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Sexual Dimorphism and Anthropometric Comparison of Craniofacial Features of Igbo and Yoruba Undergraduate Students of University of Lagos, Nigeria

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Abstract. Forensic anthropology is the practical application of anthropology to law, especially in questions related to medicolegal identity and forensic medicine. In forensics, methods involving physical anthropology present high rate of accuracy for human identification and gender estimation. This study aimed to ascertain sexual dimorphism using different craniofacial variables among Igbo and Yoruba young adults. Some craniofacial variables were measured in 300 undergraduates from University of Lagos using physical anthropometry. The mean values of all the craniofacial features studied were higher in males compared to females. Igbo students had significantly ($p \leq 0.05$) higher mean height, weight, morphological facial height (MFH), morphological facial breadth (MFB), intercanthal difference (ID), nose length (LN), left eye width (LEW), exocanthii to exocanthii (EX-EX) and subnasale to gnathion (SN-GN) values compared to Yoruba students. The mean prosopic index of the Igbo male (94.5%), Igbo females (94.6%) and Yoruba females (93.92%) showed leptoprosopic facial shape while the Yoruba males (97.52%) were hyperleptoprosopic. The mean nasal index of Igbo females (leptorrhine) was significantly ($p \leq 0.05$) lower compared to Igbo males and the Yoruba males and females (mesorrhine). Sex was significant with height, weight, MFH, MFB, ID, CH-CH, LEW, EX-EX, SN-GN at the 0.01 level (2-tailed). This study shows that height, weight, MFH, MFB, ID, CH-CH, LEW, EX-EX and SN-GN can be used to predict sex.

Keywords: Forensic anthropology; Human identification; Gender estimation; Craniofacial; Prosopic index.

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1. Introduction

The forensic anthropologist develops a biological profile of unknown, mutilated, decomposed or skeletal remains with respect to their physical characteristics so as to identify the victim of an incident for criminal investigation or legal purposes, including police investigations. In forensic science, sex determination is important for positive identification of unknown remains especially when data about the deceased is not available and for population data studies. Precise identification is the most important step in forensic and medicolegal practices[1]. Many researchers have widely made use of somatometry in the estimation of sex from different body segments like the skull, long bones, pelvis, clavicle, phalanges, ribs etc.[2] Craniofacial anthropometry is an objective technique based on a series of measurements and proportions, which facilitates the characterization of phenotypic variation and quantification of dysmorphology[3].

Anthropological patterns have been investigated in different regions around the world for human identification[4]. Craniofacial anthropometry has wide applications in Forensic Medicine, Plastic Surgery, Orthodontics, Archeology and identification of determining the origins of races[5]. It helps in the diagnosis of several craniomaxillofacial and genetic disorders, facial detection and recognition, aids the surgeons to achieve the desired results in facial reconstruction, plastic and or oral surgeries, assists in sex determination for positive human identification.

In identification of individuals, sex determination is very crucial. On an average, female body is roughly 92% in dimensions of a male individual. Thus, biological differences in dimensions and proportions of body physiques and individualized body parts of persons of two sexes and of different population groups have significant practical applications in forensic anthropological identifications[6]. Sex determination is one of the leading questions addressed when formulating the biological profile[7]. Sex is generally inferred from facial morphology which is highly reliable[8]. The anthropometric study using craniofacial features is probably the most important in this context[9].

Morphology and morphometry are two osteological methods that can be used in determining the sex of an individual. For morphological method, pelvis is the best part of skeleton to determine the sex (95%), followed by skull (92%)[10,11] while another experiment shows that the gender of an individual can be identified accurately in 80% of cases using skull alone and 98% cases using pelvis and skull together[12]. A multivariate model returned 68.5% correct classification when applied in sex determination providing a useful baseline orbital morphometric data for East Indian population[13]. A study conclusively established the existence of a definite statistically significant sexual dimorphism in Gujarati population using cephalo-facial dimensions whereby the best reliable results were obtained by using logistic regression equations in males (92%) and discriminant function in females (80.9%)[2].

A study conducted by investigators working separately across the world and with small samples of the population is clearly preliminary in nature to an extent though it may fulfil its mission if medical and anthropological investigators continue the work of establishing normative data of the face[14]. These data are urgently needed by medical professionals but have been lacking up till now in western and northern Europe, Asia, and Africa. The craniofacial features may serve as diagnostic markers for gender identification and can be used interchangeably[15]. In a study, sex discrimination using facial linear dimensions and angles was well established in Hausa ethnic group, despite sexual dimorphism shown by facial angles, only nasomental angle was good discriminator of sex[16].

The aim of this study was to ascertain the accuracy and reliability of the use of craniofacial measurements in the determination of sexual dimorphism, prediction of the sex and to establish facial anthropometry as a baseline for the Igbo and Yoruba ethnic groups using some students in University of Lagos, Nigeria. We tried to create baseline data in determining sex and to compare the craniofacial differences between males and females of the Igbo and Yoruba tribes in Nigeria using craniofacial features.

2. Materials and methods

2.1 Sample population

Three hundred students of Faculty of Science, University of Lagos, Nigeria, in the age group of 16 to 30 years, including both sexes were selected randomly. The subjects were grouped into three ethnic groups which were Igbo, Yoruba and Other (individuals from neither Igbo nor Yoruba ethnic origins).

2.2 Ethical consideration

The subjects' informed verbal and written consent was duly obtained before starting the study and the measurement process was explained to each subject. Ethical approval (CMUL/HREC/0918421) was also obtained from Health Research Ethics Committee, College of Medicine, University of Lagos, Idi-Araba, Lagos. Subjects with past and existing craniofacial trauma, deformities or facial scars were excluded from the study.

2.3 Materials used for the study

Sliding Vernier callipers (KYOTO TOOL) with scale was used for the measurements of craniofacial parameters. For the measurement of height and weight, a standard Stadiometer (RGZ-160) was used.

2.4 Anthropometric measurements

All measurements were carried out in the same way and under the same conditions. The subjects were in a sitting position, relaxed, with the head oriented in Frankfort horizontal plane. To eliminate discrepancies in relation to diurnal variation, all the measurements were taken between 14:00–16:30. The measurements were taken in triplicates to control the measurement error and the mean values of the measurements were used for further analysis. All craniofacial measurements and stature were taken in millimetre (mm). Stature was taken from the point of vertex to the floor of the stadiometer in which the subject was in a standing position with the head held in Frankfurt plane. Measurements of weight and body mass index were in kilogramme (kg) and kilogramme per meter square (kg/m^2) respectively.

