

# Original Research Article

## **Facial Analysis of the Igbo Ethnic Group of Nigeria for the Evaluation of Sexual Dimorphism**

### **ABSTRACT**

**Background:** Facial analysis defines the measurement of soft tissue in the face used in forensics, anthropology, artistic design, and facial reconstruction. The study aims to evaluate the sexual differences in facial parameters among the Igbo ethnic group of Nigeria.

**Methods:** 400 (200 males and 200 females) subjects of Igbo origin volunteered for the study. Each subject's frontal view photographs were taken in the Natural Head Position (NHP) and analyzed using Pro-Image Facial Software Version 2 to evaluate the nasal width, nasal height, mouth width, facial width, facial height, inner canthal distance, and outer canthal distance. Data obtained were analyzed with IBM SPSS (version 26) and independent T-test as an inferential statistic

**Results:** The result showed that NW was ( $M=5.16\pm0.65$ ,  $F=5.34\pm0.53$ ,  $t=-2.91$ ,  $p=0.00$ ), NH was ( $M=5.61\pm0.62$ ,  $F=5.26\pm0.57$ ,  $t=5.92$ ,  $p=0.00$ ), MW was ( $M=6.64\pm0.7$ ,  $F=6.54\pm0.71$ ,  $t=1.46$ ,  $p=0.14$ ), FW was ( $M=16.17\pm1.31$ ,  $F=15.07\pm2.04$ ,  $t=6.39$ ,  $p=0.00$ ), FH was ( $M=16.63\pm1.11$ ,  $F=16.08\pm1.31$ ,  $t=4.36$ ,  $p=0.00$ ), En was ( $M=4.62\pm0.46$ ,  $F=4.31\pm0.47$ ,  $t=6.75$ ,  $p=0.00$ ) and Ex was ( $M=12.23\pm0.86$ ,  $F=12.16\pm1.01$ ,  $t=0.82$ ,  $p=0.41$ ).

**Conclusion:** nasal width and Height, facial width and height, and inner canthal distance show gender differences among the Igbo ethnic group of Nigeria.

**Keywords:** facial analysis, soft tissue, Forensics, Anthropology, Igbo, Nigeria

### **1.0 Background**

Facial analysis defines the measurement of soft tissue in the face used in various disciplines such as forensics, facial reconstruction, anthropology, and population studies [1]. The soft cutaneous

tissue of the face such as mouth width, nasal height and width, canthal distances, and facial width and height has been a point of interest because the role of the hard tissue (skeletal structures) is an accepted fact that influences facial form but the soft tissue bears the covering which forms the external surface of the face that is made up of integument, adipose tissue, connective tissue, and muscles [2]. This constituent of the soft tissue does not always distribute itself in a uniform orderly manner in every individual and has led to greater variations in the amount and distribution. However, studies show that the predisposition of this constituent of the soft tissue and facial features in general is influenced by genetic, diet, and environmental factors which in turn has made it difficult to establish a defined difference in sex in a population [3].

In Forensics and anthropology, there is a need to establish the sexual differences in the facial parameters to aid in identification and classification when necessary [4]. However, reference data abound in our communities, but diet and environmental changes have been observed to alter the facial morphology of an individual [4,5] therefore, it is necessary to evaluate facial anthropometry continuously to remain current and have relevant data of the population. The need to establish sexual differences in facial parameters is not limited to Forensics and anthropology alone rather it will be valuable in artistic design such as face masks, nose braces [6], and so on, to pinpoint the areas of consideration also it will be value to all medical professionals involved in facial reconstruction. The importance of sexual differences in facial parameters in understanding ethnic diversity cannot be overemphasized [7].

