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ABSTRACT

Nasal anthropometry can be employed in identification of the race and sex of individuals whose identity is unknown. The sample comprised 420 subjects aged 18-65 years; comprising 210 males and 210 females across the Okun Ethnic group in Kogi State, Nigeria. The main purpose is to provide anthropometric data on the basic nasal parameters (nasal height, nasal width and nasal index) for Okun ethnic group of Kogi State Nigeria. Total body height and Nasal height were recorded with stadiometer and digital Vernier caliper respectively. Nasal index (NI) was calculated as $NB/NH \times 100$. The statistical package for social sciences (SPSS) version 23.0, Student's t-test comparison were used to determine group differences. Pearson's correlation and regression analysis were used to analyze the data. $P < 0.05$ was considered significant. The mean of total body height in the male and female was 169.10 (± 7.69) cm and 166.8 (± 7.81) cm respectively. The mean of nasal index in the male and female was 98.43 (± 8.87) mm and 97.19 (± 7.85) mm respectively. In this study, it was observed that nasal index and stature were higher in males than females, hence a significant level of sexual dimorphism. The result showed that platyrrhine nasal type was predominant among the Okun ethnic group. This study provides baseline data for quantitative description of nasal morphology in people of Okun ethnic group. This will be valuable as a nasal anthropometric tool for clinical practice, in reconstructive surgery, rhinoplasty, and in forensic science.

Keywords: Nasal index, Platyrrhine, Nasal morphometry, Okun, Sexual dimorphism.

INTRODUCTION

Anthropometry is a branch of anthropology that implies the systematic measurement of the physical properties in individuals, using scientific methods and techniques. It is also used for identification, for correlating physical metrics with racial traits (Osunwoke *et al.*, 2012). Some common anthropometric measurements include: height or length, weight, mid-upper arm circumference (MUAC), demi-span or arm span,

knee height, nasal and ear indices, head circumference, etc. (Cameron, 1978).

The human nose is anatomically a constituent of the upper respiratory system, responsible for filtration of dust and humidification of inspired air. Its upper angle (root) is continuous with the forehead, and its free tip forms the apex which projects anteriorly. The nose has two lateral nares or nostrils, which opens only to its interior surface and are separated by the nasal septum. The human nose can be found in many shapes and sizes. This

variation in 'design' could be as a result of bioenvironmental and geographical factors (mutation and evolution by natural selection), having influences which leads to different appearances of the nose (Olotu *et al.*, 2009; Heidari *et al.*, 2009).

Studies have been conducted in the past on height determination from length of hand, feet, upper extremity and facial measurements in living subjects (Jibonkumar and Lilichandra, 2006). Various studies have indicated racial and ethnic differences in nasal index amongst different populations (Esonomu *et al.*, 2013). Afro-American (Ofodile and Bokhari, 1995) and Indo-African (Sparks and Jantz, 2002) have platyrrhine nose type. Also, Howale *et al* (2012) studied 75 Dry skull of Maharashtra region and estimated the NI to be 54.30 ± 4.19 which suggests it to be Leptorrhine type.

Nasal anthropometry which deals with measuring physical indices of the nose, is thus, a vital parameter in forensic medicine, rhinoplastic surgery – being underwent for nasal repair and reconstruction, identification of gender and ethnicity, and nowadays, especially in facial recognition as a tool in biometric technology (Gangrade and Babel, 2012). Nasal index is also an invaluable tool utilized to express sexual dimorphism (Zhang *et al.*, 1990; Oladipo *et al.*, 2006), race and ancestry of an individual of an unknown identity (Franciscus, & Long, 1991; Porter & Olson, 2003). It is thus, considered as one of the best clues to racial origin. Nasal indices is a useful tool in the analysis and classification of fossil remains (forensic science) and in the study of living populations – which is particularly of use to dysmorphologists in the diagnosis of syndromes such as cleft lip and palate that are usually associated with the nose (Kopecky *et al.*, 2014).

