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Gender characterization of Nasofacial Relationship of Ibos of Imo State using discriminant function analysis

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Abstract*: Nasofacial anthropometry focuses on the facial and nasal indices which is paramount in sex determination and in racial morphological classification and categorization. Hence the aim of this study is to determine gender differences in the nasofacial parameters of Ibos of Imo state. A cross-sectional study was carried out with 280 subjects (145 males and 135 females) between the ages of 18-45 years. All photographic records were analyzed using various soft tissue landmarks. The mean values for nasolabial angle, nasofacial angle and nasion-subnasale length for males are 83.38±14.46, 30.41±3.30 and 59.08±6.04 respectively while the mean values for females are 82.79±13.73, 29.4±3.71 and 55.6±6.66 respectively. The mean values for nasofrontal, nasomental and nasal tip angles for females are 137.52±7.04, 133.53±5.16 and 112.06±8.88 respectively while males had 130.64±8.93, 131.33±4.45 and 110.32±9.31 respectively. There was significant sexual dimorphism (p < 0.05) in all parameters but for nasolabial angle. Discriminant function analysis also shows a strong prediction of sexual dimorphism in the nasofrontal angles. Some earlier studies have documented anthropometric findings on Ibos. These findings and ours are not at variance but quite complementary. The findings in this study shows that the nasofrontal, nasofacial, nasomental, nasal tip angles as well as the nasion-subnasale length can be used to determine the sex of an indigene of Imo state. Our findings would be very useful in facial reconstructive surgeries and also, forensic medicine and anthropology would benefit a great deal.*

Key words: *Nasofacial parameters, Gender, Ibos*

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I. Introduction

The facial and nasal indices and how they correlate are among the most important cephalometric parameters within the field of anthropometry useful in inter-racial and intra-racial morphological classification and categorization. They are useful in the description of the facial and nasal morphological characteristics of human population in different geographical locations and also vital for sex determination in forensic science and quantifying nasofacial dysmorphology in facial surgery. By using accurate anthropometric measurements in craniofacial region, we can treat and reconstruct congenital or post traumatic facial disfigurements successfully (Farkas et al., 2005).[1] The nose and how it relate to the rest of the face is one of the main components of facial aesthetics, and the study of its form is of great importance in plastic surgery, forensic medicine and facial reconstruction (Costa et al., 2005).[2] The nose can be divided into two parts, the external and the internal part, where the external part is the most studied part (Hochman et al, 2002).[3] The white race have a narrow, long and high nose (leptorrhine), the blacks have a wide and flat nose (platyrrhine) and Orientals have a medium sized nose in between the first two, called mesorrhine (Jimoh et al, 2011., Mar et al., 2015).[4 , 5] The nose may be evaluated by photography, lateral radiograph (cephalometry) or by a three-dimensional 3D scans and digitizers (Douglas et al, 2004; Umar et al, 2006; Leong et al 2010).[6,7,8]

There are various soft tissue parameters and landmarks for facial analysis (Burstone., 1958, Subtently., 1959, Holdaway., 1983).[9,10,11] For example, the Powel analysis used the nasofrontal, nasofacial, nasomental and mentocervical angles as determinants of ideal facial profile (Powel and Humphrey, 1984).[12] Since facial characteristics have ethnicity and gender expressions, the need to study them and establish baseline data for various races and population have been emphasized(Osunwoke et al., 2014, Oludiran et al., 2014, Ikechukwu et al., 2013, Omotoso et al., 2011, Anibor et al., 2010, Oghenemavwe et al., 2010, Oladipo et al., 2009, Moore et al.,2006 Anibor et al.,2011).[13,14 ,15,16,17,18,19,20 & 21] Imo is one of the 36 states in Nigeria and it lies in the South Eastern part of Nigeria and it is mainly occupied by the Ibo tribe. It has a population of over 4.5 million people (Afigbo, 1975).[22] The objective of this study is to quantify the gender characteristics of soft tissue relationship between the nose and face of Ibos of Imo state using discriminant function analysis.

II. Materials and method

This is a cross-sectional study involving 280 subjects (145 males and 135 females) between the ages of 18-45 years. Subjects were all indigenes of Imo state, including parents and grandparents. Written informed consent was obtained from the volunteers. All subjects included had complete dentition, class 1 occlusion, competent lips and without craniofacial anomalies. A brief questionnaire was completed for all individuals. Subjects who had undergone maxillo-facial surgery, orthodontic surgery, or such with facial scares were excluded. The Nasofacial soft tissue parameters measured were nasofrontal, nasofacial, nasomental, nasal tip angles as well as the nasion-subnasale length. Photogrammetric tool and method as described by Oghenemavwe et al., 2012 [23] was used to analyze the photographs. The data obtained were subjected to Discriminant Function Analysis using SPSS 2.0 version.