Craniofacial variables studied through physical anthropometry in both genders include:

i. Morphological facial height (MHF): straight distance between nasion and gnation (N-GN).
ii. The maximum width of face or maximum facial breadth (MFB): maximum distance between the most lateral points on the two zygomatic arches (ZY-ZY).
iii. Mouth width or labial fissure width (CH-CH): distance between the cheilion points.
iv. Intercanthal width or Intercanthal distance (ID): distance between right endocanthion and the left endocanthion (EN-EN).
v. Left Palpebral fissure length or left eye width (LEW): distance between the left exocanthion (EX-L) and the left endocanthion (EN-L).
vi. Right Palpebral fissure length or right eye width (REW): distance between the right exocanthion (EX-R) and the right endocanthion (EN-R).
vii. Outercanthal width (EX-EX): distance between the right exocanthion (EX-R) and the left exocanthion (EX-L).

viii. Lower facial height (SN-GN): distance between the subnasale (SN) and the gnathion (GN).
ix. Nasal height or the nose length (LN): distance between the Nasion (N) and the subnasale (SN).
x. Nasal width or nose width (AL-AL): distance between the right alare (AL-R) and the left alare (AL-L).

2.5 Statistical analysis

All numerical data were subjected to statistical analysis using SPSS 23.0 version. All measurements were presented in descriptive statistics and correlation analysis outputs. The statistical significance of sex differences in mean values of the measured parameters was analyzed using independent t-test. The significance of differences among the groups was determined by the Tukey HSD test. *p*–values lesser than 0.05 ($p \leq 0.05$) were considered to be statistically significant. The relationship between gender, stature and craniofacial measurements was determined by Person Correlation.

The prosopic index (PI) was calculated using this formula:

$$PI = (\text{Face Length}/ \text{Face Width}) \times 100 . \quad (1)$$

The nasal index was also calculated using the formula:

$$\text{Nasal width} / \text{Nasal length} \times 100 . \quad (2)$$

It was then classified into three groups based on nasal anthropometric parameters e.g.: leptorrhine or fine nose (≤ 69.9), mesorrhine medium (70.0–84.9), platyrrhine or broad nose (≥ 85.0).

3. Results

The mean values of height, weight, morphological facial height (MFH), morphological facial breadth (MFB), intercanthal difference (ID), chelion to chelion distance (CH-CH), left eye width (LEW), exocanthii to exocanthii distance (EX-EX), and subnasale to gnathion distance (SN-GN) were higher in male undergraduate students of Faculty of Science, University of Lagos, Nigeria compared to females as shown in Table 1.

The descriptive analysis for all measurements in both sexes shows the minimum, maximum, mean and standard deviation of all the parameters. In females, the mean maximum age, weight, nose length, nose width and BMI are high compared to the males while the males had greater mean values of MFB, ID, right eye width, CH-CH, stature and SN-GN compared to the females. Using the mean values of the craniofacial features, the facial shape of the males is hyperleptoprosopic with a prosopic index of 96.14% while the females are leptoprosopic with a prosopic index of 94.78%.

Table 2 shows the descriptive statistics for all measurements in both sexes by ethnicity. The mean values of the age (20.27 ± 0.22 years), height (1751 ± 7.72 mm), weight (70.5 ± 1.63 kg), ID (35.73±0.43mm), EX-EX (111.27 ± 0.66 mm), and SN-GN distance (68.8 ± 0.66 mm) in both male and female Igbo subjects when compared by ethnicity was higher than that of Yoruba and other tribes while nose width (42.2 ± 0.56mm) of the Igbo subjects was low compared to Yoruba and Other tribes. The Yoruba students used for this study had lower mean values of MFH (125.08 ± 0.66 mm), MFB (131 ± 0.67 mm) and nose length (58.16 ± 0.43 mm) compared to Igbo and other tribes. The Post–Hoc test showing multiple comparisons of the parameters compared to the different ethnic groups is presented in table 2. Compared to Yoruba and Other tribes, the Igbo tribe showed significantly ($p \leq 0.05$) higher mean value in the mean values of height, weight, ID, LEW, EX-EX and SN-GN. The Yoruba and Other tribes showed significantly ($p \leq 0.05$) low mean values of MFH and REW respectively. All the tribes showed no significant difference ($p \leq 0.05$) in the mean values of BMI, CH-CH, nose width and age and significant difference ($p \leq 0.05$) in the mean values of nose length. From the calculation using the mean values of the craniofacial features, the facial shape of the Yorubas' are hyperleptoprosopic with a prosopic index of 95.5% while the Igbos' are leptoprosopic with a prosopic index of 94.54%.

Table 3 shows the descriptive statistics and Post-Hoc tests using Tukey HSD for the sexes and the ethnic groups. For height, all the males showed significantly ($p \leq 0.05$) higher mean value compared to the females of the same ethnic groups. The Yoruba females had lower significant ($p \leq 0.05$) mean value compared to Igbo and other females with respect to height. Yoruba females presented a significantly ($p \leq 0.05$) low weight compared to Yoruba males and Igbo females while the Igbo females' weight was significantly ($p \leq 0.05$) high compared to Yoruba and other females. The MFH of Yoruba females was significantly ($p \leq 0.05$) decreased compared to the Yoruba males, it was also significantly ($p \leq 0.05$) different compared to Igbo and other females. Their MFH of the Yoruba males and other males were significantly ($p \leq 0.05$) different compared to the Yoruba females and other females respectively. The Yoruba females showed significantly ($p \leq 0.05$) attenuated mean values compared to the Yoruba males, Igbo and other females. The MFB of the Yoruba females was significantly ($p \leq 0.05$) low compared to the Yoruba males and Igbo females.

The facial shapes of the Igbo and Yoruba males and females was determined using the mean values of craniofacial features showing the prosopic index. The mean value of prosopic index of the Igbo male (94.5%), the Igbo females (94.6%) and the Yoruba females (93.92%) showed leptoprosopic facial shape while the Yoruba males (97.52%) were hyperleptoprosopic. The Facial shape of the Igbos and Yorubas was determined using the percentage of the prosopic index as shown in Table 4. Majority of the Igbo males, Yoruba males and Yoruba females are hyperleptoprosopic while the Igbo females are leptoprosopic. None of the females were hypereuriprosopic.

Table 1. Descriptive statistics for all measurements in both sexes.