This study was carried out to provide baseline data on facial and nasal height amongst male and female adults Okun in Kogi State, Nigeria, and to classify their nose type and the comparison of data

with other studies. Data accrued from the present investigation could provide a database for surgeons by contributing immensely to outcomes in cosmetic and reconstructive nasal surgery in the Kogi population. The results would also add to the pool of anthropological data that may be used as a point of reference by researchers, health practitioners, and forensic scientists both locally and internationally.

MATERIALS AND METHODS

A total number of four hundred and twenty subjects were recruited for this research (210 males and 210 females) across the Okun Ethnic group in Kogi State. The subjects were within the age group of 18–65 years. Structured questionnaire was used to determine the socio-demographical status of the subjects and written consent was obtained from each participants. The subjects used are those whose parents were indigenes of Okun ethnic group of Kogi State, Nigeria, so any subject whose parents are not indigenes were excluded. The sample size was determined using the Fischer's formula for large population ($>10,000$) or infinite population for determining sample size and it states thus:

$$S = \frac{z^2 \times p \times q}{d^2}$$

The method applied for this research is the direct method using digital vernier caliper with accuracy of 0.01 mm with the subject sitting in a relaxed state. The following anthropometric measurements were observed:

Nasal height (NH): Straight distance between nasion (n) and subnasale (sn) (Figure 1).

Nasal breadth (NB): Straight distance between the two nasal alae (Figure 2).

Nasal index: $NB/NH \times 100$.

Stature: The stature or height of the subject was measured in standing position to the vertex by using a portable stadiometre.

The statistical package for social sciences (SPSS) version 23.0, Student t-test comparison was used to determine group differences, Pearson's correlation and regression analysis were used to analyze the data. $P < 0.05$ was considered significant.

RESULTS AND DISCUSSION

The results were presented based on anthropometric measurements of the nose and stature. Continuous data were represented as mean standard deviation (S.D) while frequency (%) for other categorical data. The values observed from the anthropometric measurements were tabulated and the mean (S.D) values, mean difference (M.D), t-values, p-values and inference were determined for the sex (male and female). The values obtained were presented as mean (S.D) values in tables and graphs. Table 1 represents the distribution of the studied population by Local Government Areas (LGAs) and age groups respectively. Table 2 shows the mean (S.D) and test of mean difference in the nasal dimensions of the male and female. The difference in the nasal height(mm) and nasal indices of males and females was not significant ($p = 0.675$ and 0.129 respectively) possibly, due to genetic, hormonal, nutrition and other related factors. However, nasal width and stature height(cm) of males and females showed significant difference ($p < 0.02$ and $p < 0.05$ respectively). The mean S.D of males were NW (43.44 ± 3.17), NH (44.31 ± 3.23), NI (98.43 ± 8.87), and height (169.10 ± 7.69). The mean S.D of females were NW (42.78 ± 2.63), NH (44.18 ± 3.13), NI (97.19 ± 7.85) and height 166.98 ± 7.81 . Table 4 shows the nasal type distribution. For male population, 11 (5.2%) had mesorrhine nasal, 123 (58.6%) had platyrrhine nasal type and 76 (36.2%) had hyperplatyrrhine nasal type. For female population, 8 (3.8%) has mesorrhine nasal, 144 (68.6%) had platyrrhine nasal type and 58 (27.6%) had hyperplatyrrhine nasal type.

Table 3 and 4 shows the nasal type distribution and test of association with sex. It was found that there was a positive correlation between the nasal width and height (stature) in males ($r = 0.2179$, $p < 0.002$), and a positive correlation between the nasal height and stature ($r = 0.1665$, $p < 0.016$). While in the female counterpart, a positive correlation was found only between the nasal width and stature ($r = 0.0398$, $p < 0.142$). However, there was no significant relationship between the nasal index and stature for both sexes (male and female).

The relationship between nasal parameters used (width, height and index) and stature in males and females is expressed using a scatter plot Fig 3, 4 and 5 with lines of best fit and regression equations derived to show the relationship between height and nasal width in males and females subjects.

Nasal parameters and stature or body height are useful anthropometric parameters in forensic medicine, in rhinoplastic surgery, identification of gender and ethnicity especially with facial recognition as a tool in recent advances in biometrics (Anas & Saleh, 2013).

