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## Photometric Facial Analysis of Soft Tissue Profile of Okrika Adults

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Author EAO Designed study, performed the statistical analyses and wrote the first draft of the manuscript. Author EO Managed the analyses of the study and literature search. Both authors read and approved the final manuscript.*

**Original Research Article**

**Received 16<sup>th</sup> August 2013**  
**Accepted 20<sup>th</sup> February 2014**  
**Published 10<sup>th</sup> March 2014**

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### **ABSTRACT**

**Aim:** The aim of this study was to determine the facial norms of the Okrika people by photometric analysis.

**Study Design:** This study is designed to evaluate facial aesthetics and provide photogrammetric standards for male and female Okrika adults.

**Place and Duration of Study:** The population of study was drawn from natives, who reside within the community centers of Okrika town in Rivers state, south- south, Nigeria between the months of June to December, 2012.

**Materials and Method:** Standardized photographic records of 245 (comprising 160 males and 85 females) subjects in the natural head position were taken using a digital camera. Measurements taken included; Nasal length, nasal width, nasal tip projection, upper nasal length, lower nasal length and nasofrontal angle. Analysis was done using a software tool for facial analysis and Z-test.

**Result:** Results showed that the mean of the nasal width was  $33.3 \pm 0.54$ mm for males, nasal length  $41.8 \pm 0.74$ mm, nasal tip projection  $12.2 \pm 0.26$ mm, upper nasal height  $31.9 \pm 0.56$ mm, lower nasal height  $10.8 \pm 0.52$ mm and Nasofrontal angle  $134.13 \pm 0.85^\circ$  while for the females it was  $29.9 \pm 0.39$ mm for nasal width, nasal length  $38.2 \pm 0.49$ m, nasal tip projection  $10.7 \pm 0.23$ mm, upper nasal height  $28.0 \pm 3.01$ mm, lower nasal height  $10.3 \pm 0.19$ mm, Nasofrontal angle  $137.68 \pm 5.63^\circ$ . Significant differences were observed in

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the parameters measured ( $P=.05$ ).

**Conclusion:** This study could be useful in orthodontics and facial plastic surgery.

*Keywords: Photogrammetry; soft tissue; Okrika people; Nigeria.*

## 1. INTRODUCTION

Okrika ethnic group is one of the minority groups in the Niger Delta of Nigeria. They are located in an island to the south of Port Harcourt city, Rivers State where their predominant occupation is fishing and trading. Physical appearance is an important characteristic of the face. It has long been established that self esteem is strongly influenced by facial appearance [1]. Different studies on dental anthropometry have utilized arch length, facial height, nasal length, nasal width and nasal index as individual parameters [2,3,4]. Various methods have been used to evaluate facial characteristics such as anthropometry [5], photogrammetry [6,7] and cephalometry [8].

Studies have found gender differences in the nasal tip angle and nasomental angle of 141 adult Caucasians with pleasing facial aesthetics and a dental class 1 occlusion [9]. Soft tissue profile standards using angular measurements have been reported for Croatians in which there were distinct gender differences with angles larger in females than in males [10]. It has been reported that in most faces illustrated in art throughout history, the nasal prominence angle was around  $30^\circ$  or less and if measured from the glabella was within the range of  $30^\circ$  to  $40^\circ$  [11]. Most plastic surgeons concerned with facial aesthetics work basically with photographs or real patients not radiographs [12]. Studies on the value of facial, nasal, maxillary, mandibular and oro-facial heights in Nigeria have been carried out. Results showed that there was sexual dimorphism in all the parameters measured with the males having higher values than the females [13]. Soft tissue profile of other races have also been reported for Urhobos and Itsekiris in Nigeria, in which sexual differences were observed between the males and females in the parameters measured except the lower face [14,15,28] and for residents of Jos in Nigeria [16,17].