	MALE			FEMALE			
Parameters	**Min**	**Max**	**Mean ± SEM**	**Min**	**Max**	**Mean ± SEM**	***t*-Test**
Age (years)	17	26	20.04 ± 0.16	17	29	20.06 ± 0.2	0.829
Height (mm)	1590	1900	1763.4 ± 5.72	1550	1820	1656.06 ± 5.86	0.006
Weight (kg)	50	100	69.3 ± 0.82	42	130	63.96 ± 1.3	0.482
MFH (mm)	114	147	130.92 ± 0.68	108	145	123.36 ± 0.58	0.051
MFB (mm)	120	155	136.18 ± 0.74	115	143	130.16 ± 0.61	0.812
ID (mm)	30	49	35.48 ± 0.29	24	41	32.54 ± 0.34	0.047
LN (mm)	52	68	60.02 ± 0.38	43	78	59.26 ± 0.49	0.421
WN (mm)	37	55	43.5 ± 0.34	32	65	42.00 ± 0.75	0.489
CH-CH (mm)	42	68	54.66 ± 0.46	40	65	52.16 ± 0.44	0.125
REW (mm)	3	43	35.27 ± 0.48	25	40	34.7 ± 0.23	0.866
LEW (mm)	28	43	35.92 ± 0.25	35	41	28.72 ± 0.28	0.270
EX -EX (mm)	95	124	111.06 ± 0.52	95	125	108.04 ± 0.51	0.340
SN-GN (mm)	57	82	69.92 ± 0.45	55	79	63.36 ± 0.37	0.034
BMI (kg/m^2)	16	34	22.62 ± 0.31	16	44	23.86 ± 0.46	0.586

MFH = Morphological facial height, MFB = Morphological facial breadth, ID = intercanthal difference, LN = Length of nose, WN = Width of nose, CH-CH = Chelion to chelion, REW = Right eye width, LEW = Left eye width, EX-EX = Exocanthii to exocanthii difference, SN-GN = Subnasale to gnathion distance, BMI = Body mass index.

Table 2. Descriptive statistics for all measurements in both sexes by ethnicity.

ETHNIC GROUP	AGE	Height (mm)	Weight (kg)	MFH (mm)	MFB (mm)	ID (mm)	L N (mm)	WN (mm)	CH-CH (mm)	REW (mm)	LEW (mm)	EX-EX (mm)	SN-GN (mm)	BMI (kg/m^2)
IGBO	20.27 ± 0.22 **(4.45)**	1751 ± 7.73(b,c) **(5370.3)**	70.5 ± 1.63(b,c) **(239.2)**	129.17 ± 0.96(b) **(83.3)**	136.63 ± 0.82(b) **(60.7)**	35.73 ± 0.43(b,c) **(16.7)**	60.1 ± 0.45(b,c) **(18.3)**	42.20 ± 0.56 **(28.3)**	53.00 ± 0.46 **(18.7)**	36.13 ± 0.38(c) **(13)**	34.43 ± 0.47(b,c) **(20.1)**	111.27 ± 0.66(b,c) **(39.7)**	68.8 ± 0.66(b, c) **(39.6)**	23.5 ± 0.42 **(16.03)**
YORUBA	19.96 ± 0.19 **(5.6)**	1685.26 ± 7.46(a) **(8340.7)**	65.12 ± 0.99(a) **(145.4)**	125.1 ± 0.7(a,c) **(64.6)**	131 ± 0.67(a) **(68.1)**	33.44 ± 0.3(a) **(13.3)**	58.16 ± 0.43(a,c) **(28)**	43.12 ± 0.64 **(62.2)**	53.78± 0.43 **(28.12)**	35.38 ± 0.2(c) **(8.81)**	31.84 ± 0.35(a) **(18.3)**	108.9 ± 0.49(a) **(35.5)**	65.82 ± 0.49(a) **(35.3)**	23.54 ± 0.47 **(33.6)**
OTHERS	19.95 ± 0.27 **(4.22)**	1709 ± 10.63(a) **(6784.6)**	64.6 ± 1.68(a) **(169)**	129.25 ± 1.03(b) **(63.6)**	133.4 ± 1.29 **(99.8)**	32.85 ± 0.58(a) **(1986)**	62.65 ± 0.72(a,b) **(30.6)**	42.65 ± 0.97 **(56.6)**	53.1 ± 1.02 (**62.8)**	32.27 ± 0.97(a,b) **(56.1)**	30.35 ± 0.74(a) **(32.7)**	108.6 ± 0.99(a) **(59)**	65.45 ± 0.63(a) **(23.9)**	22.1 ± 0.39 **(9.04)**

The mean difference is significant at the 0.05 level. (a) $p \leq 0.05$ compared with the Igbo ethnic group; (b) $p \leq 0.05$ compared with the Yoruba ethnic group; (c) $p \leq 0.05$ compared with the other ethnic groups. The significance of differences among all groups was determined by the Tukey HSD test. The bold values in parenthesis are the variance.

H = Height, W = Weight, MFH = Morphological facial height, MFB = Morphological facial breadth, ID = intercanthal difference, LN = Length of nose, WN = Width of nose, CH-CH = Chelion to chelion, REW = Right eye width, LEW = Left eye width, EX-EX = Exocanthii to exocanthii difference, SN-GN = Subnasale to gnathion distance, BMI = Body mass index.

Table 3. Descriptive statistics for all measurements by ethnicity and sex and Post-Hoc analysis.

Ethnicity (SEX)	**Age**	**H (m)**	**W (kg)**	**MFH (mm)**	**MFB (mm)**	**ID (mm)**	**LN (mm)**	**WN (mm)**	**CH-CH (mm)**	**REW (mm)**	**LEW (mm)**	**EX-EX (mm)**	**SN-GN (mm)**	**BMI (kg/m^2)**
IGBO (M)	20.18 ± 0.24 **(3.94)**	1765 ± 8.54(d) **(4816.15)**	69.18 ± 1.29 **(109.91)**	129.64 ± 1.20(c) **(91.53)**	137.18 ± 1.04 **(70.95)**	36.27 ± 0.49 **(15.8)**	59.41 ± 0.53(c) **(18.62)**	43.55 ± 0.65(d) **(28.13)**	53.64 ± 0.59(c) **(22.57)**	36.50 ± 0.48(c) **(15.49)**	36.23 ± 0.38(d) **(9.5)**	111.41 ± 0.77 **(39.292)**	70.09 ± 0.67(d) **(29.62)**	23.14 ± 0.54 **(19.04)**
YORUBA (M)	19.86 ± 0.23 **(3.32)**	1762.38 ± 8.99(e) **(5089.40)**	69.57 ± 1.2(e) **(90.73)**	130.67 ± 0.9(e) **(51.61)**	134 ± 1.1(e) **(73.94)**	34.86 ± 0.38(e) **(8.93)**	59.14 ± 0.6(c) **(22.29)**	43.29 ± 0.37 **(8.53)**	54.71 ± 0.62 **(23.82)**	36.1 ± 0.4(c) **(10.25)**	35.81 ± 0.35(e) **(7.61)**	110.05 ± 0.66 **(27.53)**	69.81 ± 0.76(e) **(35.96)**	22.62 ± 0.46 **(13.21)**
OTHERS (M)	20.14 ± 0.48 **(4.93)**	1761.43 ± 15.65(f) **(5142.86)**	68.86 ± 2.38 **(118.93)**	135.7 ± 1.10(a,f) **(27.21)**	139.57 ± 2.34(f) **(114.86)**	34.86 ± 0.63(f) **(8.23)**	64.57 ± 0.46(a,b) **(4.46)**	44 ± 0.68 **(9.6)**	57.71 ± 1.91(a,f) **(76.41)**	28.91 ± 2.44(a,b,f) **(124.55)**	35.29 ± 0.81(f) **(13.71)**	113.00 ± 2.00(f) **(84)**	69.71 ± 0.84(f) **(14.91)**	21.00 ± 0.41 **(3.6)**
IGBO (F)	20.5 ± 0.50 **(6.00)**	1712.5 ± 14.50(a,e) **(5060.87)**	74.13 ± 5.00(e,f) **(596.46)**	127.88 ± 1.60(e) **(61.42)**	135.12 ± 1.14(e) **(31.16)**	34.25 ± 0.83 **(16.63)**	62.00 ± 0.74(e) **(13.04)**	38.5 ± 0.66(a) **(10.44)**	51.25 ± 0.43 **(4.37)**	35.13 ± 0.46 **(5.07)**	29.5 ± 0.83(a) **(16.44)**	110.87 ± 1.32 **(41.85)**	65.25 ± 1.46(a) **(51.33)**	24.50 ± 0.53 **(6.78)**