The Igbo ethnic group is one of the largest and most culturally diverse ethnic groups in Nigeria [8]. They primarily inhabit the southeastern region of Nigeria, which includes states such as Anambra, Enugu, Imo, Abia, and Ebonyi [9]. The Igbo people have a rich cultural heritage, with a language called Igbo (or Ibo) as their primary means of communication. Igbo society is known for its strong sense of community and family ties [10]. Their social structure is often organized around extended families and clans, with a focus on communal values and traditional customs. The impacts of climate change in the region are diverse and can have far-reaching consequences for the environment, agriculture, and overall livelihoods of the Igbo people [11].

The study aims to evaluate the sexual differences in facial parameters among the Igbo ethnic group of Nigeria.

## **2.0 Materials and Method**

## **2.1 Study Design**

The study adopted a cross-sectional descriptive study design to generate values of the nasal width, nasal height, mouth width, facial width, facial height, inner canthal distance, and outer canthal distance of males and females of the Igbo ethnic group of Nigeria using anthropometric standards via photogrammetry. The study population comprised subjects drawn from Abia, Anambra, Enugu, Ebonyi, and Imo State of Nigeria, and Imo State University was used as the Study area.

## **2.2 Sample Techniques and Sample Size**

A multistage random sampling technique was adopted in the study to ensure that every respondent has an equal chance of being selected and the sample size was calculated using the Taro Yamane formula of the descriptive survey.

## **2.3 Study Criteria**

The study was limited to only subjects whose parents and grandparents are of Igbo origin and currently residing in Igbo land, Subjects who fit into the designed age interval of 18-40 years were selected and they must not have any facial deformity or have undergone any facial surgery. subjects who did not meet these stated criteria were excluded from the study.

## **2.4 Photographic setup**

A descriptive questionnaire was administered to all respondents to obtain their socio-demographic variables. For facial capture, a digital camera (Nikon COOLPIX S2800, 20.1 megapixels, x5 zoom) was mounted on a tripod platform 120cm distant from a graphic board. To guarantee that the head was in a natural head position (NHP), a mirror was placed opposite the graphic board where the tripod was in between. All respondents were photographed in a calm state with their heads in the natural head position (NHP), and the images were saved to a hard drive for picture analysis.

## **2.5 Photographic analysis**

The study made use of a digitalized photo analyzer, the WinImager developed by Oghenemawve et al. (2011) to measure the soft cutaneous points of the face and determine the value of various

landmarks such as nasal width, nasal height, mouth width, facial width, facial height, inner canthal distance and outer canthal distance.

## 2.6 Statistical analysis

The data were subjected to statistical analysis using the International Business Machines Statistical Package for Social Science (IBM SPSS version 23) for statistical analysis. Independent t-test was used as an inferential statistic to test for significance between sex. A probability less than 0.05 ( $P < 0.05$ ) was considered statistically significant.

## 3.0 Results

**Table 1**, provides the descriptive statistics of the Igbo ethnic group of Nigeria, the mean $\pm$ SD for the age was  $25.72 \pm 3.26$ , NW was  $5.25 \pm 0.59$ , NH was  $5.44 \pm 0.62$ , MW was  $6.59 \pm 0.71$ , FW was  $15.62 \pm 1.80$ , FH was  $16.62 \pm 1.24$ , En was  $4.47 \pm 0.49$ , and Ex was  $12.19 \pm 0.93$ .

Sexual differences of some facial linear variables of the Igbo were presented in **table 2**. the mean $\pm$ SD of NW showed a significant differences (M= $5.16 \pm 0.65$ , F= $5.34 \pm 0.53$ , t= $-2.91$ , p= $0.00$ ), NH was also significant with gender (M= $5.61 \pm 0.62$ , F= $5.26 \pm 0.57$ , t= $5.92$ , p= $0.00$ ), MW (M= $6.64 \pm 0.7$ , F= $6.54 \pm 0.71$ , t= $1.46$ , p= $0.14$ ) it show no gender difference but FW (M= $16.17 \pm 1.31$ , F= $15.07 \pm 2.04$ , t= $6.39$ , p= $0.00$ ), FH (M= $16.63 \pm 1.11$ , F= $16.08 \pm 1.31$ , t= $4.36$ , p= $0.00$ ), both FW and FH was statistically significant with gender. The En was evaluated (M= $4.62 \pm 0.46$ , F= $4.31 \pm 0.47$ , t= $6.75$ , p= $0.00$ ) and was also significant so as Ex (M= $12.23 \pm 0.86$ , F= $12.16 \pm 1.01$ , t= $0.82$ , p= $0.41$ ) and was non-significant with gender.