Cephalometric standards have also been established for the Spanish [18], American blacks [19], Japanese- Brazilian adults with white norms [20], Thai population [21]. In an anthropometric study of the Igbos, the average nasal height was 6.31cm for males and 6.04cm for females while in another study of the adult Igbos, the average facial length for males was  $12.22 \pm 2.11$ cm and  $11.19 \pm 0.84$ cm for females. There were significant gender differences with higher values for males [22,23]. In a study carried out to evaluate the variables defining the soft tissue facial profile of a Croatian sample by means of angular measurements of 110 dental students, results revealed that distinct gender differences exist. The nasal tip angle (N-Prn-Cm) showed gender dimorphism (males  $79.85 \pm 6.36^\circ$  while females were  $84.1 \pm 5.2^\circ$ ) [10].

This study is aimed at determining the facial norms of Okrika people of Nigeria and also to establish a database for this population.

## 2. MATERIALS AND METHODS

The population of study was drawn from natives, who reside within the community centers of Okrika town in Rivers state, south- south, Nigeria between the months of June to December,

2012. A total number of two hundred and forty-five (245) volunteers between the age range 18-45 years comprising one hundred and sixty (160) males and eighty-five (85) females participated in this study. Subjects were selected on the basis that their parents and grand parents up to the second generation were both of Okrika extraction, no previous plastic reconstructive surgery of the face, no trauma of the face and no history of craniofacial syndrome. Demographic data were also obtained. This was achieved by administering a questionnaire. After informed consent has been obtained from the volunteer subjects, standard photographs of the lateral and frontal view of the face were taken in the natural head position (NHP). The photographic set-up consist of a tripod (A300) supporting a digital camera. The adjustment of the tripod height allows the optical axis of the lens to be maintained in a horizontal position. Each subject was asked to relax with both hands hanging beside the trunk. The subjects were positioned on a line marked on the floor 100cm from the camera and placed beside the subject was a meter rule that allows measurement at life size. 120 cm in front of the subject on the opposite side was a mirror. The subject had to look into the mirror with their lips relaxed so that both the front and side view can be taken in the natural head position before every recording. The operator ensured that the subject's forehead, neck and ears were clearly visible. Using the meter rule on the side as a guide, all photographic records were scaled to life size and five linear parameters and an angle on the photos were obtained:

- Nose length (n-sn): This is the measured distance between the nasion and subnasale.
- Nasal width (Al-Al): This is the measured distance between the left and right alar.
- Nasal tip projection line (Sn-Prn): This is the measured horizontal distance between the mid-facial vertical line and pro-nasale.
- Lower nasal height (Mn-Sn): This is the measured distance between the mid-nasal and sub-nasale.
- Upper nasal height (N-Mn): This is the measured distance between the nasion and mid-nasal.
- Nasofrontal angle (G-N-Prn): It is formed by drawing a line tangent to the glabella through the nasion that will intersect a line drawn tangent to nasal dorsum.
- Mid-nasal: This is the midpoint between the upper nasal height and the lower nasal height.

Four researchers were recruited to assist in the collection of data.

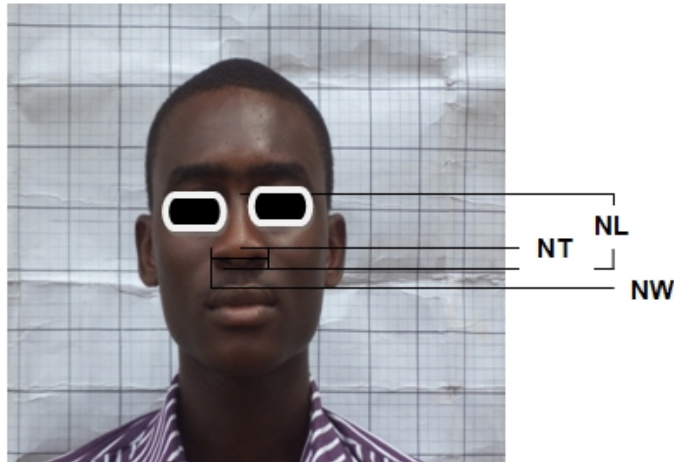
## 2.1 Data Analysis

Data analysis was done using Z-test and results presented in tables. Images were analyzed using IMG pro image analyzer. The reproducibility and reliability of the measurements were also analyzed using the Dahlberg's (1940) formula that determines the method of error (M.E).

