Journal of Advances in Medicine and Medical Research

32(4): 34-45, 2020; Article no.JAMMR.55133
ISSN: 2456-8899
(Past name: British Journal of Medicine and Medical Research, Past ISSN: 2231-0614, NLM ID: 101570965)

Angular Photogrammetric Comparison of the Craniofacial Soft-tissue Profile of Three Ethnic Groups in Southern Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author PDO designed the study, performed the statistical analysis and wrote the protocol. Author MAA wrote the first draft of the manuscript, managed the analyses of the study and also managed the literature searches. Both authors read and approved the final manuscript

Article Information

DOI: 10.9734/JAMMR/2020/v32i430397
Editor(s):
(1) Dr. Rosa Lelyana, Diponegoro University, Indonesia.
Reviewers:
(1) Karpal Singh Sohal, Muhimbili University of Health and Allied Sciences, Tanzania.
(2) Himawan Halim, Trisakti University, Indonesia.
Complete Peer review History: http://www.sdiarticle4.com/review-history/55133

Original Research Article

Received 29 December 2019
Accepted 04 March 2020
Published 28 March 2020

ABSTRACT

Aim: The aim of this study was to determine the angular craniofacial soft tissue profile of adult southern Nigerian males of Igbo, Ijaw and Yoruba extractions.
Methodology: The study made use of a total number of one thousand two hundred (1200) subjects divided into four hundred (400) subjects each from the Igbo, Yoruba and Ijaw ethnic groups of southern Nigeria whose ages ranged between 21 to 40 years. Determination of minimum sample size was done using the Taro-Yamane's formula. The study employed the use of photogrammetry. Standardized photographic record of the 1200 adults were taken in the natural head position. Photographs were analysed using a software tool (WinImager). Data generated were subjected to statistical analysis using SPSS version 25.0 and Microsoft Excel 2019.
Results: Results showed ethnic variations across the different ethnic groups. Age related changes were also observed. On comparison with other racial populations, marked differences were observed.

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Conclusion: These anthropometric values define the facial soft tissue norm of southern Nigeria and could be useful in anthropometric studies, orofacial, orthodontic and maxillofacial surgeries, and forensics.

Keywords: Comparative; angular; craniofacial; soft tissue; profile; Southern Nigeria.

1. INTRODUCTION

Physical appearance is an important characteristic of the face and an individual's self-esteem is largely influenced by appearance of the face [1]. Evaluation of soft tissue profile is one of the most important components of diagnosis in orthodontics and treatment planning [2]. In addition to appearance and facial expression, another major role of the face is to provide personal identity for every individual. The face just like other parts of the body shows morphological variation from individual to individual. The shape of the face is determined by underlying bone, thickness and distribution of the underlying fat as well as the facial muscles [3].

The understanding of facial soft tissues and their normal ranges allows for formulation of treatment plan for a particular individual in the event of a trauma or pathology. Facial dimensions are among the most important cephalometric parameters used in the description of human morphology, identification of individuals and classification of races and sex [4].

Soft tissue profile standards using photogrammetry have been reported for various races; North American population[5], Spanish[6], Himachalis of Indians [7], Brazilian Caucasians [8], Croatians [9] and Turkish [10,11].

Morphological features of different racial populations and ethnic groups are not randomly distributed but appear in geographic cluster therefore, there is a need for facial study on different ethnic groups to establish specific anthropometric data for population with different ethnic backgrounds [12]. What could be considered normal for these negroids is unknown. To this end, therefore, it becomes necessary to develop standards that would describe these southern Nigerian ethnic groups.

The aim of this study was to establish as well as compare the angular craniofacial profile of the Igbo, Ijaw and Yoruba of southern Nigeria using photogrammetry.

2. MATERIALS AND METHODS

2.1 Research Design

The study design was a cross-sectional design which determined the photogrammetric features of three southern Nigerian ethnic groups.

2.2 Population for the Study

The population for the study included participants drawn from locations in Yenegoa, Amassoma, Ogbia, Kaima and Igbogene in Bayelsa State, Owerri, Mbaitoli, Ngor-Okpala, Orlu, Mbaise and Okigwe in Imo State; Akure, Idanre, Akoko and Okitipupa in Ondo State constituted the study areas representing the Igbo, Ijaw and Yoruba areas respectively.

The Igbo, Ijaw and Yoruba are the dominant ethnic groups found in southern Nigeria. The Igbo and Yoruba along with the Hausa of northern Nigeria are the three major ethnic groups in Nigeria. The Igbo are found predominantly in southeastern and midwestern (Delta State) of Nigeria. They are also found in other African countries [13,14] and outside Africa. The Igbo people are one of the largest ethnic groups in Africa [15]. The Ijaw are found in the southernmost part of Nigeria. They dwell in riverine locations near many sea trade routes [16]. The Yoruba are predominantly found in southwestern Nigeria, where they make up to about 21% of the country's population, according to the CIA World Factbook [17].