YORUBA (F)	20.03 ± 0.29 (**7.22**)	1629.41 ± 6.10$^{(b,d,f)}$ (**3269.62**)	61.9 ± 1.4$^{(b,d)}$ (**161.47**)	121 ± 0.6$^{(b,d,f)}$ (**35.34**)	128.83 ± 0.78$^{(b,d)}$ (**53.24**)	32.41 ± 0.40$^{(b)}$ (**13.99**)	57.45 ± 0.60$^{(d,f)}$ (**31.3**)	43.00 ± 1.08 (**101.65**)	53.1 ± 0.59 (**30.44**)	34.86 ± 0.29 (**7.24**)	28.97 ± 0.27$^{(b)}$ (**6.24**)	108.07 ± 0.68 (**39.97**)	62.93 ± 0.42$^{(b)}$ (**15.14**)	24.21 ± 0.74 (**47.54**)
OTHERS (F)	19.85 ± 0.32 (**3.92**)	1680.77 ± 11.9$^{(c,e)}$ (**5490.18**)	62.31 ± 2.17$^{(d)}$ (**184.32**)	125.7 ± 1.10$^{(c,e)}$ (**48.81**)	130.08 ± 1.26$^{(c)}$ (**62.13**)	31.77 ± 0.77$^{(c)}$ (**23.08**)	61.62 ± 1.04$^{(e)}$ (**42.09**)	41.92± 1.44 (**81.23**)	50.62 ± 1.00$^{(c)}$ (**39.24**)	34.08 ± 0.55$^{(c)}$ (**11.92**)	27.69 ± 0.77$^{(c)}$ (**22.8**)	106.23 ± 0.89$^{(c)}$ (**30.97**)	63.15 ± 0.59$^{(c)}$ (**13.71**)	22.69 ± 0.53 (**11.11**)

The mean difference is significant at the 0.05 level. (a) $p \leq 0.05$ compared with the males of the Igbo ethnic group; (b) $p \leq 0.05$ compared with the males of the Yoruba ethnic group; (c) $p \leq 0.05$ compared with the males of the Other ethnic groups; (d) $p \leq 0.05$ compared with the females of the Igbo ethnic group; (e) $p \leq 0.05$ compared with the females of the Yoruba ethnic group; (f) $p \leq 0.05$ compared with the females of the Other ethnic groups. The significance of differences among all groups was determined by the Tukey HSD test.
H = Height, W = Weight, MFH = Morphological facial height, MFB = Morphological facial breadth, ID = intercanthal difference, LN = Length of nose, WN = Width of nose, CH-CH = Chelion to chelion, REW = Right eye width, LEW = Left eye width, EX-EX = Exocanthii to exocanthii difference, SN-GN = Subnasale to gnathion distance, BMI = Body mass index.

Table 4. The frequency of facial shape of the Igbos and Yorubas determined individually, according to the value of total facial index.

Range of Prosopic Index (PI) (%)	Ethnic group and sex			
	Igbo males (%)	**Yoruba males (%)**	**Igbo females (%)**	**Yoruba females (%)**
Hypereuriprosopic	4.55	1.59	0	0
Euriprosopic	4.55	3.18	0	6.9
Mesoprosopic	22.72	9.52	25	17.24
Leptoprosopic	18.18	19.04	50	31.04
Hyperleptoprosopic	50	66.67	25	44.82

The nasal index of all the males and females are 72.88 ± 0.72 and 72.03 ± 1.61 respectively. The mean value of the nasal index of Igbo females grouped as Leptorrhine was significantly (p ≤ 0.05) lower compared to the Igbo males and the Yoruba males and females that is mesorrhine. None of the ethnic groups were platyrrhine.

Table 5. Classification of the different ethnic groups based on nasal anthropometric parameters.

Sex and Ethnicity	Mean ± SEM	95% Confidence Interval for Mean		Minimum	Maximum	Nose type
		Lower Bound	Upper Bound			
Igbo (M)	73.76 ±1.35$^{(d)}$	71.06	76.47	55.88	100.00	Mesorrhine
Yoruba (M)	73.55 ± 0.84$^{(d)}$	71.87	75.23	61.54	83.64	Mesorrhine
Other (M)	68.1 ± 0.76	66.51	69.69	61.90	71.64	Leptorrhine
Igbo (F)	62.15 ± 0.97$^{(a,b,e)}$	60.14	64.16	56.67	72.13	Leptorrhine
Yoruba (F)	76.03 ± 2.32$^{(d)}$	71.41	80.65	54.10	134.88	Mesorrhine
Other (F)	69.19 ± 2.98	63.17	75.21	47.76	114.55	Leptorrhine

The mean difference is significant at the 0.05 level. (a) $p \leq 0.05$ compared with the males of the Igbo ethnic group; (b) $p \leq 0.05$ compared with the males of the Yoruba ethnic group; (c) $p \leq 0.05$ compared with the males of the Other ethnic groups; (d) $p \leq 0.05$ compared with the females of the Igbo ethnic group; (e) $p \leq 0.05$ compared with the females of the Yoruba ethnic group; (f) $p \leq 0.05$ compared with the females of the Other ethnic groups. The significance of differences among all groups was determined by the Tukey HSD test.

