Digital biometrics of face, eyes, nose and mouth of Fulanis of Ilorin in North Central Region of Nigeria

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ABSTRACT

Facial cephalometry is of great relevance in forensic civil and criminal investigations. Nigeria is divisible into six distinct North-Central, North-East, North-West, South-East, South-South and South-West geopolitical regions. It is composed of over 250 ethnic groups with the Yorubas and Fulanis as arguably the second and fourth largest ethnic groups. There is paucity of studies which investigated three-dimensional facial cephalometry in Fulanis. Therefore, in order to further provide missing normative reference biometrics data of Fulanis of Nigeria, this study examined three-dimensional digital cephalometry biometrics of the face, eyes, nose and mouth in Fulanis in comparison with those of their neighboring Yorubas who are co-residents of Ilorin, Kwara State in the North Central region of Nigeria. Age, Height, Bodyweight and facial photographs of non-related 25 Fulani males and 25 Yoruba males whose ethnic groups were confirmed by three generations (paternal and maternal) were collected with informed consent. Three-dimensional biometric data of the antero-median aspects of the face, the eyes, nose and mouth were computed and statistically analyzed with p≤0.05. Overall, the findings of the present study showed that Fulanis are of Hyperleptoprosopic or very long narrow face type and Mesorrhine or medium nose type in contrast with Leptoprosopic or long narrow face type and Plattyrrhine or broad nose type of their neighboring Yorubas who are co-residents of Ilorin in Kwara State of the North Central region of Nigeria. In addition, the Fulanis are of smaller eye fissure width, but higher mouth width compared with their co-resident Yorubas.

Keywords: facial cephalometry, three-dimensional biometrics, Fulanis, Yorubas, Nigeria

INTRODUCTION

The face extends from the forehead to the chin and forms the anterior part of the head. It is the best feature which distinguishes an individual [1,2]. This makes facial appearance, shape and biometrics vital for human identification and recognition, communication, determination of facial symmetry and beauty [1]. Facial cephalometry involves quantitative evaluation of standardized measurements of the dimensions of component parts of the face with relation to specific cephalometric reference points or landmarks to assess biological variability within and among different human populations [2]. The face includes the eyes, nose, mouth and cheeks [1]. Hence, biometrics of antero-median aspects of the face, eyes, nose and mouth are individually and/or collectively used for facial identification and recognition in civil and criminal investigations.

Cephalometric measurements could be taken directly on the living body (one-dimensional anthropometry) or on digital images obtained through imaging techniques such as photography, x-ray technology and magnetic resonance imaging (two- or three-dimensional anthropometry) [2]. One-dimensional anthropometry (1D) involves the place-

ment of calipers or measuring tapes on soft-tissue landmarks for reading standardized distances between the landmarks [3]. There are demerits associated with 1D anthropometry such as time-intensiveness, demand for patience of subjects, errors of measurements via soft-tissue displacement, limited shape information and differences in readings by one or more operators [3]. These demerits are resolved via digital biometric measurements on images since landmarks and measurements are carried out on images at convenience. In addition, biometric readings on images are automatic and dependent on algorithms devoid of reading errors due to personal inadvertent failings.

Environmental factors such as climate conditions have been previously established to have strong effects on genetic structures of ethnic groups. These effects resulted in varied genetic structuring, genetic stratifications and population genetic classifications even within populations historically belonging to same ethnic and regional groups [4,5]. This emphasizes the need for provision of biometric data of different ethnic groups across different regions of environmental and genetic influences.

Nigeria is located in West Africa and it is one-sixth of Africa's total population. Nigeria is divisible into six distinct North-Central, North-East, North-West, South-East, South-South and South-West geopolitical regions. It is composed of over 250 ethnic groups with a population of over 140 million in the last national census conducted in 2006 [6]. The Yorubas and Fulanis are arguably the second and fourth largest ethnic groups of Nigeria [6].

The Fulanis are claimed to have originated from Egypt or Upper Nile Valley, and believed to have spread out from Guinea, Mauritania and Senegal of West Africa about 1,000 years ago, and arrived at the Lake Chad Basin about 500 years ago [7]. The Fulanis founded many theocratic states such as Sokoto or Takrur and Massina [7], and are resident in many African countries such as Nigeria, Chad, Ethiopia, Niger, Senegal and Sudan. Fulanis usually travel over great distances with their cattle herds; however, some Fulanis live in permanent settlements [7].

Ilorin is a Yoruba town but cosmopolitan and comprising of residents belonging to different ethnic groups such as Yorubas, Fulanis, Hausas, Nupes and others. Ilorin is the capital city of Kwara State in the North Central region of Nigeria [6]. There are reports of 1D cephalometry [2], 3D digital anthropometry [3,8] and 3D photogrammetry [9] of the face of Yorubas in literature. Hence, the 3D digital facial cephalometry of the face, eyes, nose and mouth of Yorubas who are neighbors and co-residents of Fulanis of Ilorin in this study is only for comparative purposes in order to provide biometric data of residents living under same genetic and environmental conditions.