III. Results

The results are presented in tables 1 – 4 and figure 1. On the average, males have greater values than the females for nasolabial and nasofacial angles and nasion-subnasale length as seen in table 1. The descriptive statistics and comparison of mean values for males and females using independent t- test are presented in table 1. Females were found to have greater mean values than males for nasofrontal, nasomental and nasal tip angles. The mean values for nasofrontal, nasomental and nasal tip angles for females are 137.52±7.04, 133.53±5.16 and 112.06±8.88 respectively while males had 130.64±8.93, 131.33±4.45 and 110.32±9.31 respectively. There were statistically significant differences ($p< 0.05$) in the nasofrontal, nasofacial, nasomental and nasal tip angles.
Nasofrontal angle shows a stronger predictor of sexual dimorphism followed by nasomental angle in the discriminant function analysis as seen in tables 2 and 4. Wilk's Lambda test was significant (p-value ≤ 0.001) an indication that the measured parameters can be used to generate discriminant model needed for prediction of sex for Ibos of Imo state.

Table 1: Descriptive Statistics and Comparison of Mean of Males and Females

Parameters	Males			Females			T-value	P-value
	N	Mean	SD	N	Mean	SD		
Nasofrontal angle	145	130.64	8.93	135	137.52	7.04	< 0.007	**<0.001**
Nasolabial angle	145	83.38	14.46	135	82.79	13.73	0.724	0.725
Nasofacial angle	145	30.41	3.30	135	29.4	3.71	0.939	**0.017**
Nasomental angle	145	131.33	4.45	135	133.53	5.16	< 0.002	**<0.001**
Nasion-subnasale length	145	59.08	6.04	135	55.6	6.66	< 0.007	**0.000**
Nasal-tip angle	145	110.32	9.31	135	112.06	8.88	0.111	**<0.001**

N= number of samples, SD= standard deviation

Table 2: Standardized Canonical Discriminant function for Ibos of Imo state

Parameters	Function 1
Nasofrontal angle	0.782«
Nasolabial angle	-0.102*ˆ
Nasofacial angle	0.255«
Nasomental angle	0.519«
Nasion-subnasale length	-0.583ˆ
Nasal-tip angle	0.102ˆ

«=strong prediction, ˆ=weak prediction, *=no prediction
The discriminant model for sex categorization in our study could be stated as:
Sex= (0.782x nasofrontal) + (-0.583 x nasion-subnasale) + (0.519 x nasomental) + (0.255 x nasofacial) + (0.108 x nasal tip) + (-0.102 x nasolabial) – 24.810 constant. The predicted sex is male if value obtained is close to -0.566 and female if close to 0.608.

Table 3: Functions at group centroids for Ibos of Imo state

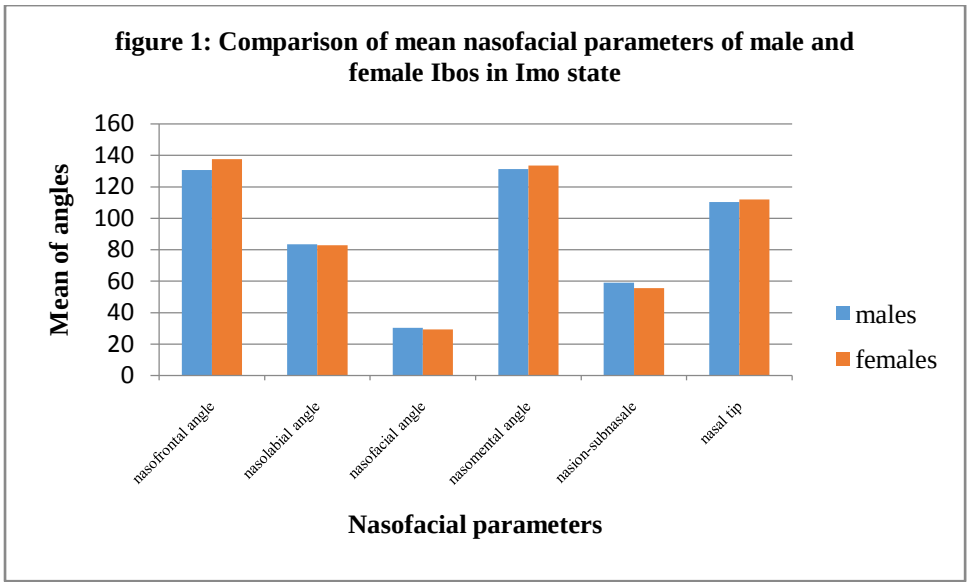
Sex	Function 1
Male	-0.566
Female	0.608

Indication: DF at or close to -0.566 predicts a male sex and values at 0.608 predicts a female.