Pearson's correlation analysis was carried out to assess the association between age, height, weight, ethnicity and craniofacial measurements in male, female and both sexes respectively. Table 6 shows that in male, age correlated with MFB, WN, CH-CH and EX-EX at 0.05 level of significance and correlated with weight, REW, and BMI at 0.01 level of significance. Height correlated with weight, CH-CH, SN-GN and BMI at 0.01 level of significance but correlated with MFB and LEW at 0.05 level of significance. Weight correlated with age, height, MFH, MFB, LN, WN, CH-CH, SN-GN and BMI at 0.01 level of significance but correlated with EX-EX at 0.05 level of significance. Morphological facial height correlated with weight, MFB, LN, EX-EX and SN-GN at 0.01 level of significance. Morphological facial breadth correlated with weight, MFH, CH-CH, LEW, EX-EX, and SN-GN at 0.01 level of significance but correlated with age, height and LN at 0.05 level of significance. Intercanthal difference correlated with REW, LEW and EX-EX at 0.01 level of significance and LN at 0.05 level of significance respectively. Length of nose correlated with weight, MFH, CH-CH, SN-GN at 0.01 level of significance but correlate with MFB and BMI at 0.05 level of significance, Width of nose correlated with weight at 0.01 level of significance but correlated with age and MFB at 0.05 level of significance. Chelion and chelion distance correlated with height, weight, MFB, LN and LEW at 0.01 level of significance but correlated with age and EX-EX at 0.05 level of significance. Right eye width correlated with age, ID, LEW and EX-EX at 0.01 level of significance. Left eye width correlated with MFB, ID, CH-CH, REW and EX-EX at 0.01 level of significance but correlated with height at 0.05 level of significance. Exocanthii to exocanthii distance correlated with age, weight and CH-CH at 0.05 level of significance but correlated with MFH, MFB, ID, REW and LEW at 0.01 level of significance. Subnasale to gnathion distance correlated with height, weight, MFH, MFB, ID and LN at 0.01 level of significance. Body mass index correlated with age, height and weight at 0.01 level of significance but correlated with LN at 0.05 level of significance.

Table 7 describes Pearson's correlation analysis outcome in female subjects. Age correlated with LEW at 0.01 level of significance. Height correlated with weight, MFH, MFB, LN, EX-EX and SN-GN at 0.01 level of significance but correlated with CH-CH at 0.05 level of significance. Weight correlated with height, MFH, MFB and EX-EX at 0.01 level of significance but correlated with LEW at 0.05 level of significance. Morphological facial height correlated with height, weight, MFB, ID, LN and SN-GN at 0.01 level of significance but correlated with LEW, and EX-EX at 0.05 level of significance. Morphological facial breadth correlated with height, weight, MFH, ID, LN, WN and EX-EX at 0.01 level of significance but correlated with LEW at 0.05 level of significance. Intercanthal distance correlated with MFH, MFB, REW and EX-EX at 0.01 level of significance. Length of nose correlated with weight, MFH, WN, CH-CH and EX-EX at 0.01 level of significance while width of nose correlated with MFB, LN and CH-CH at 0.01 level of significance. Chelion and chelion distance correlated with MFB, LN, WN, REW and LEW at 0.01 level of significance but correlated with height and EX-EX at 0.05 level of significance. Right eye width correlated with ID, CH-CH, LEW and EX-EX at 0.01 level of significance. Left eye width correlated with age, CH-CH, REW and EX-EX at 0.01 level of significance and also with LN, MFH, MFB and BMI at 0.05 level of significance. Exocanthii to exocanthii distance correlated with height, weight, MFB, ID, REW, LEW and SN-GN at 0.01 level of significance and also with MFH, LN, WN and CH-CH at 0.05 level of significance. Subnasale to gnathion distance correlated with height, MFH and EX-EX at 0.01 level of significance. Body mass index had no correlation with all the parameters which were analysed in the female subjects.

Table 6. Correlation between age, height, weight and craniofacial features in male subjects.

	AGE (years)	H (mm)	W (kg)	MFH (mm)	MFB (mm)	ID (mm)	LN (mm)	W N (mm)	CH-CH (mm)	REW (mm)	LEW (mm)	EX-EX (mm)	SN-GN (mm)	BMI (kg/m^2)
AGE (years)	1.00	-0.05	0.26**	0.08	0.18*	-0.04	-0.04	0.18*	-.18*	-.22**	-0.12	0.17*	-0.02	0.36**
H (mm)	-0.05	1.00	0.23**	0.14	0.17*	0.13	0.05	-0.06	0.25**	-0.08	0.2*	0.01	0.24**	-0.23**
W (kg)	0.26**	0.23**	1.00	0.36**	0.22**	-0.11	0.27**	0.23**	0.29**	0.1	0.14	0.19*	0.33**	0.28**
MFH (mm)	0.08	0.14	0.36**	1.00	0.22**	0.02	0.43**	-0.05	0.12	0.1	-0.05	0.23**	0.56**	-0.08
MFB (mm)	.018*	0.17*	0.22**	0.22**	1.00	0.12	0.21*	0.21*	0.27**	0.03	0.25**	0.33**	0.34**	-0.1
ID (mm)	-0.04	0.13	-0.11	0.02	0.12	1.00	-.18*	0.14	-0.14	0.26**	0.31**	0.39**	0.21**	-0.00
LN (mm)	-0.04	0.05	0.26**	0.43**	0.21*	-.18*	1.00	0.04	0.28**	-0.12	-0.08	0.01	0.29**	-0.18*
WN (mm)	.175*	-0.06	0.23**	-0.05	0.21*	0.14	0.04	1.00	-.011	0.01	0.12	.129	0.01	0.02
CH-CH (mm)	-.182*	0.25**	0.29**	0.12	0.27**	-.014	0.28**	-0.11	1.00	-0.01	0.25**	0.21*	0.12	-0.14
REW (mm)	0.22**	-0.08	.01	.01	0.03	0.26**	-0.12	0.01	-0.01	1.00	0.51**	0.47**	0.07	0.12
LEW (mm)	-0.12	0.2*	0.14	-0.05	0.25**	0.31**	-0.08	0.12	0.25**	0.51**	1.00	0.59**	0.09	-0.09
EX-EX (mm)	.168*	0.01	0.19*	0.23**	0.33**	0.39**	0.01	0.13	0.21*	0.47**	0.59**	1.00	0.16	-0.02
SN -GN (mm)	-.017	0.24**	0.33**	0.56**	0.34**	0.21**	0.29**	0.01	0.12	0.07	0.09	0.16	1.00	-0.08
BMI (kg/m^2)	0.36**	0.23**	0.28**	-0.09	-0.1	-0.01	-.18*	0.02	-0.14	0.12	-0.09	-0.02	-0.08	1.00

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

H = Height, W = Weight, MFH = Morphological facial height, MFB = Morphological facial breadth, ID = intercanthal difference, LN = Length of nose, WN = Width of nose, CH-CH = Chelion to chelion, REW = Right eye width, LEW = Left eye width, EX-EX = Exocanthii to exocanthii difference, SN-GN = Subnasale to gnathion distance, BMI = Body mass index.