Few studies evaluated 1D facial cephalometry in Fulanis [10] of Nigeria. However, there is paucity or no reports of 2D or 3D facial cephalometry in Fulanis resident in Nigeria as a single and separate ethnic entity. Therefore, in order to further provide missing normative reference biometrics data of Fulanis of Nigeria, this study examined three-dimensional digital cephalometry biometrics of the face, eyes, nose and mouth in Fulanis in comparison with those of their neighboring Yorubas who are co-residents of Ilorin, Kwara State in the North Central region of Nigeria.

MATERIALS AND METHODS

Ethical approval

This research work was approved by the University of Ilorin Ethical Review Committee (UERC) with approval number UERC/ASN/2018/1261. Experimental procedures were carried out in accordance with the National Ethics and Operational Guidelines for Research on Human Subjects, the Number code (1947); the World Medical Association Declaration of Helsinki (1964) and its amendments, the Helsinki Declaration of 1975, as revised in 2000 and the Council of International Organization of Medical Sciences (CIOMS) guidelines of 1993 as stated on the research policy of the UERC.

Determination of sample size and samples collection

Fifty healthy and unrelated males (25 Fulanis and 25 Yorubas) were selected from volunteers amongst individuals of Fulani and Yoruba ethnic groups resident in Ilorin, Kwara State using purposive random sampling technique [3,8,11-13].

The aims and objectives of the study were verbally explained to all subjects. Consent forms were distributed to the volunteers to seek their informed consent, and each subject signed the Consent Form to indicate given approval. Data on age in years, height in meters, bodyweight in kilograms and facial photographs were obtained from each subject only when confirmed as Fulanis and Yorubas by three generations (parents and grandparents).

Procedures for taking facial photographs

1. At the photometry point, a 300 mm square box was marked on a white cardboard behind the head of each subject with which the subject's facial photographs were taken.

2. Two reference points of a linear distance of 300 mm were manually marked on the square box.
3. The subjects were asked to remove any visible facial accessories that can obscene the faces.
4. The head of each subject was adjusted to anatomical position.
5. The subjects were asked to look straight and forward as the pictures were taken.
6. A 900 mm distance was ensured from the camera standing point to the photometry point.
7. The pictures were taken with the aid of a 3D digital camera held on a camera tripod stand with adjustable height, while the camera was fixed to the height of each subject.

Definitions of terminologies of measured cephalometric parameters

Trichion (tr):	The point on the hairline in the midline of the forehead. It cannot be determined on a bald head, thus no individual with a bald head was used in this study [2,3,8,11,14,15].
Glabella (g):	The smooth prominence between the eyebrows which connects the superciliary ridges [3,11,16].
Zygion (zy):	The most lateral point on the soft tissue contour of the zygomatic arch [3,11,16].
Exocanthion (ex):	The soft tissue point situated at the outer commissure of each eye fissure [14,16].
Endocanthion (en):	The soft tissue point situated at the inner commissure of each eye fissure [14,16].
Maxillofrontale (mf):	The soft tissue point situated at each lateral margin of the base of the nasal root at the level of the endocanthion [12,16].
Nasion (n):	The point in the midline of both the nasal root and the nasofrontal suture. The slight ridge on which it is situated can be felt by the observer's fingernail. This point is above the line that connects the two inner canthi [2,12,15,17,18].
Alare (al):	The most lateral point on the ala of the nose [12,16].
Pronasale (prn):	The most protruded point of the apex of the nose [12,16].
Subnasale (sn):	The point on the living body where the nasal septum between the nostrils merges with the upper cutaneous lip in the midsagittal plane [2,12,15,17,18].

Stomion (sto):	The imaginary point at the crossing of the vertical facial midline and the horizontal labial fissure between gently closed lips, with teeth shut in the natural position [14,15,17,18].
Cheilion (ch):	The point located at each labial commissure [14,15,17-19].
Crista philtri (cph):	The point on each elevated margin of the philtrum just above the vermilion line [14,15,17-19].
Labiale superius (ls):	The midpoint of the upper vermilion line [14,15,17-19].
Labiale inferius (li):	The midpoint of the lower vermilion line [14,15,17-19].
Sublabiale (sl):	The midpoint on the labiomental soft tissue contour. It determines the lower border of the lower lip or the upper border of the chin. It corresponds with the mentolabial ridge [14,15,17-19].
Gnathion (gn):	The lowest median landmark on the lower border of the mandible and is the lowest point used in measuring facial height. It is identified by palpation and is identical to the bony gnathion. It is also referred to as the Menton [14,15,17-19].

Cephalometric evaluations of dimensions of the face

Distances of the Facial Width (zygion to zygion), Total Face Height (trichion to gnathion) and Morphological Face Height (nasion to gnathion) were computed in this study (Figure 1). Facial Index (FI) was calculated as the percentage proportion of Morphological Face Height to Facial Width.