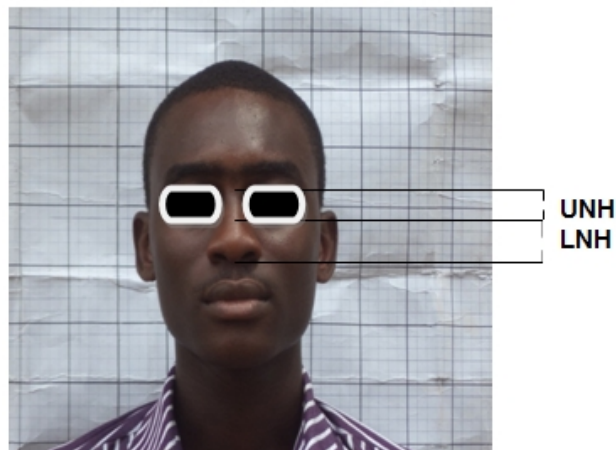
## 3. RESULTS

The result of this study is as presented in the Tables below: Table 1. Table shows mean of the measured values with a significant difference in the nasofrontal angle, nasal width (al-al), nasal length,(n-sn) nasal tip projection (sn-prn), upper nasal height (n-nm) and lower nasal height (mn-sn) of males and females ( $P=0.05$ ) Table 2. Table shows a comparison of measured parameters with some other populations within and outside Nigeria, Table 3.

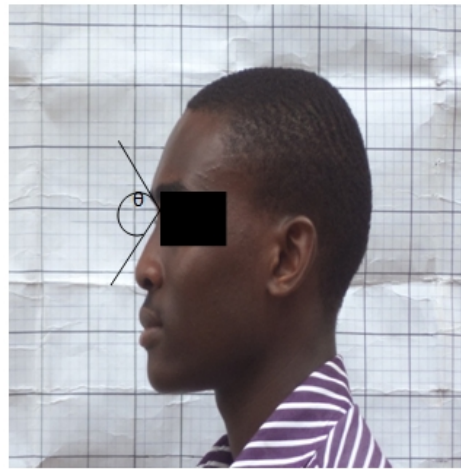
Table shows the determination of method error using Dahlberg's formula. The nasofrontal angle, showed the highest method error. This is to say that the angle may not be too reliable because of the variation. All other values obtained with the method error are reliable. Fig. 1 soft tissue landmarks used in this study: nasal length (NL), Nasal tip (NT), Nasal width (NW). Frontal view. Fig. 2 soft tissue landmarks showing Upper nasal height (UNH) and lower nasal height (LNH). Frontal view. Fig. 3 showing nasofrontal angle of an adult Okrika male. Lateral view.



**Fig. 1. soft tissue landmarks used in this study: nasal length (NL), nasal tip (NT), nasal width (NW), frontal view**



**Fig. 2. Soft tissue landmarks showing upper nasal height (UNH) and lower nasal height (LNH), frontal view**



**Fig. 3. Showing nasofrontal angle of an adult okrika male, lateral view**

**Table 1. Descriptive statistics and comparison of mean values for measured parameters in males and females (mm)**

Parameters	Sex	Mean±SD	Sem	z cal
Nasofrontal angle	M	134.13±0.85°	0.01	4.66
	F	137.68±5.63	0.02	
Nasal Width (Al-Al)	M	33.3±0.54	0.04	5.82
	F	29.9±0.39	0.04	
Nasal length (N-Sn)	M	41.8±0.74	0.06	5.00
	F	38.2±0.49	0.05	
Nasal tip projection (Sn-Prn)	M	12.2±0.26	0.02	4.64
	F	10.7±0.23	0.02	
Upper nasal height (N-Mn)	M	31.9±0.56	0.04	1.18
	F	28.0±3.01	0.04	
Lower nasal height (Mn-Sn)	M	10.8± 0.52	0.04	0.89
	F	10.3± 0.19	0.02	