Table 7. Correlation between age, stature, ethnicity and craniofacial features in female subjects.

	AGE (years)	**H (mm)**	**W (kg)**	**MFH (mm)**	**MFB (mm)**	**ID (mm)**	**LN (mm)**	**W N (mm)**	**CH-CH (mm)**	**REW (mm)**	**LEW (mm)**	**EX-EX (mm)**	**SN-GN (mm)**	**BMI (kg/m²)**
AGE (years)	1	.021	.148	.096	.076	.120	.066	-.129	-.149	-.094	.263**	.139	.011	.027
HEIGHT (mm)	.021	1	.499**	.285**	.288**	-.007	.215**	.060	-.175*	-.003	-.024	.228**	.215**	-.131
WEIGHT (kg)	.148	.499**	1	.385**	.518**	.086	.120	.076	.009	.045	.199*	.262**	.024	.069
MFH (mm)	.096	.285**	.385**	1	.298**	.235**	.592**	-.003	-.112	-.125	-.204*	.177*	.264**	.073
MFB (mm)	.076	.288**	.518**	.298**	1	.301**	.032	.337**	.261**	-.036	-.177*	.332**	.037	-.029
ID (mm)	.120	-.007	.086	.235**	.301**	1	.100	.029	-.159	-.216**	-.086	.375**	.123	.095
LN (mm)	.066	0.22**	0.12	0.59**	0.03	0.1	1	-0.24**	-0.22**	-0.04	-0.05	0.22**	0.00	0.05
WN (mm)	-0.13	0.06	0.076	-0.00	0.34**	0.03	-0.24**	1	0.65**	0.08	-0.08	0.18*	-0.11	-0.04
CH-CH (mm)	-0.15	-0.18*	.01	-0.11	0.26**	-0.16	-0.22**	0.65**	1	0.39**	0.22**	0.20*	-0.11	0.1
REW (mm)	-0.09	-0.00	0.05	-0.13	-0.04	-0.22**	-0.04	0.08	0.39**	1	0.36**	.252**	-0.04	0.08
LEW (mm)	0.26**	-0.02	0.2*	-0.2*	-0.18*	-0.09	-0.05	-0.08	0.22**	0.36**	1	0.41**	-0.14	0.17*
EX-EX (mm)	.014	0.23**	0.26**	0.18*	0.33**	0.38**	0.22**	0.18*	0.2*	0.25**	0.41**	1	0.24**	0.06
SN -GN (mm)	0.01	0.22**	0.02	0.26**	0.04	0.12	0.00	-0.11	-0.11	-0.04	-0.14	0.24**	1	-0.05
BMI (kg/m²)	0.03	-0.13	0.07	0.07	-0.03	0.1	0.05	-0.04	0.1	0.08	0.17*	.056	-0.05	1

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).
H = Height, W = Weight, MFH = Morphological facial height, MFB = Morphological facial breadth, ID = intercanthal difference, LN = Length of nose, WN = Width of nose, CH-CH = Chelion to chelion, REW = Right eye width, LEW = Left eye width, EX-EX = Exocanthii to exocanthii difference, SN-GN = Subnasale to gnathion distance, BMI = Body mass index.

Table 8 describes the correlation analysis output in both sexes. Age correlated with weight, CH-CH, REW and LEW at 0.01 level of significance but correlated with MFB, EX-EX and BMI at 0.05 level of significance. Height correlated with weight, MFH, MFB, ID, LN, CH-CH, LEW, EX-EX, SN-GN and BMI at 0.01 level of significance.

Weight correlated with age, height, MFH, MFB, LN, CH-CH, LEW, EX-EX and SN-GN at 0.01 level of significance but correlated with WN at 0.05 level of significance. MFH correlated with height, weight, MFB, ID, LN, LEW, EX-EX and SN-GN at 0.01 level of significance. MFB correlated with height, weight, MFH, ID, WN, CH-CH, LEW, EX-EX and SN-GN at 0.01 level of significance but correlated with age and LN at 0.05 level of significance. Intercanthal distance correlated with height, MFH, MFB, LEW, EX-EX and SN-GN at 0.01 level of significance. Nose length correlated with height, weight, MFH, WN and SN-GN at 0.01 level of significance but correlated with MF and EX-EX at 0.05 level of significance. Width of nose correlated with MFB, LN, CH-CH and EX-EX at 0.01 level of significance but correlated with weight at 0,05 level of significance. Chelion and chelion distance correlated with age, height, weight, MFB, WN, LEW and EX-EX at 0.01 level of significance and also correlated with REW and SN-GN at 0.05 level of significance. Right eye width correlated with age, LEW and EX-EX at 0.01 level of significance but correlated with CH-CH at 0.05 level of significance. Left eye width correlated with height, weight, MFH, MFB, ID, CH-CH, REW, EX-EX and SN-GN at 0.01 level of significance. Exocanthii to exocanthii distance correlated with height, weight, MFH, MFB. ID, WN, CH-CH, REW, LEW and SN-GN at 0.01 level of significance and with age and LN at 0.05 level of significance. Subnasale to gnathion distance correlated with H, W, MFH, MFB, ID, LN, LEW and EX-EX at 0.0 level of significance but correlated with CH-CH and BMI at 0.05 level of significance. BMI correlated with height at 0.01 level of significance but correlated with age and SN-GN at 0.05 level of significance.

Table 8. Correlation between age, height, weight and craniofacial features in both male and female subjects.