Evaluations of cephalometric parameters of the eyes

Distances of the Biocular Distance (exocanthion to exocanthion), Eye fissure Width (exocanthion to endocanthion) and Interocular Distance (endocanthion to endocanthion) were computed in this study (Figure 1). Canthal Index (CI) was calculated as the percentage proportion of Interocular Distance to Biocular Distance.

Evaluations of cephalometric parameters of the nose

Distances of the Width of the nasal root (maxillofrontale to maxillofrontale), Nose Height or Nose Length (nasion to subnasale), Nose Width (alare to alare), Nasal Bridge Length (nasion to pronasale) and Nasal Tip Protrusion (subnasale to pronasale)

were evaluated in this study (Figure 1). Nasal Index (NI) was calculated as the percentage proportion of Nose Width to Nose Height.

Evaluations of cephalometric parameters of the mouth

Distances of the Width of the Mouth: (cheilion to cheilion), Width of the Philtrum: (crista philtri to crista philtri), Height of the Skin portion of the Upper Lip (subnasale to labiale superius), Upper Lip Height (subnasale to stomion), Vermilion Height of the Upper Lip (labiale superius to stomion), Vermilion Height of the Lower Lip (stomion to labiale inferius), Lower Lip Height (stomion to sublabiale) and Height of the Skin portion of the Lower Lip (labiale inferius to sublabiale) (Figure 1).

Procedures for calculating biometric parameters of the face, eyes, nose and mouth

On the facial image, the selected cephalometric landmarks were identified based on definitions of such landmarks from existing literatures [3,8,11,14], and marked using Adobe Photoshop brushes. The two referenced points which represent the distance of 300 mm were equally marked using Adobe Photoshop brushes. The number of pixels across the two reference points represented the given distance and was then used to determine the actual life size or distance between any other two points of facial parameters detected on the image using trigonometric and geometric theories. Since some of the points were not at the same horizontal or vertical levels, the actual distance was converted using the pixels of the two reference points and their computed distance as read by the Adobe Photoshop. The size of each image was divided by 2 to reduce the image size on the Adobe Photoshop before conversion.

For example, the Total Facial Height (TFH) is defined as the linear distance between the Trichion and Gnathion. The TFH computed by the Adobe Photoshop was converted to actual life size or distance as follows:

Manually computed distance between the two reference points (X):	= 300 mm
Computed distance X using Adobe Photoshop:	= 323 mm
Computed TFH distance between selected two anthropometric reference points using Adobe Photoshop:	= 330/2 = 165 mm.
Conversion of computed TFH distance to life size:	= 165 x 300/323 mm = 153 mm.

Statistical analysis

Computed data were statistically analyzed using the statistical package for the social science software (SPSS Statistics version 23.0) developed by the International Business Machines Corporation (IBM). Data were presented as Mean ± Standard Deviation (SD) with determination of level of significance at p-values ≤ 0.05.
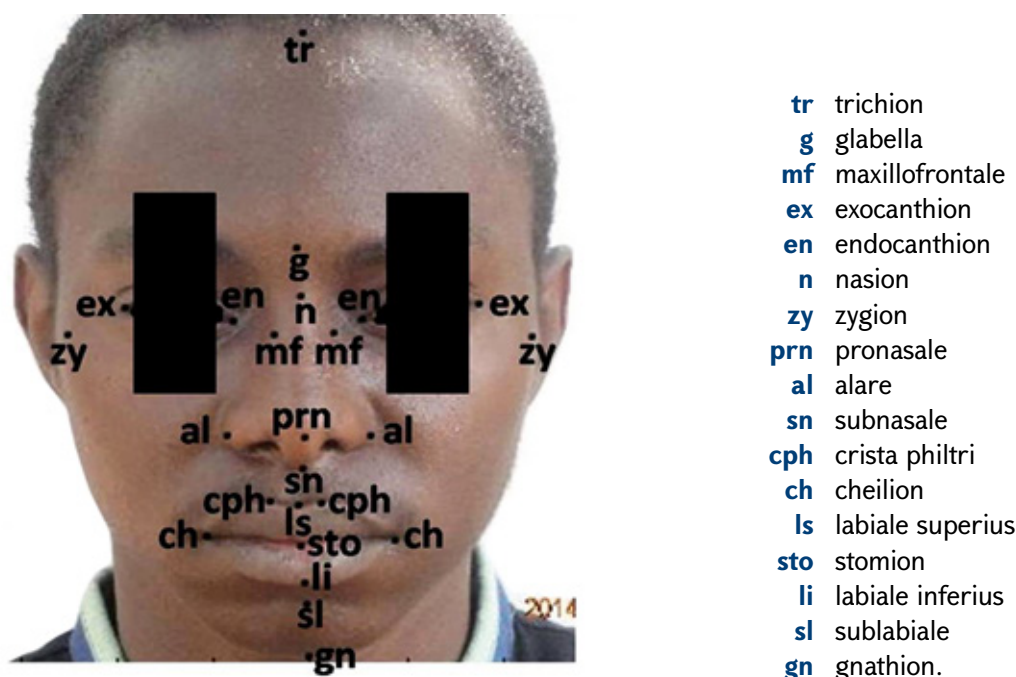

tr	trichion
g	glabella
mf	maxillofrontale
ex	exocanthion
en	endocanthion
n	nasion
zy	zygion
prn	pronasale
al	alare
sn	subnasale
cph	crista philtri
ch	cheilion
ls	labiale superius
sto	stomion
li	labiale inferius
sl	sublabiale
gn	gnathion.