*Critical Z score at (P=.05) =1.96, Sem= standard error of mean, SD= standard deviation*

**Table 2. Comparison of measured parameters with some other populations (mm)**

Author/Date	Population	NFR(°)	Nw (al-al)	NL (n-sn)	NTP (sn-prn)
Present study 2012	Okirika	134.13±0.85°(m)	33.3±0.54(m)	41.8±0.74(m)	12.2±0.26(m)
		137.68±5.63°(f)	29.9±0.39(f)	38.2±0.49(f)	10.7±0.23(f)
Oghenamavwe et al., 2010	Urhobos	117.75± 9.07(m)			
		127.85±8.50 (f)			
Anic-Milosevic et al. 2008 [10]	Croatsians	139.11(f)			
		136.38(m)			
Akpa et al. 2003 [22]	Igbos			48.7±0.84(m)	
				44.0±0.76 (f)	
Ese et al., 2011 [15]	Itsekiri	132.45(m)			
		125.95(f)			
Powells &Humphries, 1984 [28]	North American Caucasians		34.8±2.7(m)	53.2±3.3(m)	20.6± 2.2 (m)
			31.9±1.0(f)	49.2±2.9(f)	19.4±1.7(f)

*NFR= Nasofrontal angle, Nw= Nasal width, NL=Nasal Length, NTP= Nasal tip projection*

**Table 3. Method error according to the formula of Dahlberg (1940) [30]**

<b>Parameters</b>	<b>Method error</b>
Nasofrontal angle	1.50
Nasal width (Al-AL)	0.68
Nasal length (N-Sn)	0.79
Nasal tip projection (Sn-Prn)	0.28
Upper nasal height (N-Mn)	0.52
Lower nasal height (Mn-Sn)	0.57

#### **4. DISCUSSION**

This study was carried out to provide a data base and facial norms of soft tissue profile analysis of Okrika people. All measured parameters showed significant gender difference which was higher in males except for the lower nasal height which showed no significant difference. The higher naso-frontal angle of Okrika women implies that they have less prominent glabella and wider nose with bulbous tip when compared to their male counterparts. This is in line with the study on the Igbo and Itsekiri females in which it was reported that the nasofrontal and nasomental angles were higher than that of their male subjects [15,28].

Measurement of the human face has always been an interesting subject for anatomists, artistes and surgeons. Consistent quality photographs are important not only to document pre and post-operative results and communicating with patients, but are also essential in preoperative planning and accurate evaluation of post operative results [24].

The Korean American women's nasal bridge inclination angle stands at  $136.8^{\circ} \pm 6.4$  and that of the North American women stands at  $134.3^{\circ} \pm 7.0$ , the mean nasal bridge inclination angle in Javanese women were also found to be equal to  $138.04^{\circ}$  and significantly different from the value of the white women but is in line with the values obtained in this study [25,26]. The result obtained from this study was higher than that recorded for the Urhobos in Nigeria but for females and males in the naso-frontal angle [14,27]. While for the nasal length, the values obtained were lower than that of the Igbos, Turkish population [28] and the North American Caucasians [22,29]. The mean nasal width in this study is 29.9mm in females and 33.3mm in males which is lower than that observed in the Turkish population which is 32.32mm in females and 35.15mm in males [28]. The relationship of the nose with the facial plane is a facial parameter of aesthetic importance [14]. This applies in the case of the naso-frontal angles of the Okrika males and females and other measured parameters. It can be used as a tool for racial, ethnic identification and gender differentiation.

#### **5. CONCLUSION**

The knowledge of the facial characteristics (nasal parameters) of the Okirika people adds to the existing data for the Nigerian population. Photometric analysis of soft tissue facial profile of Okrika people suggests significant gender difference using the different anatomical soft tissue nasal landmarks.

The data presented in this study will serve as a reference for plastic surgeons and a baseline for further study.

## **ACKNOWLEDGEMENTS**

I wish to thank the good people of Okirika who participated in this study for their maximum cooperation and also all those who assisted in one way or the other in data collection.

## **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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