Clinical Anthropometric Assessment of the Adult Face of Yorubas in Nigeria

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ABSTRACT

BACKGROUND: Variations exist in facial anthropometric dimensions based on sex, age, and ethnicity. These variations may be of diagnostic, forensic, and anthropological significance.

PURPOSE: To establish naso-orofacial anthropometric database for the Yoruba tribe, noting important distinguishing features and sexual variations.

MATERIALS AND METHODS: The normative data of 678 adult Nigerians of Yoruba ethnic origin were determined by 25 clinical measurements (17 nasal, 4 orolabial, and 4 facial measurements).

RESULTS: Majority (61.5%) of individuals were male with a mean age of 29.52 ± 8.97 (age range, 18–60 years). Significant sexual dimorphism exists, with males having higher scores in vertical and linear dimension, whereas females have higher angular dimensions. Females have wider nasal root width and nasofrontal and nasolabial angles compared to males, whereas males have wider facial width and height.

CONCLUSION: This normative anthropometric data can serve as a template for comparison of future studies and has applications for treatment planning in facial reconstruction of patients of Yoruba origin

KEYWORDS Anthropometry, face, Nigeria, nose, Yoruba

INTRODUCTION

Craniofacial anthropometry is increasingly used in medicine for diagnosis, treatment planning, and monitoring outcome of craniofacial surgery as well as growth monitoring. Other areas of application include forensic medicine and industrial design of prosthesis and implants (Kolar and Salter, 1997; Doddi and Eccles, 2010; Naini, 2011). Direct facial anthropometry is considered the gold standard and is widely used (Farkas *et al*., 2005; Omotoso *et al*., 2011). Normative anthropometric data exist for different countries (Farkas *et al*., 2005; Ngeow and Aljunid, 2009; Fang *et al*., 2011; Salah *et al*., 2014; Maalman *et al*., 2017) and for Nigeria (Saheeb *et al*., 2004; Umar *et al*., 2006; Oladipo *et al*., 2009; Olotu *et al*., 2009; Esomonu and Badamasi, 2012; Jaja *et al*., 2011; Olusanya *et al*., 2018; Anibor *et al*., 2013), reflecting wide variations on account of ethnic, gender, age, and individual differences. Majority of the Nigerian studies report on cephalic, nasal, and canthal indices of other ethnic groups using different methods. Only one study (Akinlolu, 2016) reports craniofacial anthropometric data of the human face and nose among the Yorubas using photogrammetry method. The Yorubas are a majority ethnic group in the southwestern part of Nigeria. This study aimed to report craniofacial anthropometric data of the nose and face in the Yorubas using clinical anthropometry, thereby establishing aso-orofacia anthropometric database for the tribe.

MATERIALS AND METHODS

Study Design

This was a cross-sectional observational study.

Study Population

Six hundred and seventy-eight consecutive adult patients, staff, and students of the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria, aged between 18 and 60 years had facial and nasal measurements done.

The Declaration of Helsinki was adhered to throughout the study. The study was conducted between August

2017 and May 2018. Ethical and Research Committee of the Hospital approved the study, and informed consent was obtained from the participants.

Individuals of Yoruba ethnic origin who willingly gave written informed consent permitting the clinical measurements of their faces were included; those with a history of craniofacial trauma, facial paralysis, congenital or acquired anomalies, and/or maxillofacial surgeries; pregnant women; or recent weight loss, tribal marks, mentally handicapped, and uncooperative individuals were excluded from the study.

The respondents' age at the last birthday, gender, and tribe (including both parents' tribe) were documented in a predesigned pro forma.

Clinical anthropometric measures

All clinical anthropometric measurements were done by properly and extensively trained resident doctors who are dentists rotating through Ear, Nose, and Throat Department of the Obafemi Awolowo University Teaching Hospitals. The measurements were made with sliding calipers, measuring tape, compass, protractor, nasal root height instrument, and level and angle finder.

All participants were seated comfortably in an examining chair in a relaxed state and upright position or supine (depending on the measurement to be taken) and were asked to remove their eye glasses if any. Clinical anthropometric measurements were taken from the face (middle and lower third) and nose directly avoiding excessive pressure that could lead to tissue deformation.

The distance was measured between the two points/ facial landmarks marked in its passive state with a pair of Vernier calipers. Extreme care and attention were given to prevent any change in the position of landmark consequent to changes in facial expression. The readings on the Vernier scale were noted to the fraction of one-tenth of a millimeter. Three such recordings were made to arrive at an average value

Seventeen nasal and eight facial clinical anthropometric measurements were done as follows:

Nasal measurements include 13 linear dimensions, 3 angles of the nasal profile, and 1 inclination. Of the 13 linear measurements, 12 are projective and one, alar contour, is a surface measurement [Table 1].

Facial measurements: eight linear facial measurement were taken, of which four were linear orolabial measurements (vertical) and the other four were linear facial measurements (three vertical and one horizontal) [Table 2].

Statistical analysis

All statistical analyses were conducted using STATA software (version 12.0; Stata Corporation, TX, USA). Numerical variables were expressed as mean ± standard deviation and categorical variables were showed as frequencies.