Fig.1 Cephalometric features and landmarks of the face, eyes, nose and mouth.

RESULTS AND DISCUSSION

Age, Height, Bodyweight and Body Mass Indices of Fulanis and Yorubas

The Age, Bodyweight and Height for Fulani subjects ranged from 20 to 80 years, 51 to 66 kg and 1.57 to 1.81 m, respectively. The mean values for Age and Body Mass Index for Fulanis were 35.20 years and 20.41 kg/m2, respectively. The Age, Bodyweight and Height for Yoruba subjects ranged from 20 to 25 years, 51 to 81 kg and 1.60 to 1.84 m, respectively. The mean values for Age and Body Mass Index for Yorubas were 21.87 years and 21.62 kg/m2, respectively.

These observations implied that the Fulani subjects tended to be of lower bodyweight and height compared with those of Yoruba subjects used in this study. In addition, both Fulanis and Yorubas had normal BMI classification with values between 18.5 and 25.0 kg/m2.

3D biometric measurements of the face and face types of Fulanis and Yorubas of Ilorin in North Central region of Nigeria

Statistical analyses showed non-significant (p>0.05) higher mean value of Total Face Height in Fulanis compared with Yorubas as presented in Table 1. Contrariwise, there were non-significant (p>0.05) lower mean values of Morphological Face Height and Face Width in Fulanis compared with Yorubas as presented in Table 1. Fulanis had higher value of FI of 97.4 compared with their neighboring Yorubas with FI of 93.5 (Table 1).

The face is classified, based on the Facial or Prosopic Index (FI), as Hypereuroprosopic or very short broad face (FI <79.9), Europrosopic or short broad face (FI 80.0-84.9), Mesoprosopic or medium round face (FI 85.0-89.9), Leptoprosopic or long narrow face (FI 90.0-94.9) and Hyperleptoprosopic or very long narrow face (FI >95.0) [3,10,11,14,20,21].

The results of FI (97.4 in Fulanis and 93.5 in Yorubas of Ilorin in North Central region of Nigeria) obtained in the present study implied that Fulanis have the Hyperleptoprosopic or very long narrow face type while Yorubas have the Leptoprosopic or long narrow face type.

3D biometric Face types of Fulanis and Yorubas of Ilorin in North Central region of Nigeria in comparison with previous 1D studies in ethnic groups within and outside Nigeria

The Hyperleptoprosopic or very long narrow face type in Fulanis (FI: 97.4) resident in Ilorin of North Central region of Nigeria in the present study is in agreement with those of Maina et al. (2012) [10] which reported the Hyperleptoprosopic or very long narrow face type as the dominant face type in Fulanis of Gombe State in North Eastern region of Nigeria. In addition, the Leptoprosopic or long narrow face type in Yorubas resident in Ilorin of North Central region of Nigeria in the present study is in agreement with those of Akinlolu (2016a) [3] which reported the Leptoprosopic or long narrow face type in Yorubas of Osun State in the South Western region of Nigeria.

Furthermore, the Hyperleptoprosopic and Leptoprosopic face types observed in Fulanis and Yorubas, respectively, who are residents of Ilorin

Table 1. Comparative biometric measurements (mean ± standard deviation, mm) of the antero-median aspects of the Face between Fulani and Yoruba ethnic groups

Cephalometric Parameters	Fulani	Yoruba	p-value
Total Face Height	164.0 ± 2.65	155.0 ± 10.62	0.45
Facial Width	78.0 ± 2.93	93.0 ± 2.86	0.42
Morphological Face Height	76.0 ± 2.90	87.0 ± 3.17	0.45
Facial Index	97.4	93.5	NIL

Table 2. Comparative biometric measurements (mean ± standard deviation, mm) of the Eyes between Fulani and Yoruba ethnic groups

Cephalometric Parameters	Fulani	Yoruba	p-value
Biocular Distance	76.0 ± 8.0	79.0 ± 3.0	0.98
Interocular Distance	31.0 ± 3.0	29.0 ± 5.3	0.90
Eye Fissure Width	26.0 ± 2.0	28.0 ± 4.6	0.92
Canthal Index	40.8	36.7	NIL

of North Central region of Nigeria in the present study differ with those of previous 1D studies which reported the Mesoprosopic face type in males of Benins (FI: 87.98), aged 16 to 35 years, in Edo State of South – South region of Nigeria [22], in males of Malays (FI: 90.85) of South-East Asia, aged 19 to 30 years [21] and in males of Indians (FI: 87.19) of Asia, aged 18 to 22 years [23]. It must be noted that Nigerians are blacks and of expected different face type compared with Asians. Hence, the similar Mesoprosopic face type reported in Benins of South – South region of Nigeria by Omotoso et al. (2011) [22] in agreement with those of Malays and Indians who are Asians must have been due to errors of readings of 1D data. This confirms the reliability of 3D biometrics data over those of 1D studies.