## 4.0 Discussion

The present study evaluates the sexual differences of facial linear parameters among the Igbo ethnic group of Nigeria, where nasal width was  $5.16 \pm 0.65$  in males and females was  $5.34 \pm 0.54$ . the nasal height in males was  $5.61 \pm 0.62$  and in females was  $5.26 \pm 0.57$ . both nasal width and height showed sexual differences among the Igbo population. the findings agree with Mohammed et al., [12] in their study of nasal index among the Hausa ethnic group of Nigeria, that there are sexual differences in nasal width and height. Oladipo et al., [13] study in southern Nigeria stated that nasal width and height showed significant gender differences. The study by Agburun et al., [14] among the Ikwerres of Rivers State, Nigeria, also reported that there are sexual differences in nasal width and height among the Ikwerres population though Esomonu et

al., [15] study among the Bekwara ethnic group of Cross River State findings is inconsistent with the present study but our study has shown consistency with [16, 17, 18, 19]. Our findings further suggest that males have a larger nasal height than female but female has broader nose compared to males among the Igbo ethnic group of Nigeria

In orthodontics, assessing the width of the mouth is crucial for diagnosing and treating issues related to malocclusion [20]. The present study evaluates the mouth width of the Igbo ethnic group of Nigeria and the result showed that males had a mean of  $6.64 \pm 0.70$  while females had  $6.54 \pm 0.71$ , the comparison shows no gender difference among the Igbo of Nigeria. The finding of the study disagrees with a study on anthropometric study of the mouth width in Kalabari, Rivers State, Nigeria. By Benwoke et al., [21], Uche et al., [22] among Nigerians of Delta State extraction, and Houlton et al., [23] on southern Africans, there are significant gender differences.

The present study evaluates the facial width and height of the Igbo ethnic group of Nigeria. The results showed that male facial width was  $16.17 \pm 1.31$  while female was  $15.07 \pm 2.04$ . the facial height for males was  $16.63 \pm 1.11$  while the female was  $16.08 \pm 1.31$ . the comparison showed that both facial width and height exhibit sexual differences among the Igbo of Nigeria. The present study agrees with Adelaja et al., [24] on the evaluation of facial index among the Igbo. In their report, they stated that there are sexual differences in facial width and height. Okwesili et al., [25] among the Igbo also reported sexual differences though Ese, [26] among the Ika ethnic group of Delta State reported that there is no gender difference in facial height, she further stated that facial width had a significant gender difference. Human may vary in their measurement due to many factors that can alter the human morphology. Jeremic et al., [27] study in central Serbia, and Yesmin et al., [28] among the Malay population have also reported in their works that there are significant sexual differences in facial width and height. Even a study carried out among university students of Tehran University India by Dodangheh et al., [29] also reported that there are sexual differences in facial width and height. The study further suggests that males have a higher facial width and height than the females in Igbo ethnic group of Nigeria.