2.3 Sample Size and Sampling Technique

The sampling technique was multistage random sampling. Subjects were randomly selected from amongst adult males from the three (3) major tribes (Yoruba, Ijaw and Igbo) residing in Imo, Ondo and Bayelsa states all in southern Nigeria. Four hundred (400) subjects were randomly selected from each of the Igbo, Ijaw and Yoruba ethnic groups giving a total number of one thousand two hundred (1200). Minimum sample size for the study was determined using the Taro-Yamane formula, $n=N/〖1+N(e)^2〗$ where n

= minimum sample size, N = total population and e = margin of error = 0.05.

Only Adult males between the ages of 21 and 40 years were included in this research. It was ascertained that recruited subjects have both parents and four grand parents from the same ethnic group and had no previous history of orthodontic or surgical treatment. This was determined through questionnaires.

2.4 Materials/Photographic Setup/ Photo-graphing

The study made use of questionnaires, digital camera (Nikon COOLPIX S2800, 20.1 mega pixel, x5 zoom), software tool for photographic image analysis (WinImager®), Photographic Tripod Stand (WT 3570), 100cm meter rule, graph sheet, 32 GB media card and card reader.

The photogrammetric method involved direct capturing of photographic images of the face taken from a digital camera (Nikon COOLPIX S2800) under illumination and analysis of the photographs using facial parameters derived from standard anatomical landmarks. The photographic set-up was made for capture in the natural head position (NHP), with a minimum resolution of 640 × 480 pixel. The set-up was done with a tripod (WT 3570) for supporting the digital camera. Adjustment of the tripod enabled the optical axis of the lens that was kept in a horizontal position during the recording, adapted to each subjects' body height in a standing position. Each subject was made to be relaxed with both the arms hanging freely on each side of the trunk. The camera to the subject distance was maintained at a constant distance of 1.0 – 1.5 meters for all the subjects. The subject was asked to look at an object at his eye level. Then the subject was asked to keep the lips in relaxed position so that the right-side profile record was taken in Natural Head Position (NHP). The same procedure was repeated for every subject. The subject`s forehead, neck and ear were clearly visible and their lips were in repose.

2.5 Digitalisation

Photographs were transferred to a computer, and with the appropriate landmarks (Figs. 1 and 2), measurements were extracted with the aid of a software-tool for facial analysis, the WinImager developed by Oghenemavwe et al. [18]. The images captured by the digital camera were evaluated with the aid of the software tool transferred to spread sheet and databases on the computer screen generated values which were used as the result.