	AGE (years)	H (mm)	W (kg)	MFH (mm)	MFB (mm)	ID (mm)	LN (mm)	W N (mm)	CH-CH (mm)	REW (mm)	LEW (mm)	EX-EX (mm)	SN-GN (mm)	BMI (kg/m^2)
SEX	0.01	-0.61**	-0.2**	-0.44**	-0.34**	-0.36**	-0.07	-0.11	-0.22**	-0.06	-0.74**	-0.23**	-0.55**	-0.13*
AGE (years)	1.00	-0.01	0.18**	0.08	0.12*	0.05	0.02	-0.05	-0.16**	-.15**	0.07	0.15*	-0.01	0.14*
H (mm)	-0.01	1.00	0.42**	0.41**	0.37**	0.26**	0.16**	0.08	0.17**	-0.01	0.49**	0.23**	0.48**	-0.21**
W (kg)	0.18**	0.42**	1.00	0.4**	0.41**	0.09	0.18**	0.13*	0.15**	0.07	0.26**	0.26**	0.23**	0.10
MFH (mm)	0.08	0.41**	0.4**	1.00	0.36**	0.27**	0.49**	0.03	0.11	0.06	0.25**	0.28**	0.57**	-0.06
MFB (mm)	0.12*	0.37**	0.41**	0.36**	1.00	0.31**	0.13*	0.28**	0.32**	0.03	0.28**	0.38**	0.36**	-0.1

ID (mm)	0.05	0.26**	0.09	0.27**	0.31**	1.00	0.01	0.09	-0.05	0.1	0.32**	0.43**	0.33**	0.01
LN (mm)	0.02	0.16**	0.18**	0.49**	0.13*	0.01	1.00	-0.15**	0.02	-0.08	0.01	0.14*	0.15**	-0.04
WN (mm)	-0.05	0.08	0.13*	0.03	0.28**	0.09	-.15**	1.00	0.39**	0.04	0.06	0.17**	0.01	-0.04
CH-CH (mm)	-0.16**	0.17**	0.15**	0.11	0.32**	-0.05	0.02	0.39**	1.00	0.12*	0.32**	0.25**	0.14*	-0.03
REW (mm)	-0.15**	-0.01	0.07	0.06	0.03	0.1	-0.08	0.04	0.12*	1.00	0.33**	0.38**	0.06	0.08
LEW (mm)	0.07	0.49**	0.26**	0.25**	0.28**	0.32**	0.01	0.06	0.32**	0.33**	1.00	0.49**	0.39**	-0.05
EX-EX (mm)	0.15*	0.23**	0.26**	0.28**	0.38**	0.43**	0.14*	0.17**	0.25**	0.38**	0.49**	1.00	0.29**	-0.01
SN-GN (mm)	-0.01	0.48**	0.23**	0.57**	0.36**	0.33**	0.16**	0.01	0.14*	0.06	0.39**	0.29**	1.00	-0.12*
BMI (kg/m^2)	0.14*	-.021**	0.10	-0.06	-0.1	0.01	-0.04	-0.04	-0.03	0.08	-0.05	-0.01	-0.12*	1.00

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

H = Height, W = Weight, MFH = Morphological facial height, MFB = Morphological facial breadth, ID = intercanthal difference, LN = Length of nose, WN = Width of nose, CH-CH = Chelion to chelion, REW = Right eye width, LEW = Left eye width, EX-EX = Exocanthii to exocanthii difference, SN-GN = Subnasale to gnathion distance, BMI = Body mass index.

4. Discussion

Estimation of sex is an important concern to the forensic anthropologist as it is critical for the identification individuals in cases of mass disaster, and mutilated bodies. The use of anthropometry may arise under several circumstances which may be natural, intentional or accidental. In any of these circumstances, the sex of an individual can be accurately identified in 80% of cases using skull alone and 98% cases using pelvis and skull together[12]. Additionally, while planning facial surgeries and designing of facial instruments, the anthropometry of face is important in formulating standard sizes. Facial analysis is anthropologically useful to identify the racial, ethnical, and sexual differences[19]. Although males and females differ in many characteristics, the face plays a significant role in identification. However, a viewer often cannot describe the exact reason of how he could determine if a person is a male or a female. It is difficult to specify exactly the features and the reasons that enable a viewer to make the distinction[20]. The craniofacial features may serve as diagnostic markers for gender identification and can be used interchangeably[15]. Individual differences in body shape and configuration among different ethnic groups may be attributed to their genetic makeup, the type of nutrition and environmental conditions. Many investigators have shown significant differences in craniofacial complex among ethnic and racial groups[16,21-25]. It has therefore become very necessary for the establishment of anthropometric standards for the evaluation of deviations in craniofacial morphology, for a particular population[26].

In this study it was observed that males have significantly higher mean value in most of the facial variables studied compared to the females. This is similar to the studies carried out by some other researchers[2,16,27-30]. A study on Malaysian students of Melaka Manipal Medical College showed that all female values were lesser than those of males[19]. This may indicate that females were, in general, having smaller faces than males[31]. The significant difference found in the craniofacial features of males and females can be attributed to activities of the male hormone testosterone. The results of a study indicate that by adulthood, most soft-tissue features of the human head and face show strong evidence of sexual dimorphism[32].

The mean morphological facial height (MFH) value was higher in male (130.92 ± 0.68 mm) compared to the female (123.36 ± 0.58 mm). This finding agrees with the findings of Joy *et al* (2009) and Singh *et al* (2017) who reported higher mean MFH values in male compared to female to be 12.25 ± 2.11 cm in males and 11.19 ± 1.92 cm in females, and 112.10 ± 5.66 mm in males and 102.15 ± 5.40 mm in female respectively[15,22]. The mean MFH value was high in Igbo ethnic group (129.17 ± 0.96 mm) compared to the Yoruba ethnic group (125.08 ± 0.66 mm). The mean morphological height of the Igbo males (129.64± 1.2 mm), Igbo females (127.88 ±1.6 mm), Yoruba males (130.67 ± 0.9 mm) and Yoruba females (121 ± 0.6 mm) are shown in table 3. There was no significant difference in the mean values among the males but the Igbo females were significantly higher than the Yoruba females. A study reported a significantly ($P < 0.05$) higher facial height in males (12.25 ± 2.11 cm) compared to females (11.19 ± 1.92 cm) of Igbo ethnic origin while in our experiment there was no significant ($P \leq 0.05$) difference in MFH among the Igbo males and females[22]. It was reported that the sexual dimorphism in facial dimensions of the Bini's of South-Southern Nigeria, the MFH of the males and females was 113.62 ± 9.44 mm and 105.04 ± 6.58 mm respectively[23] while other researchers observed that the mean facial height in Ijaw males was 11.58 cm and 10.86 cm in Ijaw females[24].

The MFB of the males and females are 136.18 ± 0.74 and 130.16 ± 0.61 respectively which is greater than their MFH. The MFB of Igbo males and females are 137.18 ± 1.04 and 135.12 ± 1.14 respectively while the MFB for Yoruba males and females is 34 ± 1.1 and 128.83 ± 0.78 respectively. The Yoruba females' MFB was significantly low compared to the Yoruba males and Igbo females. In a study of the facial index among Malay population morphological facial width was 129.9 ± 7.71mm for males and 125.00 ± 7.51mm for the females[19] while another group of researchers carried out a similar study on young adult Malaysian Malays and found that the facial width was 121 ± 153 mm in males and 123 ± 142 mm females[33]. Sexual dimorphism was shown using facial dimensions of the Bini's of South-Southern Nigeria whereby the MFB of the males and females are 124.63 ± 5.78 and 122.28 ± 6.39 respectively[23].