4.5% of the total sample (420) was seen to have the mesorrhine nasal type, 63.6% was seen to have the platyrrhine nasal type and 31.9% had the hyperplatyrrhine nasal type. 11 (5.2%) male subjects had mesorrhine nasal type, 123 (58.6%) male subjects had platyrrhine nasal type and 76 (36.2%) male subjects had hyperplatyrrhine nasal type. On the other hand, 8 (3.8%) female subjects had mesorrhine nasal type, 144 (68.6%) female subjects had platyrrhine nasal type and 58 (27.6%) female subjects had hyperplatyrrhine. The results of the present study reveals that the mean height for males is 169.10 ± 7.69 and for females 166.98 ± 7.81 .

Risley (1915), reported that the nasal index of Africans is basically platyrrhine; this does agree with our study which showed that the Okun tribe has predominantly platyrrhine. Morphometric

parameters are dependent upon age, race and sex and so a Platyrrhine nose could be typical to the Okun tribe. Oladipo *et al.*, (2009), also reported a platyrrhine nose type in an analysis of the nasal indices of Igbo, Ijaw and Yoruba ethnic groups in southern Nigeria. In another study carried out among the Bekwaras in Cross River State, Nigeria; Esomonu reported a platyrrhine nose type.

In this study it was observed that nasal height and nasal width was higher in males than in females. The studied nasal dimensions in this study were observed to have sexual dimorphic characteristic with significantly higher values in males than females. All measured parameters showed high sex difference as observed by Oladipo *et al.* (2009); Sharma *et al.* (2014) and Ukoha *et al.* (2016).

However, a few studies have recorded mesorrhine nose type among some ethnic groups in Nigeria. Oladipo reported a mesorrhine nose type for Andoni ethnic group of Rivers State in Nigeria, also Ikwerre males fell under the mesorrhine nose type, Ibibio females and Yakurr males of South-South Nigeria and Hausas of Northern Nigeria. The reason for the platyrrhinity of the Okun ethnic groups of Kogi State can be linked to postulation made by Hall that broader noses (Platyrrhine) are favoured in warmer climates, whereas narrower noses are favoured in cold climates. The result of this study conforms to this postulation as the Okun people are within the warmer climates regions of Nigeria.

From Table 1 and 2, the Okun males had significantly higher nasal height, nasal width and nasal index compared to their female counterparts ($P < 0.05$) indicating *sexual dimorphism*. This result also conforms to previous studies where sexual dimorphism was observed. Oladipo reported

platyrrhine nose type in an analysis of the nasal indices of Igbo, Ijaw and Yoruba ethnic groups of southern Nigeria with males having significant higher nasal index than females ($P < 0.05$). Eliakim-Ikechukwu reported higher values of nasal parameters among the Yakurr females in the study of the nasal parameters of Ibibio and Yakurr ethnic groups in South- South Nigeria.

Other Nigerian ethnic group that have platyrrhine nose type include the Igbos, Ijaws and Yoruba (Oladipo *et al.*, 2007), the Okrikas (Oladipo *et al.*, 2009), and Bini ethnic group (Oludiran *et al.*, 2010). Findings of this study and the comparison of the nasal index with other works have shown that though anthropological differences exist in the values of the nasal indices of adult Okun population, they still fall within the broad platyrrhine class of nose prevalent in the African continent.

Conclusion

The nasal index is said to be related to regional and climatic differences (Farkas *et al.*, 1986) and one of the best clues to racial origin (Madison, 2004). The prevalent nasal type for the Okun population was the platyrrhine nasal type. However, the males had higher percentage of those with mesorrhine nasal type, while the females had the highest platyrrhine nasal type in the population.

hyperplatyrrhine and mesorrhine nasal types take second and third place respectively. It was found that there was a positive correlation between the nasal width and the stature dimension in males ($r = 0.2179$, $p < 0.002$), While in the female counterpart, a positive correlation between the nasal width and stature ($r = 0.0398$, $p < 0.142$). However, there was no significant relationship between the nasal indice and stature for both sexes (male and female).