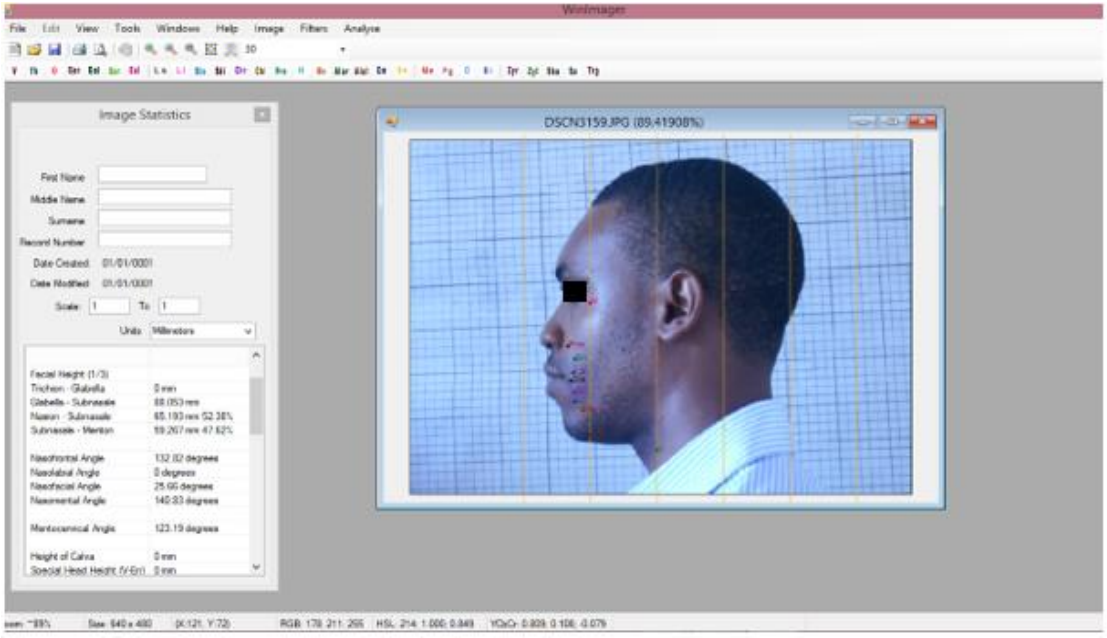

Fig. 1. Digitalisation

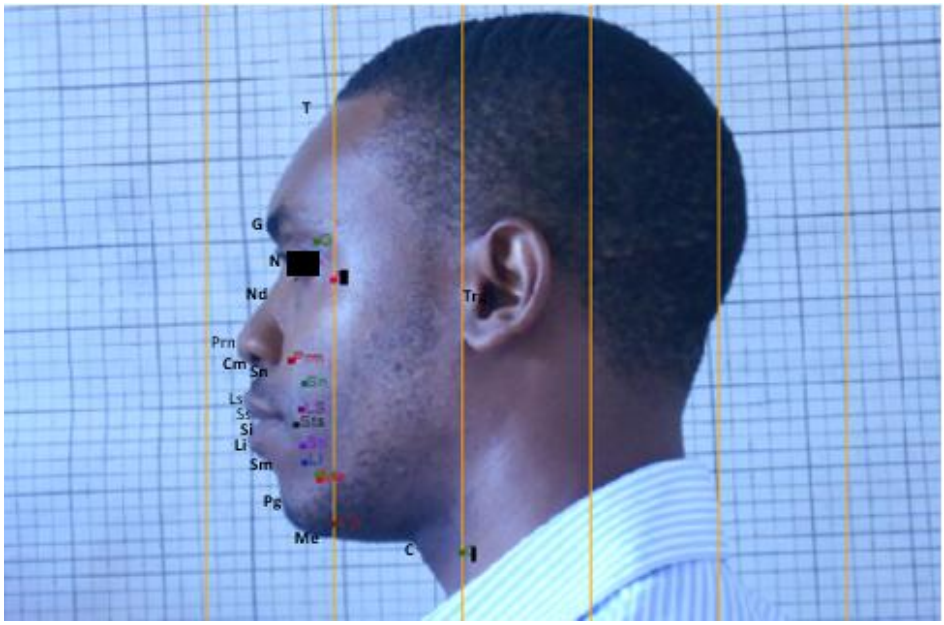

Fig. 2. Soft-tissue points: trichion (T), glabella (G), nasion (N), nasal dorsum (Nd), tragion (Trg), pronasal (Prn), columella (Cm), subnasal (Sn), labial superior (Ls), stomion superior (Ss), stomion inferior (Si), labial inferior, supramentale (Sm), pogonion (Pg), menton (Me), cervical point (C)

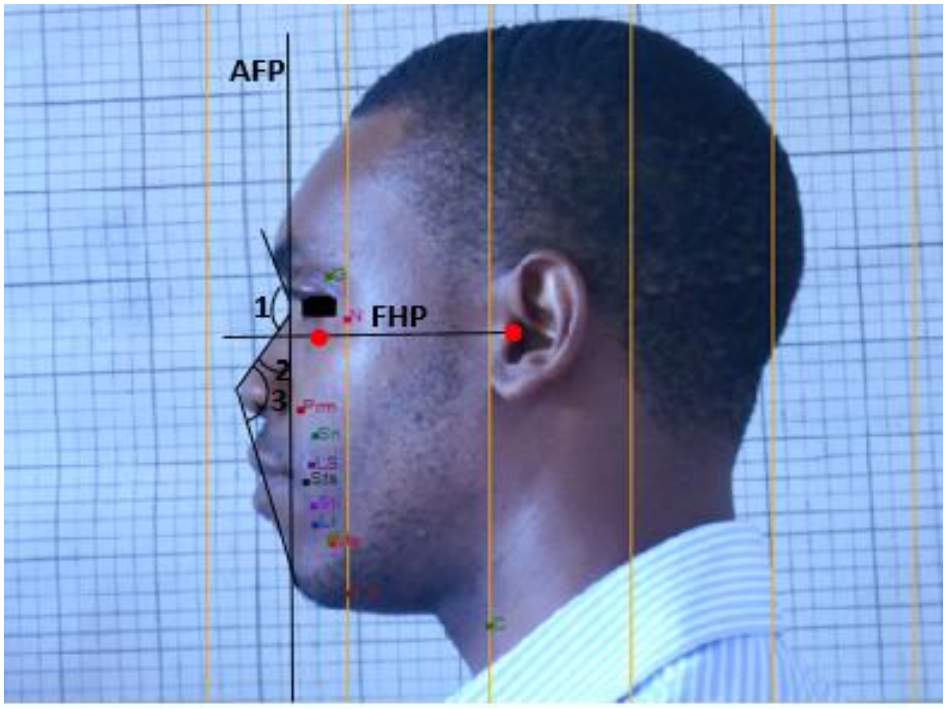

Fig. 3. Illustration of angular parameters: Nasofrontal angle (G-N-Prn), 2 nasofacial angle (G-Pg/N-Prn), 3 nasomental angle (N-Prn-Pg), AFP (anterior facial plane), FHP (Frankfort horizontal plane)