3D biometric measurements of the eyes of Fulanis and Yorubas of Ilorin in North Central region of Nigeria

Statistical analyses showed non-significant (p>0.05) higher mean value of Interocular Distance in Fulanis compared with Yorubas as presented in Table 2. Contrariwise, there were non-significant (p>0.05) lower mean values of Biocular Distance and Eye Fissure Width in Fulanis compared with Yorubas as presented in Table 2. Fulanis had higher value of CI of 40.0 compared with their neighboring Yorubas with CI of 36.7 (Table 2).

The authors are not aware of any study which previously reported 1D or 3D biometrics of the eyes of Fulanis resident in Nigeria for comparative analyses. Hence, the reported biometric data of the eyes of Fulanis in this study are novel and of importance in forensic determinations.

3D biometric measurements of the eyes of Fulanis and Yorubas of Ilorin in North Central region of Nigeria in comparison with previous 1D studies in ethnic groups within and outside Nigeria

Comparisons of mean values of Biocular Distance showed lower values in Fulanis: 76 and Yorubas: 79 of Ilorin of North Central region of Nigeria in the present study when compared to those of previous 1D anthropometric studies in Kalabaris of Rivers State: 103.9, aged 16 to 18 years [24], Ijaws of Bayelsa State: 110.91, aged 22 to 40 years [25], and Ibibios of Akwa Ibom State: 111.5, aged 18 to 80 years [26], all in the South - South region of Nigeria.

In comparison with ethnic groups outside Nigeria, the Fulanis of Nigeria in the present study had a similar mean value of Biocular Distance of 76 compared with those of 1D studies in Angolans of Southern Africa: 76.3, aged 18 to 30 years [17]. However, both Fulanis and Yorubas of Nigeria in the present study had lower mean values of 76 and 79 respectively when compared with those of 1D studies in African Americans: 96.6, aged 18 to 30 years and North American Whites: 89.4, aged 18 to 30 years, males [17].

Comparisons of mean values of the Interocular Distance showed higher values in Fulanis: 31 and Yorubas: 29 resident in Ilorin of North Central region of Nigeria in the present study when compared with those of previous 1D anthropometric studies in Kalabaris of South – South region of Nigeria: 18.5 [24] and Angolans of Southern Africa: 28.3 [17]. In contrast, comparisons of mean values of the Interocular Distance in Fulanis: 31 and Yorubas: 29 resident in Ilorin of North Central region of Nigeria in the present study showed lower values when compared to those of previous 1D anthropometric studies in Ijaws of South – South region of Nigeria: 42.37 [25], Ibibios of South – South region of Nigeria: 35.2 [26], African Americans: 35.8 [17] and North American Whites males: 32.9 [17].

Canthal Indices of Fulanis and Yorubas of Ilorin in North Central region of Nigeria in comparison with other ethnic groups of Nigeria

Statistical analyses showed that Fulanis had higher value of CI of 40.8 compared with their neighboring Yorubas with CI of 36.7 (Table 2).

The CI values were higher in Fulanis: 40.8 and Yorubas: 36.7 of Ilorin of North Central region of Nigeria examined in the present study when compared with those of previous 1D anthropometric studies in males of Kalabaris of Rivers State: 17.84 [24] and Ibibios of Akwa Ibom State: 31.64 [26] in the South – South region of Nigeria.

3D biometric measurements of the nose of Fulanis and Yorubas of Ilorin in North Central region of Nigeria

Statistical analyses showed non-significant (p>0.05) higher mean values of Nose height and Nose Width in Fulanis compared with Yorubas as presented in Table 3. Contrariwise, there were non-significant (p>0.05) lower mean values of Width of the Nasal Root, Nasal Bridge Length and Nasal Tip Protrusion in Fulanis compared with Yorubas as presented in Table 3. Fulanis had lower value of NI of 84.6 compared with their neighboring Yorubas with NI of 88.9 (Table 3).

Table 3. Comparative biometric measurements (mean ± standard deviation, mm) of the Nose between Fulani and Yoruba ethnic groups

Cephalometric Parameters	Fulani	Yoruba	p-value
Width of Nasal Root	16.0 ± 3.0	19.0 ± 0.5	0.54
Nasal Bridge Length	31.0 ± 8.0	34.0 ± 5.0	0.95
Nasal Tip Protrusion	7.0 ± 1.2	7.2 ± 3.1	0.89
Nose Height	39.0 ± 1.68	36.0 ± 3.52	0.93
Nose Width	33.0 ± 0.93	32.0 ± 2.82	0.98
Nasal Index	84.6	88.9	NIL

Table 4. Comparative biometric measurements (mean ± standard deviation, mm) of the Mouth between Fulani and Yoruba ethnic groups