Table 4: Stepwise statistics for best predictors of sex in Ibos of Imo state

Step	Entered	Wilk's Lambda			
		Statistic	df1	df2	Significant
1	Nasofrontal	0.846	1	278	<0.001
2	Nasomental	0.950	1	278	<0.001
3	Nasofacial	0.979	1	278	0.017
4	Nasal tip	0.991	1	278	<0.001

Indication: nasofrontal is the best predictor followed by nasomental, nasofacial and nasal tip angles.



IV. Discussion

This study looked at gender differences of nasofacial relationship of Ibos of Imo state between 18 and 45 years of age using discriminant function analysis. The nasofacial parameters analyzed were nasofrontal, nasolabial, nasofacial, nasomental and nasal tip angles as well as the nasion-subnasale length. The nasofrontal, nasolabial, nasofacial, nasomental and nasal tip angles as well as nasion-subnasale length for males are 130.64, 83.38, 30.41, 131.33, 110.32 and 59.08 respectively. The nasofrontal, nasolabial, nasofacial, nasomental and nasal tip angles as well as nasion-subnasale length for females are 137.52, 82.79, 29.4, 133.53, 112.06 and 55.6 respectively. Previous research and documentations have shown that facial and nasal indices are very useful in the classification and categorization of gender and race. Some earlier studies have documented anthropometric findings on Ibos, though ours focuses on Imo state being one of the ancient ancestral heritages of the people. However most of the findings are not at variance with ours but rather serves to complement and consolidate on the findings of this present study.

The nasofrontal angles of males and females show some variation compared to the others which show minimal or no difference. Females were noticed to have higher angles in most of the parameters examined but for the nasolabial and nasofacial angles, which show no significant variation. The nasion-subnasale length was greater in the males whereas the nasal tip angle was higher in the females. This agrees with the findings by Osunwoke et al,[13] in which females had higher values in all parameters but for the mentocervical angle. However the variation in their study for both genders was not marked. Statistical analysis for p value < 0.05 shows a significant difference in the nasofrontal, nasofacial, nasomental and nasal tip angles as well as the nasion-subnasale length. There was no significant variation ($p< 0.05$) in the nasolabial angle. Hence our study shows significant sexual dimorphism in all parameters except for nasolabial angle. This is at consent with the reports of Osunwoke et al.[13] This present study also agrees with the findings of Oghenemavwe et al.[18] who documented nasofacial parameters for Ibos in Port Harcourt. Infact the nasofrontal angle for Ibos in Port Harcourt and those in our study shows great similarity for both genders, with minimal differences for other parameters measured. This buttresses the fact that female Ibos have greater nasofrontal angles than their male counterparts. Our findings show great consent with Anibor et al.[21] who also documented significant gender differences in nasofrontal and nasomental angles of Ibos. However Olotu et al. [24] reported higher values in males, yet with significant gender differences. Other studies by Ikechukwu et al. and Osunwoke et al.[13] report greater female nasofrontal angles in Yorubas, Ibos and Khana ethnic groups of Nigeria. Also just like our study, they all documented significant sexual differences. Using discriminant function analysis, our findings show a

strong prediction of sexual dimorphism in the nasofrontal, nasomental and nasofacial angles. The nasolabial angle in our study though higher in males, holds no statistically significant sexual dimorphism ($p > 0.05$).

V. Conclusion

The findings in this study shows that the nasofrontal, nasofacial, nasomental, nasal tip angles as well as the nasion-subnasale length can be used to determine the sex of an indigene of Imo state. These parameters can as well be used to categorize the sex of Ibos generally, as seen from previous research. However the nasofrontal angle proves a stronger predictor of sex for the Ibos and as well for other ethnic groups. This study also shows that female Ibos have a greater nasofrontal angle than male Ibos, and mildly greater values or no marked variation in other nasofacial parameters except for nasion-subnasale. Our study thus agrees with the Powel analysis that nasofrontal, nasofacial, nasomental and mentocervical angles constitute stronger insight into the facial profile of an individual. Our findings would be very useful in facial reconstructive surgeries bearing in mind some changes expected in the various parameters during surgery and as well what is aimed to achieve based on gender. Also forensic medicine and anthropology would benefit a great deal from this study.

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