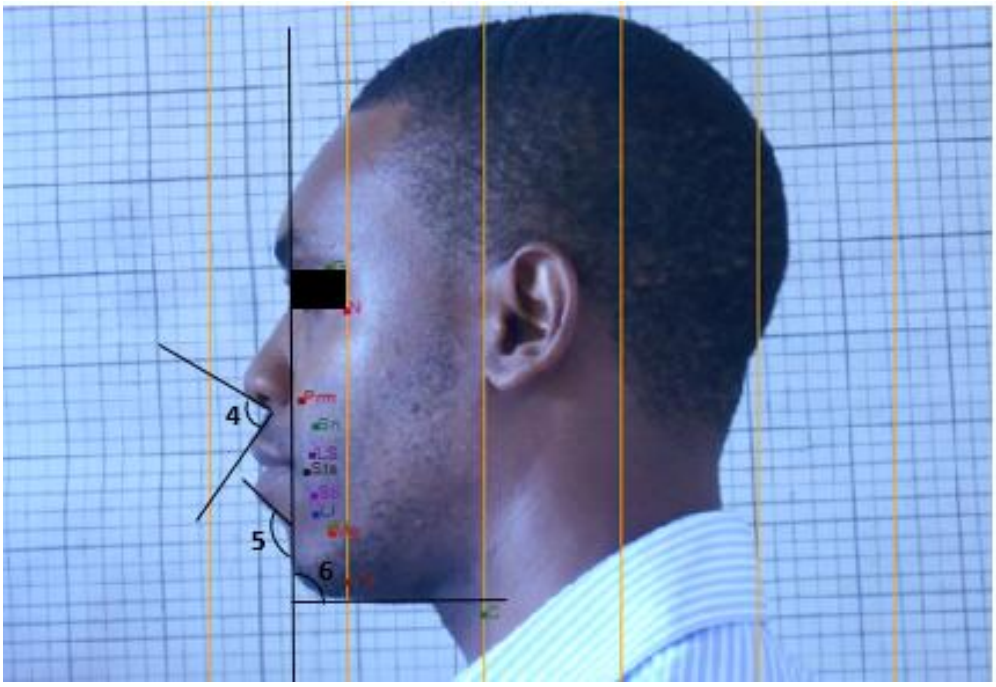

Fig. 4. Illustration of angular parameters: 4 Nasolabial angle (Cm-Sn-Ls), 5 mentolabial angle (Li – Sm- Pg). 6. mentocervical angle (G-Pg/C-Me)

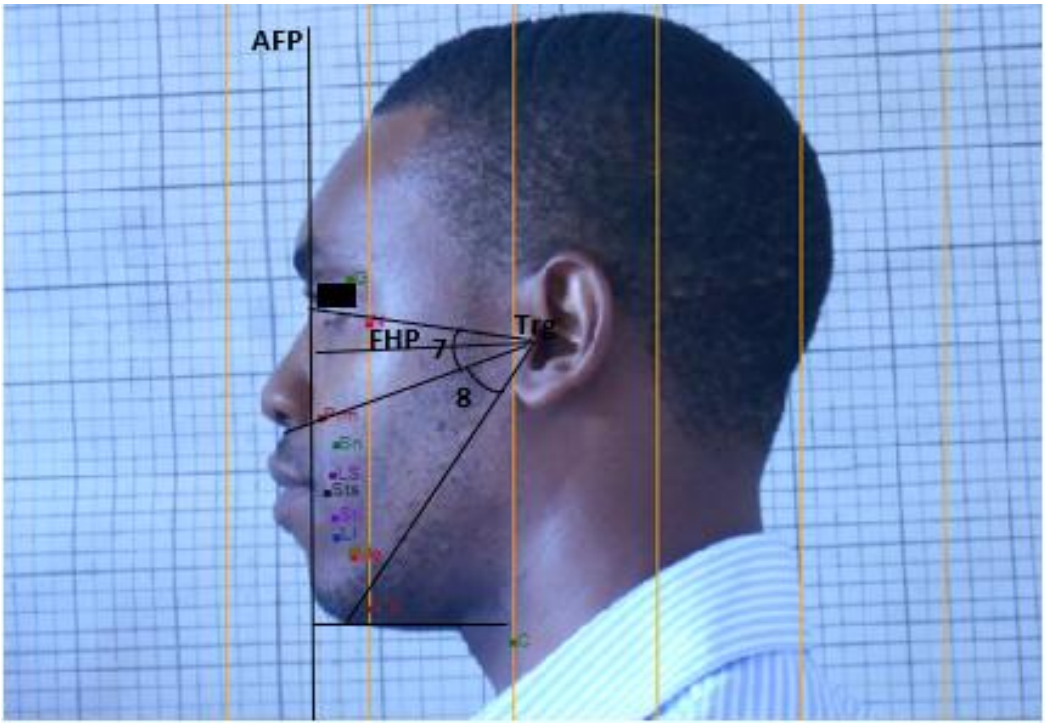

Fig. 5. Illustration of angular parameters: angle of medium facial third (N-Trg-Sn), 8 Angle of the inferior facial third (Sn-Trg -Me)