Cephalometric Parameters	Fulani	Yoruba	p-value
Width of the Mouth	42.3 ± 9.0	39.8 ± 15.0	0.93
Upper Lip Height	17.0 ± 2.0	21.0 ± 5.0	0.33
Height of Skin portion of Upper Lip	14.0 ± 6.5	12.0 ± 8.0	0.86
Lower Lip Height	11.0 ± 2.0	13.0 ± 3.0	0.88
Height of Skin portion of Lower Lip	4.5 ± 3.0	4.0 ± 1.0	0.42
Width of the Philtrum	15.0 ± 6.0	13.0 ± 7.0	0.84
Vermillon Height of Upper Lip	7.0 ± 2.0	10.0 ± 2.7	0.42
Vermillon Height of Lower Lip	8.7 ± 5.0	12.0 ± 7.0	0.73

There is paucity of studies which examined biometrics of Width of Nasal Root and Nasal Bridge Length in Nigerians for comparative analyses. Hence, comparative analyses of mean values of Width of Nasal Root with ethnic groups outside Nigeria showed lower values in Fulanis: 16 and Yorubas: 19 of Nigerians when compared to those of previous 1D anthropometric studies in African Americans: 27, aged 18 to 30 years (Porter, 2004) and North American Whites: 19.6 males (Porter, 2004). However, Fulanis of Nigeria had a lower mean value of 16 compared with those of previous 1D anthropometric study in Chinese: 18.3, aged 18 to 66 years [27].

3D biometric measurements of the nose of Fulanis and Yorubas of Ilorin in North Central region of Nigeria in comparison with 1D studies in ethnic groups outside Nigeria

In addition, evaluated mean values of Nasal Bridge Length showed lower values in Fulanis: 31 and Yorubas: 34 of Nigerians in the present study when compared to those of previous 1D anthropometric studies in African American males: 45.4, aged 18 to 30 years and North American White males: 50 [18].

Nose types of Fulanis and Yorubas of Ilorin in North Central region of Nigeria

Statistical analyses showed that Fulanis had lower value of NI of 84.6 compared with their neighboring Yorubas with NI of 88.9 (Table 3).

The nose is classified, based on the NI as leptorrhine or long narrow nose (NI ≤69.90), mesorrhine or medium nose (NI 70.0-84.90) and platyrrhine or broad nose (NI ≥85.0) [12,28,29]. The leptorrhine nose type is characteristic of Caucasians while the mesorrhine and platyrrhine nose types are associated with Caucasoids of Indo-Aryan ancestry and Blacks [12,28]. The observed NI of 84.6 in Fulanis and NI of 88.9 in Yorubas of Ilorin of North Central region of Nigeria in the present study implied that Fulanis have the mesorrhine nose type while the Yorubas have the platyrrhine nose type.

3D biometric Nose types of Fulanis and Yorubas in comparison with 1D studies in other ethnic groups of Nigeria

The mesorrhine nose type in Fulanis (NI: 84.6) of Ilorin of North Central region of Nigeria in the present study is similar to those of previous 1D studies which reported the mesorrhine nose type in Hausa males (NI: 71) aged 17 to 25 years, in Kano, Kano State of North – Western region

of Nigeria [30], but differ with those of previous 1D studies in the South – South region of Nigeria which reported platyrrhine nose type of males of Benins (NI: 97.65), aged 21 to 25 years, of Edo State [22], Isokos (NI: 92.35), aged 18 to 35 years, in Delta State [31] and Igbos (NI: 95.8), aged 18 to 30 years, resident in Delta State [32], Okrikas (NI: 86.23), aged 21 to 30 years, of Rivers State [33] and Ekpeyes (NI: 93.72), aged 18 to 32 years, of Rivers State [29].

The plattyrrhine nose type (NI: 88.9) observed in Yorubas of Ilorin of Kwara State of North Central region of Nigeria in the present study is in agreement with previous 1D studies which reported the platyrrhine nose type in Yoruba males (NI: 90.0) resident in Osun and Oyo States, aged 18 to 30 years of South West region of Nigeria [32] and Yoruba males resident in Kano State of North West region of Nigeria (NI: 100) [30]. However, the plattyrrhine nose type (NI: 88.9) in Yorubas of Ilorin of North Central region of Nigeria in the present study differ from those of previous 1D studies which reported mesorrhine nose type in males of Andonis (NI: 79.83) [33] and Ikwerre males of River State (NI: 84.81) [29] of South – South region of Nigeria.

Nose types of Fulanis and Yorubas in comparison with 1D studies in ethnic groups outside Nigeria

In comparison with ethnic groups outside Nigeria but within Africa, the reported mesorrhine nose type in Fulanis of Nigeria (NI: 84.6) is in contrast with the plattyrrhine nose type in 1D nose study in Angolan males (NI: 93), aged 18 to 30 years [17]. However, the reported mesorrhine nose type in Fulanis of Nigeria (NI: 84.6) in the present study is similar with those of reported mesorrhine nose type in Arabs (NI: 74.48), Indians (NI: 72.4) and Singaporeans (NI: 72.4) [28] possibly because the Fulanis are of closer ancestry with Arabs with narrower nose type compared with Blacks.