This study also revealed that the outercanthal distance or exocanthii to exocanthii (EX-EX) was significantly higher in male subjects (111.06 ± 0.52mm) as compared to female subjects (108.04 ± 0.51mm). The finding from this study were in accordance with the findings in the study among dental students of University of Mosul whereby it was reported that the exocanthii to exocanthii (EX-EX) in male is 120.90 ± 6.4 mm, and in female, it was less and was found to be 110.35 ± 5.9 mm[34]. Younger population tends to have lower values of intercanthal distance in comparison to older population, and the intercanthal measurements became constant in the third decade of life[37]. The Igbos (111.27 ± 0.66) showed significantly higher exocanthii to exocanthii (EX-EX) distance compared to the Yoruba's (108.9 ± 0.49). The mean outer canthal distance for Urhobo males and female were 13.1cm and 12.1cm respectively, the Itsekiris were 12.9cm and 11.4cm respectively[36] while the outercanthal distance adult male and female in Ika North and South local government of Delta State was 110.29 ± 8.66 and 110.64 ± 8.73 respectively[37]. It was also discovered that the mean intercanthal distance (ID) in male was higher (35.48 ± 0.29 mm) than the female (32.54 ± 0.34 mm). This finding is similar to the study that reported that the intercanthal distance was significantly higher in male (34 ± 14.0 mm) compared to female (30.0 ± 39.0 mm) among Nigerians[35]. The Igbo males and females had an ID of 36.27 ± 0.49 mm and 34.25 ± 0.83 mm respectively while the Yoruba males and females had an ID of 34.86 ± 0.38mm and 32.41 ± 0.4 mm respectively. The ID for the Yoruba males was significantly ($P < 0.05$) high compared to the Yoruba females. Some researchers reported that the mean inner canthal distance for Urhobo males and females were 3.4 cm and 3.0 cm respectively while Itsekiri males and females were 3.5 cm and 3.3 cm respectively[35]. The Intercanthal Distance (ID) of adult male and female in Ika North and South local government of Delta State are 34.06 ± 4.09 and 33.59 ± 4.05 respectively[36].

The mean value of nose length for the all males and females are 60.02 ± 0.38 and 59.26 ± 0.49 respectively while the mean value of the nose width is 43.5 ± 0.34 mm for all the males and 42 ± 0.75 mm for the all females showing that the males had higher mean values of nose length and width. This study shows that the mean value of nose length of Igbo males and females (60.1± 0.45 mm) is significantly ($P \leq 0.05$) high compared to the Yoruba males and females (58.16 ± 0.43 mm) while there was no significant ($P \leq 0.05$) difference in the mean nose width of the Igbos' (42.2 ± 0.56 mm) and Yorubas' (43.12 ± 0.64 mm). There was no significant ($P \leq 0.05$) difference in the mean nose length of the Igbo (59.41± 0.53 mm) and Yoruba (59.14 ± 0.6 mm) males while the mean nose length of the Igbo females (62 ± 0.74 mm) was significantly ($P \leq 0.05$) high compared to the Yoruba females (57.45 ± 0.6 mm). The mean nose width of the Igbo males (43.55 ± 0.65 mm) was significantly ($P \leq 0.05$) high compared to the Igbo females (38.5 ± 0.66 mm) but there was no significant ($P \leq 0.05$) difference between the Yoruba males (43.29 ± 0.37 mm) and females (43 ± 1.08 mm). A study by, they showed that the Ijaw male and female had mean nasal height of 4.08 and 3.89 cm respectively and mean nasal width of 4.06 and 3.79 cm respectively[37]. The results from a study of adult Omoku from Ogba/ Egbema/ Ndoni Local Government Area of Rivers State, Nigeria showed that the males and females had mean nasal height of 4.66 cm and 4.36 cm respectively and mean nasal width of 4.01cm and 3.93cm respectively[38]. In a study of the sexual dimorphism in facial dimensions of the Bini's of South-Southern Nigeria the mean nose length of the males and females are 43.05 ± 3.83 mm and 39.93 ± 3.96 mm respectively while the mean nose width is 41.14 ± 3.30 mm and 37.34 ± 3.50 mm respectively[23]. The nose width of males of Igede and Idoma ethnic groups of Benue State, Nigeria are 11.32 ± 0.43 and 9.2 ± 0.19 respectively while the Igede and Idoma females are 11.31 ± 0.35 and 9.3 ± 0.14 respectively[39].

The results of this study show evidence of sexual dimorphism. The Igbos showed significantly higher mean values of height, weight, morphological facial height, morphological facial breadth, intercanthal distance, length of nose, left eye width, exocanthii to exocanthii and subnasale to gnathion compared to the Yorubas though, there was no significant difference between the Igbo males and the Yoruba males using the tested craniofacial features. The mean values of height, width of nose, left eye width and subnasale to gnathion of Igbo males were significantly high compared to the Igbo females. For the Yoruba tribe, the values of height, weight, morphological facial height, morphological facial breadth, intercanthal distance, left eye width and subnasale to gnathion for the females was significantly low compared to the males. This can be attributed to natural increase in most cartilaginous tissue features of the human head and face as they attain adulthood due to the male hormone testosterone which causes the changes in the face structure of the male. In a study, the results showed that in the adolescence age group, significant sex differences were present in 72 % (21/29) of measurements, involving all regions of the head and face[33]. This is probably because after puberty, the sex differences became more pronounced and this involves a wide variety of traits. Some of the other factors influencing the dimorphism among humans can be weight (studies indicate a normal male is 1.2 heavier than a normal female), height, hair, face, muscles (more among men than women), voices, body shapes, colour, size of eyes, and behaviours[40].

5. Conclusion

From these analyses, we demonstrated that the male and the female faces are significantly different. In an attempt to determine the morphometric features especially craniofacial features most responsible for the dimorphism, it was deduced that height (H), weight (W), morphological facial height (MFH), morphological facial breadth (MFB), intercanthal difference (ID), exocanthii to exocanthii (EX-EX), subnasale to gnathion (SN-GN), Left eye width (LEW), the Chelion to chelion distance (CH-CH) and body mass index (BMI) are some of the anthropometric features that are responsible for dimorphism so, they can be used as diagnostic markers to predict sex.

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