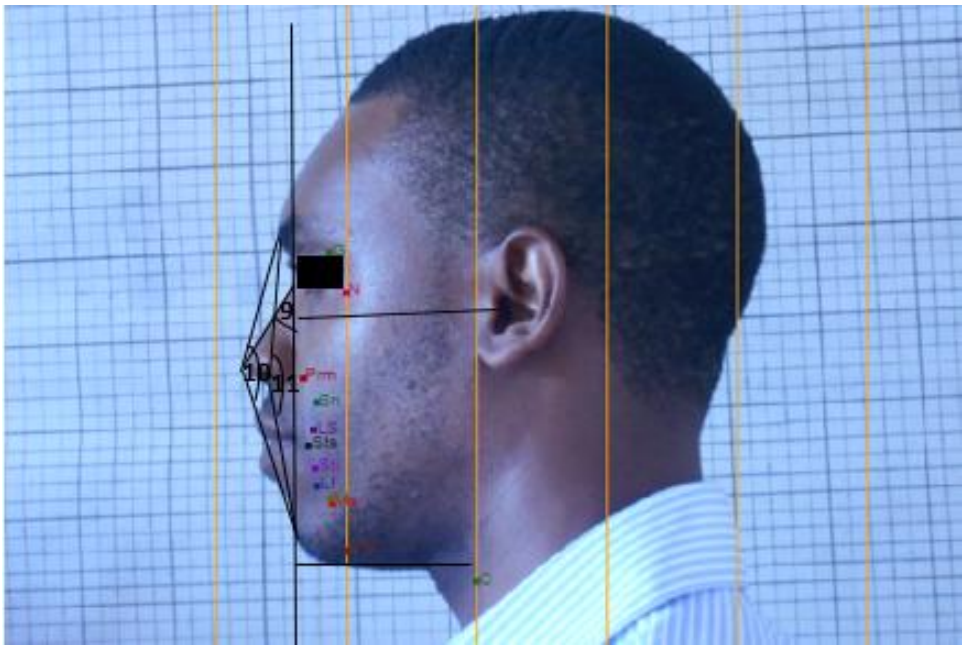

Fig. 6. Illustration of angular parameters: 9. Vertical Nasal Angle (N- Prn/AFP) 10. Angle of Facial Convexity (G-Sn-Pg) 11. Angle of Total Facial Convexity (G-Prn-Pg)

2.6 Precautions

Errors were minimized by taking the following precautions:

- It was ensured that photographs were taken with the subject's head in natural head position and eye level at the Frankfurt plane.
- The camera to the subject distance was maintained at a constant distance of 1.0 – 1.5 meters for all the subjects.
- Measurements were taken using anatomical landmarks.
- It was also ensured that the software used for the research had readings in degrees.

2.7 Statistical Analysis

Statistical analysis was done using statistical package for the social science (SPSS version 25.0) and Microsoft Excel 2019. Continuous variables were presented as mean $\pm$ SD; minimum and maximum. Analysis of variance (ANOVA) was done to establish significant differences in the measured anthropometric parameters according to ethnic group. Age was categorized into two groups, 21 – 30 and 31 – 40 years. Independent sample t-test was therefore carried out to determine significant difference in the measured anthropometric parameters according to age. The confidence interval was set at 95%, therefore $p< 0.05$ was considered significant.

3. RESULTS AND DISCUSSION

Results are shown in Tables 1–5. Table 1 shows descriptive statistics of the measured angular craniofacial parameters of the three southern Nigerian ethnic groups, the respective mean of each group and the total mean of the three ethnic groups. Mean nasofrontal angle (G-N-Prn) was found to be highest among the Igbos and least among the Yorubas. Nasomental angle (N-Prn-Pg) was highest among the Yorubas and least in the Igbos. Mentocervical angle (G-Pg/C-Me) was highest among the Ijaws and least among the Yorubas. Angle of Facial Convexity (G-Sn-Pg) was highest among the Igbos and least among the Yorubas while nasolabial angle (Cm-Sn-Ls) was highest among Yorubas and least among the Igbos. Angle of medium facial third (N-Trg-Sn) was highest among the Ijaws and least in the Igbos. Vertical nasal angle (N- Prn/AFP) was highest among the Igbos and least among the Yorubas. ANOVA showed that Nasomental angle (N-Prn-Pg) and angle of the inferior facial third (Sn-Trg -Me) on comparison among the three ethnic groups were not statistically significant ($\rho>0.05$); other angular parameters were statistically significant ($\rho<0.05$) (Table 2).

Table 1. Descriptive statistics of the measured angular craniofacial parameters of the Igbo, Ijaw and Yoruba ethnic groups