Inter and intraexaminer reliability was assessed by having the same operator recalculating twenty randomly selected records 1 week after the initial measurements.

TABLE 1. Definition of landmarks

Anthropometric measurements	Landmark	Measurement name
Linear measurements-projective-horizontal		
mf:mf	maxillofrontale-maxillofrontale	Nasal root width
al:al	alare-alare	Nose width
	Indeterminate	Columella width
Sbal-sn	Sub-alare-sub-nasale (bilateral)	Nostril floor width
	Indeterminate	Ala thickness
Linear measurements-projective-sagittal		
Sn-prn	Subnasale-pronasale	Nasal tip protrusion
en-m'	endocanthion-nasal midline (bilateral)	Nasal root height
en-m'	-	Nasal root slope
ac-prn	alar curvature point-pronasale (bilateral)	Ala length
sn'-c	Subnasale-highest point of columella	Columella length
Linear measurement-projectile-vertical		
n-sn	Nasion-subnasale	Nose height
n-prn	Nasion-pronasale	Nasal bridge length
Linear measurement-surface		
ac-prn s	Alar curvature point-pronasale surface (bilateral)	Alar surface length
Angles and inclinations		
	Indeterminate	Nasofrontal angle
	Indeterminate	Nasolabial angle
	Indeterminate	Nasal tip angle
	Indeterminate	Nasal bridge inclination

Random error was calculated using Dahlberg's formula (Galvao *ET AL*., 2012) as follows:

$$SDe = \sqrt{\sum^{d2} 2n}$$

where "*D*" is the difference between the repeated measurements and "*N*" is the number of repeated measurements.

RESULTS

The mean age of the enrolled individuals was 29.52 ± 8.97 years (range, 18–60 years). Four hundred and seventeen (61.5%) of the participants were male and 261 (38.5%) were female with male: female ratio of 1.6:1.

The naso-orofacial anthropometric norms of the Yorubas are shown in Tables 3 and 4. In general, all the anthropometric measurements were different between the males and females. With regard to nasal measurements, the mean values for nasal root height, alar height and thickness, and columella length were higher in females when compared with males. Nasofrontal, nasolabial, and nasal tip angles were also found to be generally higher in females than males. The higher values recorded in the females were statistically significant for nasal root width, alar height and thickness, alar surface length, nasofrontal angle, nasolabial angle and nasal tip angle [Table 3]. On the other hand, vertical linear measurements such as face height and nose height were higher in males than females. Males also recorded higher horizontal values for nasal width, face width, and nostril floor width. All these differences were statistically significant, except for the face height [Tables 3 and 4].

For lip measurements, the mean values for upper lip height and upper vermillion height were higher in males [Table 4], in contrast to lower vermillion height and cutaneous upper lip height which were higher in females.

TABLE 2. Definition of landmarks

Landmark		Measurement name
Orolabial measurements		
Linear measurements-projective-vertical		
sn-sto	Subnasale-labiale superius	Upper lip height
sn-ls	labiale superius-stomion	Philtrum lenght
ls-sto	-	Upper vermillion height
sto-li	Stomion-labiale inferius	Lower vermillion height
Facial measurements		
Linear measurements-projectve-vertical		
n-gn		Face height
n-sto		Upper face height
sn-gn		Lower face height
Linear measurements-projectve-horizontal		
zy-zy		Face width

DISCUSSION

Oladipo *et al*. in 2008 in an earlier study reported the nasal index in Yorubas of ages 18–45 years. The present report direct clinical anthropometric linear and angular measurements of the nose and the face of the Yorubas of wider age range 18–60 years. The use of several parameters of measurements in linear and angular dimensions ensured detailed characterization of the nasofacial structures. Both parents of the participants were of Yoruba ethnic origin. The ethnic origin of the grandparents of the participants was not assessed, and this could potentially affect the ethnic homogeneity of the sample.

The results of the present study demonstrated sexual dimorphism in all the parameters measured. It is noteworthy that the minimum measurements were always recorded for the Yoruba women in vertical and horizontal linear dimensions, except for the columella length. The face height and width are distinguishing metric parameters of the human face in vertical and horizontal dimension (Omotoso *et al*., 2011). The higher values recorded for both face height and width in the present study agree with conventional literature (Kolar and Salter, 1997; Farkas *et al*., 2005; Salah *et al*., 2014;

Olotu *et al*., 2009; Umar *et al*., 2006), except for wider bizygomatic dimension reported for Greek (Kolar and Salter, 1997) and Malay (Ngeow and Aljunid, 2009) females. However, the small sample sizes of these reports make this unlikely to be representative of the whole populations. Even though males have higher face height in the present study, females interestingly have higher LFH. Higher values were also reported by Umar *et al*., 2006, for lower face height in another Nigerian study. This finding coupled with the lower angular parameters in females may be useful and applicable in formulating a distinguishing index for gender recognition. More studies are needed to further explore this phenomenon. Olotu *et al*., 2009, and Anibor *et al*., 2013, described nasal indices in Igbo and Ijaw ethnic groups as ratio of nasal length and height. In the present report, we reported additional nasal parameters such as nasal slope and inclination, which we believe gives a more comprehensive description of the nose. Sexual differences also occurred in slope and inclination of the nose in this study with higher values in males.