Illustrations

Table 1: The distribution of the studied population by LGAs stratified by sex

SEX	LOCAL GOVERNMENT AREA					Total
	IJUMU	KABBA/BUNU	MOPA/MURO	YAGBA EAST	YAGBA WEST	
Male (%)	48 (22.9%)	45 (21.4%)	46 (21.9%)	30 (14.3%)	41 (19.5%)	210 (50%)
Female (%)	39 (18.6%)	37 (17.6%)	40 (19.0%)	51 (24.3%)	43 (20.5%)	210 (50%)
Total (%)	87 (20.7%)	82 (19.5%)	86 (20.5%)	81 (19.3%)	84 (20.0%)	420

Table 2: The mean (S.D) and test of mean difference in the nasal parameters and height of male and female Okun population

Variables	Male			Female			t-test		
	Mean±S.D	Min	Max	Mean±S.D	Min	Max	t-value	p-value	Inf.
Nasal width(mm)	43.44±3.17	36.90	53.30	42.78±2.63	36.40	50.80	2.343	0.02	S
Nasal height(mm)	44.31±3.23	35.80	53.20	44.18±3.13	35.10	53.20	0.42	0.675	NS
Nasal index (mm)	98.43±8.87	74.90	128.13	97.19±7.85	74.90	130.77	1.52	0.129	NS
Height (cm)	169.10±7.69	150.00	186.00	166.98±7.81	141.00	184.00	2.795	0.005	S

Note: S.D=Standard deviation; Inf. =inference

Table 3: Nasal type distribution and test of association with sex

Sex	Nasal type			Test of Association			
	Mesorrhine	Platyrrhine	Hyperplatyrrhine	Df	χ^2 -value	p-value	Inf
Male (%)	11 (5.2%)	123 (58.6%)	76 (36.2%)	2	4.543	0.103	NS
Female (%)	8 (3.8%)	144 (68.6%)	58 (27.6%)				
Total (%)	19 (4.5%)	267 (63.6%)	134 (31.9%)				

Note: D.F=Degree of freedom, χ^2 =Chi-square, Inf=inference

Table 4: Nasal type distribution and test of association with sex

Variables	correlation with Height (cm) in males				correlation with Height (cm) in females			
	R	R ²	P-value	R _e	R	R ²	P-value	R _e
Nasal width (mm)	0.2179	4.75%	0.002	0.615 (N.W) + 142.36	0.2534	6.42%	0.0002	0.648 (N.W) + 139.26
Nasal height (mm)	0.16z65	2.77%	0.016	0.338 (N.H) + 154.1	0.142	2.02%	0.0398	0.415 (N.H) + 148.65
Nasal index	0.0109	0.01%	0.8756	N/A	0.09	0.01%	0.1941	N/A

Note: r=Pearson's coefficient, R²= Coefficient of determination; R_E=Regression Equation; NS= Not Significant; S= Significant; Inf= Inference. N/A not available.

Figures



Fig. 1: Measuring the Nasal Height (NH)



Fig. 2: Measuring the Nasal Breadth (NB)

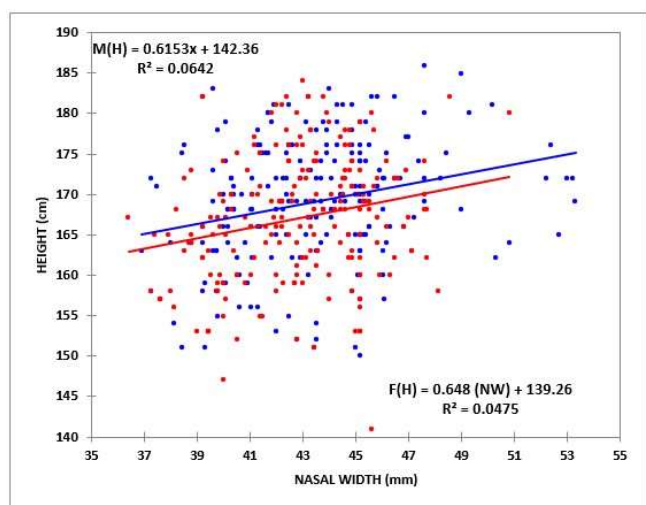


Fig. 3: Scatter plots of Height against Nasal width in males (blue) and female (Red)