Angular craniofacial parameters	IGBO [N = 400]			IJAW [N = 400]			YORUBA [N = 400]			ALL [N = 1200]		
	Mean±SD	Min	Max	Mean±SD	Min	Max	Mean±SD	Min	Max	Mean±SD	Min	Max
Age (years)	25.00±4.54	21.00	40.00	27.43±5.35	21.00	40.00	26.04±4.96	21.00	40.00	26.16±5.06	21.00	40.00
G-N-Prn	129.44±5.92	120.00	142.74	128.50±4.90	121.10	138.90	127.53±4.74	120.10	138.90	128.49±4.98	120.00	142.74
G-Pg/N-Prn	34.95±3.56	27.64	42.00	35.42±2.42	26.69	40.90	36.22±2.26	26.69	39.93	35.53±2.81	26.69	42.00
N-Prn-Pg	132.45±9.69	120.10	154.30	134.61±6.63	120.81	154.60	136.41±7.05	90.30	154.60	134.49±7.96	90.30	154.60
G-Pg/C-Me	90.41±2.48	86.39	99.80	91.76±2.54	87.21	105.19	90.15±2.65	87.21	105.19	90.77±2.57	86.39	105.19
G-Prn-Pg	139.69±6.33	130.10	157.00	140.09±5.96	130.30	156.60	141.53±6.40	130.10	156.60	140.43±6.23	130.10	157.00
G-Sn-Pg	162.54±6.75	155.20	180.00	161.42±6.80	155.11	179.90	160.96±7.12	155.10	179.90	161.64±6.92	155.10	180.00
Cm-Sn-Ls	93.56±4.43	88.14	105.10	94.36±3.72	89.10	104.12	95.31±4.06	89.10	104.12	94.41±4.10	88.14	105.10
N-Trg-Sn	23.08±2.46	19.90	35.00	25.60±2.39	20.11	34.30	24.95±2.51	20.11	34.30	24.54±2.47	19.90	35.00
Sn-Trg -Me	30.28±3.72	25.11	40.10	32.37±3.58	25.11	37.90	33.05±3.78	25.11	37.90	31.90±3.70	25.11	40.10
N- Prn/AFP	30.16±6.89	20.10	45.70	29.96±6.55	21.10	44.70	27.99±6.99	20.10	44.70	29.37±6.88	20.10	45.70
Li – Sm- Pg	113.25±4.96	95.11	121.10	111.61±5.85	96.10	120.90	111.56±5.95	95.11	120.80	112.14±5.65	95.11	121.10

G-N-Prn = Nasofrontal angle, G-Pg/N-Prn = Nasofacial angle, N-Prn-Pg = Nasomental angle, G-Pg/C-Me = Mentocervical angle, G-Prn-Pg = Angle of total facial convexity, G-Sn-Pg = Angle of facial convexity, Cm-Sn-Ls = Nasolabial angle, N-Trg-Sn = Angle of medium facial third, Sn-Trg -Me = Angle of inferior facial third, N- Prn/AFP = Vertical nasal angle, Li – Sm- Pg = Mentolabial angle, SD = Standard deviation, Min = Minimum, Max = Maximum

Independent sample t-test showed that nasofrontal angle (G-N-Prn) and mentocervical angle (G-Pg/C-Me) on comparison between the age groups among the Igbo subjects were statistically significant with ρ-values 0.01 and 0.00 respectively whereas the other angular parameters showed no statistically significant difference (ρ>0.05) (Table 3) whereas among the Ijaws, the angular parameters showed no statistically significant difference (ρ>0.05) (Table 4). Among the Yoruba subjects, only the nasolabial angle (Cm-Sn-Ls) showed a statistically significant difference (ρ=0.01) on comparison between the age groups. No significant difference was observed in the other angular parameters (ρ>0.05) (Table 5).

Table 2. Angular craniofacial parameters compared according to ethnic group using ANOVA

Angular craniofacial parameters	Sum of squares	Mean square	Df	F-value	P-value	Inference
Age (years)	1196.10	598.05	2	24.31	0.00	**S**
G-N-Prn	871.42	435.71	2	16.05	0.00	**S**
G-Pg/N-Prn	58.95	29.48	2	4.31	0.01	**S**
N-Prn-Pg	25.99	12.99	2	0.25	0.78	N S
G-Pg/C-Me	388.97	194.48	2	22.48	0.00	**S**
G-Prn-Pg	275.20	137.60	2	3.31	0.04	**S**
G-Sn-Pg	898.81	449.40	2	9.35	0.00	**S**
Cm-Sn-Ls	221.61	110.80	2	6.34	0.00	**S**
N-Trg-Sn	94.26	47.13	2	6.99	0.00	**S**
Sn-Trg -Me	86.97	43.48	2	2.95	0.05	NS
N- Prn/AFP	1149.95	574.98	2	12.38	0.00	**S**
Li – Sm- Pg	739.94	369.97	2	11.78	0.00	**S**

S = Significant, NS = Not significant

Table 3. Descriptive statistics of the measured angular craniofacial parameters according to age in Igbo subjects