The normative values of inner and outer canthal distance are very important for the successful reconstruction of the canthal area. The present study presents that the inner canthal distance of

Igbomales was  $4.62 \pm 0.46$  and for females was  $4.31 \pm 0.47$  while the outer canthal distance for males was  $12.23 \pm 0.86$  and for females was  $12.16 \pm 1.01$ . The study further showed that inner canthal distance had a significant gender difference among the Igbo but outer canthal distance showed no gender difference. The finding of this study agrees with Oladipo et al., [30] study on the canthal index among the Ibibios, they reported that inner canthal distance showed gender difference and outer canthal distance showed no gender difference. Jaja et al., [31] in their study also reported that inner canthal distance is significant while outer canthal distance showed no gender difference among young Nigerians. A study carried out in India also agrees with the present study that inner canthal distance showed significant gender difference and outer canthal was insignificant. Even a study among the Isoko in Delta State, Nigeria also agrees with the present study that inner canthal distance had a significant gender difference and outer canthal had no gender difference. Though the present disagrees with a study by Eboh et al., [32] among the Urhobos, Nigeria. They reported that outer canthal distance had a significant gender difference. Osunwoke et al., [33] among Igbo also contradict the present study, they reported that inner canthal distance showed no gender difference, in 2012, Osunwoke et al., [34] study on inner and outer canthal distance among the Ijaws, their findings disagreed with the present study because they reported that outer canthal distance showed a significant gender difference. Oladipo et al., [35] also disagree with this study, they reported a significant gender difference among Ikwerre, Rivers State, Nigeria. The findings of this study further suggest that males have a higher inner canthal distance than females but there is no difference in outer canthal distance.

The above-discussed study has shown some similarities and differences in facial parameters among different ethnic groups and the difference could be attributed to ethnicity, race, methodology, and environmental factors.

## **5.0 Conclusion:**

The study has shown gender differences in nasal width and height, facial width and height, and inner canthal distances. The findings of the study will have a practical application in Forensics, Anthropology, Artistic and Industrial design, and to medical professionals involved in facial reconstruction.

## **CONSENT**

A written consent was issued to every subject to declare their consent to participate in this study as per University Standards.

### **ETHICAL APPROVAL**

The study was approved by the ethical research committee of the University of Port-Harcourt, Port-Harcourt, Nigeria.

UNDER PEER REVIEW

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UNDER PEER REVIEW

**Table 1 Descriptive Statistics for Igbo**

<b>Parameters</b>	<b>N</b>	<b>min</b>	<b>max</b>	<b>Mean</b>	<b>SEM</b>	<b>Std. Deviation</b>
age	400	18.00	40.00	25.72	0.16	3.26
NW (cm)	400	3.86	6.92	5.25	0.03	0.59
NH (cm)	400	3.54	7.68	5.44	0.03	0.62
MW (cm)	400	3.78	9.37	6.59	0.04	0.71
FW (cm)	400	10.38	21.40	15.62	0.09	1.80
FH (cm)	400	11.80	21.36	16.36	0.06	1.24
En (cm)	400	3.04	6.10	4.47	0.02	0.49
Ex (cm)	400	10.18	15.24	12.19	0.05	0.93

*NW= nasal width, NH= nasal height, MW= mouth width, FW= facial width, FH= facial height, En= inner canthal distance, Ex= outer canthal distance,*

**Table 2, Compare the mean of Igbo facial linear measurements based on gender**

<b>Parameters</b>	<b>male</b>	<b>female</b>	<b>t-score</b>	<b>p-value</b>	<b>Inference</b>
NW (cm)	5.16±0.65	5.34±0.53	-2.91	0.00	S
NH (cm)	5.61±0.62	5.26±0.57	5.92	0.00	S
MW (cm)	6.64±0.70	6.54±0.71	1.46	0.14	NS
FW (cm)	16.17±1.31	15.07±2.04	6.39	0.00	S
FH (cm)	16.63±1.11	16.08±1.31	4.56	0.00	S
En (cm)	4.62±0.46	4.31±0.47	6.75	0.00	S
Ex (cm)	12.23±0.86	12.16±1.01	0.82	0.41	NS

*NW= nasal width, NH= nasal height, MW= mouth width, FW= facial width, FH= facial height, En= inner canthal distance, Ex= outer canthal distance, NS=Non-significant, S= significant,  $p<0.05$*