Canthal indices have also been used to characterize the orbital differences in the Nigerian population (Oladipo *et al*., 2009; Jaja *et al*., 2011; Esomonu and Badamasi, 2012), but we did not measure canthal index in the present study owing to difficulties of direct clinical measurements around the orbit. Within the limits of permissible intra- and interexaminer reliability, the naso-orofacial clinical anthropometric norms of the Yorubas have been reported. Significant gender

TABLE 3. Distribution of the anthropometric measurements of the nose by gender

Anthropometric measurements	Combined, mean±SE	Female		Male		*P*
		Mean±SD	Median (IQR)	Mean±SD	Median (IQR)	
Nasal root width	19.87±0.30	20.98±8.29	20 (8)	19.19±7.15	18 (7)	0.0013*
Nose width	40.04±0.23	38.86±5.36	40 (6)	40.79±6.22	41 (6)	0.0000*
Columella width	7.14±0.18	7.01±5.99	6 (3)	7.24±3.83	6.8 (4)	0.0397*
Nostril floor width	12.14±0.35	11.95±10.04	10 (4)	12.26±8.63	10 (6)	0.0092*
Alar thickness	6.35±0.20	7.34±7.25	5 (3)	5.75±3.12	(3)	0.0245*
Nasal tip protrusion	15.96±0.27	15.68±8.00	15.5 (8)	16.15±6.19	17 (8)	0.0196*
Nasal root height	16.77±0.39	16.85±10.04	14.5 (10)	16.71±9.78	(10)	0.6788
Nasal root slope	21.00±0.26	20.96±6.07	20 (8)	21.01±7.25	(10)	0.4920
Alar height	22.38±0.43	23.38±11.26	20 (15)	21.78±10.83	18 (17.5)	0.0433*
Columella length	10.49±0.36	11.26±9.32	8 (9.5)	10.02±9.17	(5)	0.0866
Nose height	42.73±0.39	40.93±8.64	42 (5)	43.85±10.59	44 (8)	0.0001*
Nasal bridge length	38.17±0.41	36.96±10.95	37 (11)	38.94±10.17	38 (9)	0.0082*
Alar surface length	52.93±1.07	56.32±25.16	70 (48)	50.87±28.02	(56)	0.0215*
Nasofrontal angle	132.55±0.54	134.32±12.76	135 (10)	131.37±14.86	131 (14)	0.0033*
Nasolabial angle	85.61±0.97	89.48±25.57	89 (25)	83.08±23.69	(28)	0.0014*
Nasal tip angle	70.27±1.03	74.05±23.21	80 (35)	67.91±28.41	(49)	0.0354*
Nasal bridge inclination	57.20±1.26	56.26±33.43	39 (35.5)	57.88±32.63	(35)	0.0643

***Statistically significant. IQR - Inter-quartile range, SE - Standard error, SD - Standard deviation**

TABLE 3. Distribution of the anthropometric measurements of the nose by gender

Anthropometric measurement	Combined, mean±SE	Female		Male		*P*
		Mean±SD	Median (IGR)	Mean±SD	Median (IGR)	
Upper lip height	24.93±0.26	24.65±6.70	24(6)	25.06±4.63	25(6)	0.1320
Cutaneous upper lip height	15.84±0.17	15.89±3.37	16(3)	15.82±3.56	16(4)	0.6398
Upper vermillion height	11.14±0.24	10.98±3.14	11(4)	11.22±5.60	11 (3.5)	0.8367
Lower vermillion height	12.24±0.11	12.47±2.40	12(3)	12.14±2.32	12(3)	0.2879
Face width	130.04±1.86	127.49±41.50	115(17)	131.21±36.39	124 (24.5)	0.0009*
Face height	118.37±0.71	117.62±13.97	115 (13.5)	118.72±14.92	118(14)	0.1439
Upper face height	68.38±0.50	70.83±6.96	70 (10)	67.25±11.35	69 (12.5)	0.0121*
Lower face height	69.30±0.52	71.75±7.47	71 (9.5)	68.17±11.70	70 (11.5)	0.0109*

***Statistically significant. IQR - Inter-quartile range, SE - Standard error, SD - Standard deviation**

dimorphism exists, with males having higher scores in vertical and linear dimension, whereas females have higher angular dimension. The reasons for this sexual dimorphism are not clear; however, genetic and epigenetic factors as well as environmental causes may be implicated.

In the present study, we used a convenient sample, which although relatively small compares well with similar studies (Oladipo *et al*., 2008). This is a limitation to the study, larger studies are therefore recommended before generalization for the entire Yoruba population can be made.

CONCLUSION

This normative anthropometric data showed significant gender dimorphism and can serve as a template for comparison of future studies with applications for treatment planning in facial reconstruction of patients of Yoruba origin.

FINANCIAL SUPPORT AND SPONSORSHIP

Nil.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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