Angular craniofacial parameters	Age group	N	Mean	SD	t-test			
					df	t-value	p-value	Inference
G-N-Prn	21 – 30	350	129.21	6.03	73.72	-2.49	0.01	S
	31 – 40	50	131.07	4.74				
G-Pg/N-Prn	21 – 30	350	35.27	2.98	80.34	0.54	0.59	NS
	31 – 40	50	35.09	2.10				
N-Prn-Pg	21 – 30	350	134.63	8.50	82.57	-0.32	0.75	NS
	31 – 40	50	134.93	5.80				
G-Pg/C-Me	21 – 30	350	91.73	3.60	76.51	3.63	0.00	S
	31 – 40	50	90.19	2.69				
G-Prn-Pg	21 – 30	350	140.85	6.94	398.0	1.14	0.25	NS
	31 – 40	50	139.65	7.01	0			
G-Sn-Pg	21 – 30	350	162.96	6.87	398.0	-0.20	0.84	NS
	31 – 40	50	163.16	6.95	0			
Cm-Sn-Ls	21 – 30	350	93.75	4.65	398.0	-0.80	0.42	NS
	31 – 40	50	94.32	5.10	0			
N-Trg-Sn	21 – 30	350	25.71	2.32	52.14	3.02	0.00	S
	31 – 40	50	23.57	4.94				
Sn-Trg -Me	21 – 30	350	30.72	4.10	398.0	0.17	0.86	NS
	31 – 40	50	30.62	4.40	0			
N- Prn/AFP	21 – 30	350	29.96	6.58	57.15	-1.21	0.23	NS
	31 – 40	50	31.52	8.76				
Li – Sm- Pg	21 – 30	350	113.37	4.91	398.0	1.27	0.20	NS
	31 – 40	50	112.41	5.25	0			

SD = Standard deviation, S = Significant, NS = Not significant

Table 4. Descriptive statistics of the measured angular craniofacial parameters according to age in Ijaw subjects

Angular craniofacial parameters	Age group	N	Mean	SD	t-test			
					df	t-value	p-value	Inference
G-N-Prn	21 – 30	308	129.30	4.99	0.75	398.00	0.45	NS
	31 – 40	92	128.86	4.59				
G-Pg/N-Prn	21 – 30	308	35.62	2.65	-	398.00	0.26	NS
	31 – 40	92	35.98	2.69	1.12			
N-Prn-Pg	21 – 30	308	134.83	6.31	0.41	398.00	0.68	NS
	31 – 40	92	134.52	6.29				
G-Pg/C-Me	21 – 30	308	90.64	2.45	-	398.00	0.07	NS
	31 – 40	92	91.18	2.81	1.80			
G-Prn-Pg	21 – 30	308	140.11	6.07	0.13	398.00	0.90	NS
	31 – 40	92	140.03	5.61				
G-Sn-Pg	21 – 30	308	161.24	6.54	-	398.00	0.33	NS
	31 – 40	92	162.03	7.62	0.98			
Cm-Sn-Ls	21 – 30	308	94.33	3.71	-	398.00	0.75	NS
	31 – 40	92	94.47	3.78	0.32			
N-Trg-Sn	21 – 30	308	25.51	2.36	-	398.00	0.15	NS
	31 – 40	92	25.92	2.47	1.44			
Sn-Trg -Me	21 – 30	308	30.27	3.51	-	398.00	0.31	NS
	31 – 40	92	30.71	3.80	1.01			
N- Prn/AFP	21 – 30	308	29.89	6.59	-	398.00	0.71	NS
	31 – 40	92	30.18	6.44	0.38			
Li – Sm- Pg	21 – 30	308	111.29	5.95	-	398.00	0.05	NS
	31 – 40	92	112.67	5.40	2.00			

SD = Standard deviation, NS = Not significant

Table 5. Descriptive statistics of the measured angular craniofacial parameters according to age in Yoruba subjects

Angular craniofacial parameters	Age group	N	Mean	SD	t-test			
					df	t-value	p-value	Inference
G-N-Prn	21 – 30	327	127.32	4.58	398.0	-1.87	0.06	NS
	31 – 40	73	128.46	5.33	0			
G-Pg/N-Prn	21 – 30	327	35.21	2.25	398.0	-0.17	0.87	NS
	31 – 40	73	35.26	2.32	0			
N-Prn-Pg	21 – 30	327	134.10	7.13	398.0	-1.87	0.06	NS
	31 – 40	73	135.81	6.57	0			
G-Pg/C-Me	21 – 30	327	90.16	2.59	398.0	0.19	0.85	NS
	31 – 40	73	90.10	2.92	0			
G-Prn-Pg	21 – 30	327	139.48	6.46	398.0	-0.30	0.76	NS
	31 – 40	73	139.73	6.15	0			
G-Sn-Pg	21 – 30	327	160.99	7.35	398.0	0.16	0.88	NS
	31 – 40	73	160.84	6.03	0			
Cm-Sn-Ls	21 – 30	327	93.52	4.18	129.4	2.58	0.01	**S**
	31 – 40	73	92.36	3.29	8			
N-Trg-Sn	21 – 30	327	24.93	2.50	398.0	-0.30	0.76	NS
	31 – 40	73	25.03	2.58	0			
Sn-Trg -Me	21 – 30	327	30.06	3.80	398.0	0.16	0.88	NS
	31 – 40	73	29.99	3.73	0			
N- Prn/AFP	21 – 30	327	27.81	6.91	398.0	-1.10	0.27	NS
	31 – 40	73	28.80	7.37	0			
Li – Sm- Pg	21 – 30	327	111.72	5.90	398.0	1.10	0.27	NS
	31 – 40	73	110.87	6.15	0			