The plattyrrhine nose type (NI: 88.9) observed in Yorubas of the present study differs with previous 1D studies which reported mesorrhine nose type in African American males (NI: 83.2) [17].

3D biometric measurements of the mouth of Fulanis and Yorubas of Ilorin in North Central region of Nigeria in comparisons with ethnic groups within and outside Nigeria

Statistical analyses showed non-significant (p>0.05) higher mean values of Width of the Mouth, Height of Skin portion of Upper Lip, Height of Skin portion of Lower Lip and Width of the Philtrum in Fulanis compared with Yorubas as presented in Table 4. Contrariwise, there were non-significant (p>0.05) lower mean values of Upper Lip Height, Lower Lip Height, Vermillon Height of Upper Lip and Vermillon Height of Lower Lip in Fulanis compared with Yorubas as presented in Table 4.

Mean values of Mouth Width were lower in Fulanis: 42.3 ± 9.0 mm and Yorubas: 39.8 ± 15.0 mm (Table 4) in the present study, when compared with those of previous 1D anthropometric studies in males of Hausa: 49.5, Igbos: 54.3 and Yorubas: 53 [19] resident in same Ilorin of North Central region of Nigeria, aged 18 to 30 years. The reported differences in 1D and 3D data could be due to reading errors of 1D anthropometry.

In comparison with 1D mouth studies in males of ethnic groups outside Nigeria, there were lower mean values of Mouth Width in Fulanis: 42.3 ± 9.0 mm and Yorubas: 39.8 ± 15.0 mm (Table 4) of Ilorin of North Central region of Nigeria when compared with Angolans of Southern Africa: 54.4, aged 18 to 30 years [17], Malaysians of South East Asia: 48.8, aged 18 to 25 years [34], African Americans: 53.7, aged 18 to 30 years (Porter, 2004) and North American Whites: 54.5 of North America [18].

Computed mean values of Height of skin portion of upper lip of 14 in Fulanis (Table 4) was higher than those of previous 1D anthropometric studies in males of Hausas: 11, Yorubas: 11 and Igbos: 10.9 [19] resident in same Ilorin of North Central region of Nigeria, but lower than those of Malaysian males: 13.1 [34]. In addition, computed mean values of Height of skin portion of upper lip of 12 in Yorubas (Table 4) was similar to those of previous 1D anthropometric studies in males of Hausas: 11, Yorubas: 11 and Igbos: 10.9 [19] resident in the same Ilorin of North Central region of Nigeria, but lower than those of Malaysian males: 13.1 [34].

The computed mean value of Upper Lip Height of 17 in Fulanis of Nigeria (Table 4) was lower when compared with previous 1D anthropometric studies in Hausa males: 21.2, Igbo males: 21.8 and Yoruba males: 21.9 in same Ilorin of North Central region of Nigeria [19], and in Malaysian males: 22.7 [34]. However, the computed mean value of Upper Lip Height in Yorubas: 21 (Table 4) was similar to of previous 1D anthropometric studies in Yoruba males: 21.9 and Igbo males: 21.8 [19] in the same Ilorin of North Central region of Nigeria, but lower than those of Malaysian males: 22.7 [34].

The mean values of Vermilion Height of Upper Lip in Fulanis: 7.0 and in Yorubas: 10 (Table 4) were similar to those of previous 1D anthropometric studies in males of Hausas: 8.1, Yorubas: 9.2

and Igbos: 8.2 [19] in the same Ilorin of North Central region of Nigeria, and with those of Malaysians: 9.8 [34].

Computed mean value of Vermilion Height of Lower Lip in Fulanis: 8.7 (Table 4) was similar to those of previous 1D anthropometric studies in males of Yorubas: 8.6, Hausas: 9.1 and Igbos: 8.9 [19] in the same Ilorin of North Central region of Nigeria. In contrast, the computed mean value of Vermilion Height of Lower Lip in Yorubas: 12.0 (Table 4) was higher than those of previous 1D anthropometric studies in males of Yorubas: 8.6, Hausas: 9.1 and Igbos: 8.9 [19] in the same Ilorin of North Central region of Nigeria; but same with those of Malaysian males: 12 [34].

CONCLUSIONS

Overall, the findings of the present study provide novel 3D biometric cephalometry of the face, eyes, nose and mouth of Fulanis resident in Nigeria which are not available in literature. The Fulanis of Nigeria are of Hyperleptoprosopic or very long narrow face type and Mesorrhine or medium nose type in contrast with Leptoprosopic or long narrow face type and Plattyrrhine or broad nose type of their neighboring Yorubas who are co-residents of Ilorin in Kwara State of the North Central region of Nigeria. In addition, the Fulanis are of smaller eye fissure width, but higher mouth width compared with their neighboring Yorubas who are co-residents of Ilorin in Kwara State of the North Central region of Nigeria.

