	70–84.9
Platyrrhine	Moderately wide nose	85–99.9
Hyperplatyrrhine	Vast nose	100 or more

2.6 Reliability Test

The reliability of the instrument was examined by the researcher using two methods; first in the field by collecting data from the subject directly and on photographs afterward a paired T-test was run to compare both data and the result showed no significant differences. Secondly, the

researchers used Cronbach alpha to evaluate the reliability of the result and the result showed accepted and reliable.

2.7 Statistical analysis

The data were subjected to statistical analysis using the International Business Machines Statistical Package for Social Science (IBM SPSS version 23) for statistical analysis. Independent t-test was used as an inferential statistic to test for significance between sex on numerical data (the indices) and chi-square was also used as an inferential statistic to test for significance between sex and categorical data (the facial, and nasal). A probability less than 0.05 ($P < 0.05$) was considered statistically significant.

3.0 RESULTS

Table 3 evaluates the facial and nasal index based on gender, the findings revealed that males had a facial index of 103.13 ± 9.35 and females 96.10 ± 13.65 . and 86.21 ± 10.82 was observed in the nasal index of males, and in females was 105.48 ± 12.97 . There was a sexual difference observed in the facial and nasal index.

Our study revealed that hyperleptoprosopic was the predominant facial type in both males and females and showed no gender difference (Table 4). The males and females were observed to have broad noses (platyrrhine) and were significant with gender (Table 5).

Table 3., Descriptive Statistics

	minimum	maximum	mean	SEM	Std. Dev
face width	12.98	21.40	16.4499	0.10938	1.47565
face height	7.49	21.19	16.3695	0.14452	1.94969
face index	52.41	128.41	100.1993	0.87727	11.83496
nose width	4.02	6.78	5.1678	0.03999	.53955
nose height	4.12	7.63	5.5608	0.04893	.66011
nasal index	65.07	135.88	94.2619	1.12058	15.11740
head width	10.00	18.80	14.5248	0.08407	1.07988
head height	15.30	28.00	23.7545	0.13973	1.79486
cephalic index	46.47	98.04	61.5029	0.52701	6.76957

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Table 4, Association of indices based on sex

	Sex	Mean	St.D	SEM	T-test	p-value	Inference
facial index	male	103.13	9.3519	0.908	4.126	0.00	S
	female	96.1024	13.652	1.5660			
nasal index	male	86.2158	10.82660	1.05157	-10.893	0.00	S
	female	105.4841	12.97367	1.48818			

S=significant, NS= not significant (p<0.05)

Table 5 Distribution of facial type base on sex

	euriprosopic	hyperleptoprosopic	hypereuryprosopic	leptoprosopic	mesoprosopic	X ²	Df	p-value	Inference
sex female	0 (0.0%)	54 (71.1%)	5 (6.6%)	7 (9.2%)	10 (13.2%)	11.4	4	0.022	S
sex male	1 (0.9%)	87 (82.1%)	0 (0.0%)	12 (11.3%)	6 (5.7%)				

Table 6 Distribution of nasal type based on sex

sex	leptorrhine	mesorrhine	platyrrhine	X ²	Df	p-value	Inference
female	1(1.3%)	0(0.0%)	75 (98.7%)	48.243	2	0.00	S
male	4(3.8%)	47(44.3%)	55(51.9%)				

4.0 DISCUSSION

Our study presents that 103.13 ± 9.35 and 86.21 ± 10.82 were males' facial and nasal index respectively while females were 96.10 ± 13.65 and 105.48 ± 12.97 , representing facial and nasal index respectively, the facial and nasal index showed sexual differences among Igbo ethnic group. The differences observed in the facial and nasal index of the Igbo could be attributed to multiple factors including the growth pattern observed in males and females. The epiphyses of the female are said to fuse first compared to males which indirectly shows that males have a higher chance of bone growth for extra years compared to females. However, hormonal influences could also contribute to the difference because during puberty, males undergo a surge increase in testosterone which influences bone growth. Cultural practices could also play a vital role attributing to the differences observed in facial and nasal index. Igbo people are well known for their post-natal cultural practices of molding the face and its features in the early post-natal period. Our findings agree with Esomonu et al. [7] that nasal index had a statistical gender difference among the Bekwara ethnic group of Cross Rivers State of Nigeria and Mohammed et al. [11] also state that nasal index was significant with gender among the Hausa ethnic group of Nigeria. A study of the nasal index in the southern part of Nigeria by Oladipo et al. [17], and Staka et al. [18] among the Kosovo Albanian Population also revealed that nasal index shows a significant gender difference. However, Oladipo et al. [19] study on nasal index among the Okrika ethnic group contradicts our findings. They reported no gender differences observed in nasal index. Our finding on nasal index further suggests that the female nose is quite broad compared to the males.

The relationship between facial width and height was also considered in the study and it shows further that there was a difference in the male and female facial index, though it was contradicted by Sudikshya et al. [20] who's in their report stated that facial index has no difference in male and female but our findings agree with Yesmin et al. [21] among the Malay population, Dodangheh et al. [22] among medical students and Okwesili et al. [23] among the Igbo population, that there were differences in male and female facial index.

The present study further evaluates the facial and nasal types prevalent among the Igbo ethnic group of Nigeria. It revealed that 82% of the females had hyperleptoprosopic type of face and 58.5% of males were observed with hyperleptoprosopic facial type, though Okwesili et al., [23] have stated that leptoprosopic facial type is predominant in Africans, however, their claims must

have arisen from several related kinds of literature. Our findings agree with their study and also the findings of Ese et al. [24] but Our findings contradict Kumar and Lone, [25] among Haryanvi adults, they reported that mesoprosopic was predominant and in the Malay population, Yesmin et al. [21] also reported a similar result.

Among the Igbo, a broad nose (platyrrhine) was observed more and it was followed by mesorrhine type of nose (44.3%). A study by Jonasson and Willis, [26] has shown that the size and shape of the nose most often time is influenced by climatic conditions and sex. Another anthropometric study has quantified the shape of the nose in various ethnicities and races. The findings of the study agree with Oladipo et al. [19].

The above-discussed study has shown some similarities and differences with another related study on the evaluation of facial and nasal indices of the Igbo ethnic group of Nigeria. The difference could be attributed to ethnicity, environmental factors, races, or methods use in the study.

5.0 CONCLUSION

The study has shown that there are gender differences in facial index, nasal index, facial type, and nasal type among the Igbo ethnic group of Nigeria and will be of importance to clinical anatomists and forensic anthropologists

ABBREVIATION

Glabella (gb), Menton (mt), postcranium (op), Zygomatic (Zy), ala of the nose (al), nasion (n), subnasal (sn)

ETHICAL APPROVAL

The study was approved by the Faculty Research Committee of Basic Medical Sciences, University of Port Harcourt, Nigeria.

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