SD = Standard deviation, S = Significant, NS = Not significant

3.1 Discussion

In clinical practice, anthropometric measurements are used to quantify changes in the craniofacial framework. This helps in the discovery of different features distinguishing various races/ethnic groups. This study employed the use of photogrammetry to investigate the craniofacial soft tissue norm of three southern Nigerian ethnic groups of Igbo, Ijaw and Yoruba. Standardized photographs taken in natural head position were used for the photogrammetric analysis. The study highlighted the fact that there exist ethnic variations amongst the southern Nigerian ethnic groups as most of the parameters studied showed significant difference. However, these observed variations were not marked. For instance, among the three ethnic groups, nasofrontal angle (G-N-Prn) was found to range from 127.53° - 129.44° with a mean of 128.49±4.98°. This mean value did not greatly vary from the respective values for each of the three ethnic groups. Compared to other races, mean nasofrontal angle (G-N-Prn) of the three Southern Nigerian populations (128.49±4.98˚) was markedly lower than that reported by Pandian et al. [19] among adult Indians (132.13±5.11˚), 135.50±5.68˚ among Persians [20], 138.57±6.81˚ in an adult Caucasian sample of Galicians [6] and 129.56±7.96˚ in Bangladesh [21] while it was close to that reported by Devi et al. [22] in Bengal (128.06˚). This could be attributed to prominence of glabella, a typical negroid feature. The mean nasofacial angle (G-Pg/N-Prn) (35.53±2.81) was lower compared to that of the Bangladeshis (40.27±4.54) as reported by Ferdousi et al. [21] and higher than those of North Americans (35.0˚) and Himachalis (33.26°) [7,5]. Nasomental angle (N-Prn-Pg) (134.49±7.96˚) was higher than that of the Bangladeshi (132.79 ±5.10) [21]. Mentocervical angle (G-Pg/C-Me) (90.77±2.57˚) was higher than that reported among Persians (86.61˚) [20], Galicians (79.85±7.19˚) [6] and Indians (77.8±5.63˚) [19]. Bergman [23] reported that in Class II and vertical maxillary deficiency cases, a more marked mentolabial angle could be noticed; adding that the angle tends to be more when the lower incisors are in upright position. Angle of Total Facial Convexity (G-Prn-Pg) (140.43±6.23˚) was lower than that (141.54±4.96˚) reported by Pandian *et al*. [19] among Indians. Angle of Facial Convexity (G-Sn-Pg) (161.64±6.92˚) was lower than that of the Indians (169.67±4.93˚) [19], Persians (166.41±4.12˚) [20] and Bengalis (165.138˚) [22], and higher than that of the Bangladeshi Garos (158.65±12.17˚) [21]. Nasolabial angle (Cm-Sn-Ls) (94.41±4.10˚) was lower than those of the Bangladeshis (98.28±12.98˚) [21], Persians, 107.44±7.74˚ [20], Galicians, 105.2±13.28˚ [6] and Indians (106.64±8.68˚) [19]. Bergman [23] states that for every indicated orthodontic or surgical correction, nasolabial angle (Cm-Sn-Ls) has to be 102 ± 8◦. This according to Bergman [23] could find use in the assessing upper lip position, and a part of extraction decision. Angle of medium facial third (N-Trg-Sn) (24.54±2.47˚) was lower than that of Indians (25.38±2.20˚) as reported by Pandian et al. [19] and Galicians (28.9±2.61˚) [6]. Angle of the inferior facial third (Sn-Trg -Me) (31.90±3.70˚) was higher than that of the Indians (29.58±2.69˚) [19] and lower than that of the Galicians (36.8±3.59˚) [6]. Vertical Nasal Angle (N- Prn/AFP) (29.37±6.88˚) was lower than that reported for Indians (32.99±3.82˚) [19] and Galicians (33.8±5.82˚) [6]. Mentolabial angle (Li – Sm- Pg) (112.45±5.89˚) was lower than those reported in Iran (131.82±15.47˚) and (124.36±8.46˚) [24]. Nasomental (N-Prn-Pg), nasofrontal (G-N-Prn) and nasofacial (G-Pg/N-Prn) angles were developed by Powell and Humphreys [5] to highlight the relationship between the nose and the face. Widespread assessment of angular relationships is crucial in soft tissue profiling giving that not all facial traits directly follow the underlying dentoskeletal profile [24]. Some researchers have identified the effect of age on body dimension [25]. Significant age-related changes were observed across the age groups in some of the parameters in the respective ethnic groups while others were not significant. Our findings imply that this negroid population has lower facial angles than Caucasians.

4. CONCLUSION

For a successful treatment of post-traumatic or congenital facial disfigurements in members of the same group, surgeons need access to craniofacial databases from accurate anthropometric measurements. This study has established standardized normal values for the southern Nigerian population. It will find use in orthodontics, maxillary and maxillofacial medicine as it has described normal ranges for facial soft tissues and the values that would allow for formulation of treatment plan for individuals from the region in the event of a trauma or pathology. It will also be relevant to forensics and anthropometric studies. It has also defined the craniofacial anthropometric position of this negroid population among other populations of the world.

CONSENT

As per international standard or university standard written patient consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
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