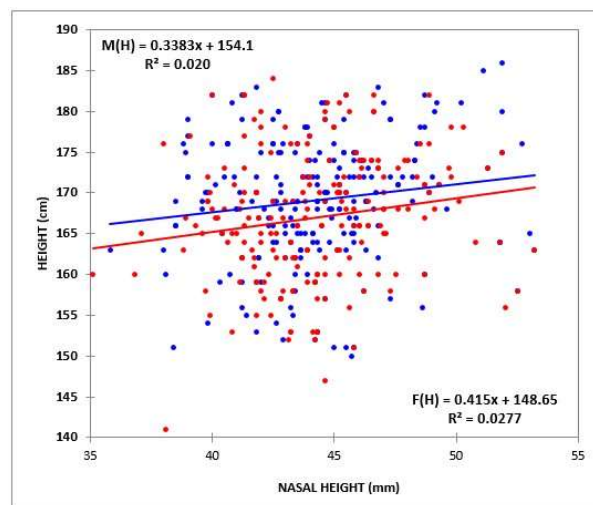


Fig. 4: Scatter plots of Height against Nasal height in males (blue) and female (Red)

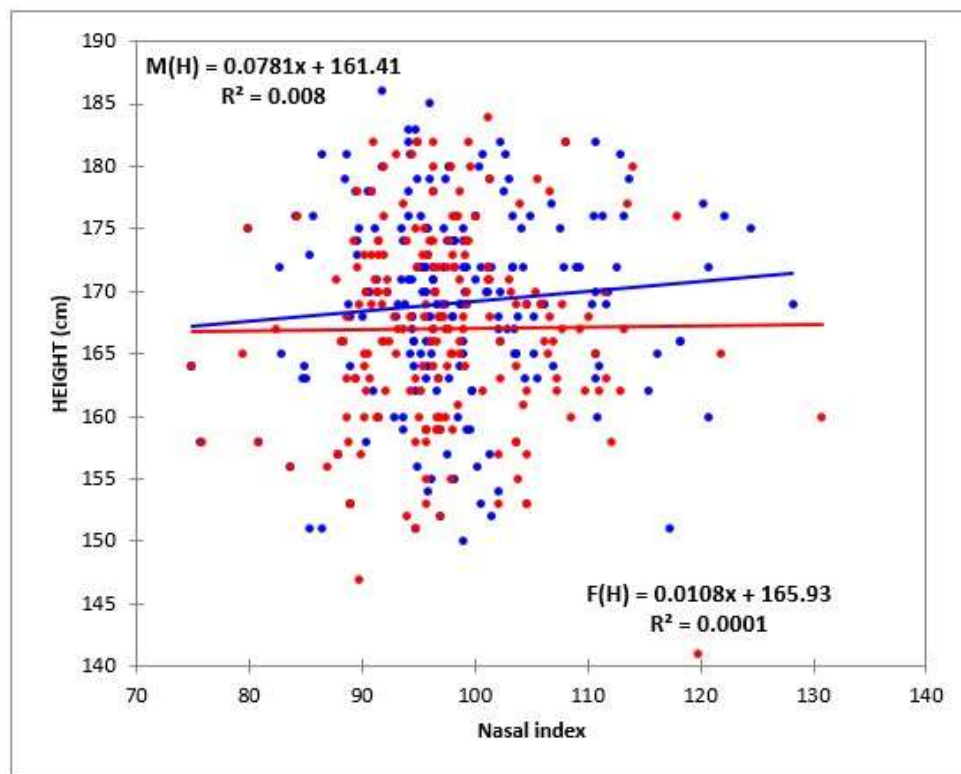


Fig. 5: Scatter

against Nasal index in males (blue) and female (Red)

plots of Height

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