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Նիգերիայի Հյուսիս-Կենտրոնական շրջանի իլորինցի ֆուլանիների դեմքի, աչքերի, քթի և բերանի թվային կենսաչափությունը

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ԱՄՓՈՓԱԳԻՐ

Դեմքի գանգաչափությունը մեծ նշանակություն ունի դատաբժշկական քաղաքացիական և քրեական հետաքննության մեջ։ Նիգերիան բաժանվում է վեց տարբեր աշխարհագրաքաղաքական Հյուսիս-կենտրոնական, Հյուսիսարևելյան, Հյուսիսարևմտյան, Հարավարևելյան, Հարավ-հարավային և Հարավարևմտյան շրջանների։ Այն բաղկացած է ավելի քան 250 էթնիկ խմբերից, որոնցից յորուբաներն ու ֆուլանիները, հավանաբար, երկրորդ և չորրորդ ամենամեծ էթնիկ խմբերն են։ Ֆուլանիների դեմքի եռաչափ գանգաչափությունը ուսումնասիրող հետազոտությունները սակավ են։ Ըստ այդմ, Նիգերիայի ֆուլանիների բացակայող նորմատիվային կենսաչափական տվյալ-

ները տրամադրելու նպատակով այս հետազոտությունն ուսումնասիրել է նրանց դեմքի, աչքերի, քթի և բերանի եռաչափ թվային գանգաչափությունը՝ համեմատելով նրանց հարևան յորուբաների հետ, որոնք բնակվում են Նիգերիայի Հյուսիս-կենտրոնական շրջանի Կվարա նահանգի Իլորին քաղաքում։ Իրազեկ համաձայնություն ստանալուց հետո հավաքվել են 25-ական ֆուլանի և յորուբա տղամարդկանց (նրանց էթնիկ պատկանելությունը և բարեկամական կապի բացակայությունը հաստատվել է երեք սերունդներով՝ հայրական և մայրական) տարիքային, հասակային ու մարմնի քաշի տվյալները, ինչպես նաև նրանց դեմքի լուսանկարները։ Դեմքի, աչքերի, քթի և բերանի առաջամիջնակ կողմերի եռաչափ կենսաչափական տվյալները հաշվարկվել և վիճակագրորեն վերլուծվել են։ Ընդհանուր առմամբ, սույն հետազոտության արդյունքները ցույց են տվել, որ իլորինցի ֆուլանիներն ունեն հիպերլեպտոպրոզոպիկ կամ շատ երկար նեղ դեմքի տիպ և մեզոռին կամ միջին քթային տիպ՝ ի տարբերություն իրենց հարևան յորուբաների լեպտոպրոզոպիկ կամ երկար նեղ դեմքի տիպի և պլատիռին կամ լայնաքիթ տեսակի։ Բացի դրանից, ֆուլանիներն ունեն ավելի փոքր աչքի ճեղքի լայնություն, բայց ավելի մեծ բերանի լայնություն՝ համեմատած իրենց համաբնակիչ յորուբաների հետ։

Հիմնաբառեր. *դեմքի գանգաչափություն, եռաչափ կենսաչափություն, ֆուլանիներ, յորուբաներ, Նիգերիա*

Цифровая биометрия лица, глаз, носа и рта илоринских фулани из Северо-Центрального региона Нигерии

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АБСТРАКТ

Цефалометрия лица имеет большое значение для судебно-медицинских гражданских и уголовных расследований. Нигерия делится на шесть отдельных геополитических регионов – Северо-Центральный, Северо-Восточный, Северо-Западный, Юго-Восточный, Южно-Южный и Юго-Западный. В её состав входят более 250 этнических групп, среди которых народности йоруба и фулани являются, пожалуй, второй и четвёртой по численности этническими группами. Существует мало исследований, в которых изучалась трёхмерная цефалометрия лица у фулани. Поэтому, чтобы предоставить недостающие нормативные эталонные биометрические данные фулани Нигерии, в данном исследовании были изучены трёхмерные цифровые цефалометрические показатели лица, глаз, носа и рта у фулани в сравнении с их соседями йоруба, которые совместно проживают в Илорине, штат Квара, в Северо-Центральном регионе Нигерии. Возраст, рост, масса тела и фотографии лица неродственных 25 мужчин-фулани и 25 мужчин-йоруба, этническая принадлежность которых была подтверждена тремя поколениями (отцовским и материнским), были собраны с информированного согласия. Трёхмерные биометрические данные переднесрединных сторон лица, глаз, носа и рта были рассчитаны и статистически проанализированы при p≤0.05. В целом результаты настоящего исследования показали, что фулани имеют гиперлептопрозопический или очень длинный узкий тип лица и мезоррин или средний тип носа в отличие от лептопрозопического или длинного узкого типа лица и платиррин или широкого типа носа их соседей йоруба, которые совместно проживают в Илорине в штате Квара на севере Центрального региона Нигерии. Кроме того, у фулани меньше ширина глазных щелей, но больше ширина рта по сравнению с их соседями йоруба.

Ключевые слова: *лицевая цефалометрия, трёхмерная биометрия, фулани, йоруба, Нигерия*