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# Normative Value of Linear Craniofacial Parameters in Ijaws Resident in Port Harcourt

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## Abstract

**Background**: The aim of the study was to generate linear craniofacial anthropometric database for Ijaws resident in Port Harcourt using photogrammetry.

**Methods**: The study involved 300 subjects (150 males and 150 females) between the ages of 18 to 40 years randomly selected from Port Harcourt environs. Direct anthropometric and photogrammetric methods were used in this study. Frontal and lateral view photographs of the subjects taken in the natural head position were analyzed using Pro Image facial analysis software. Seven craniofacial parameters were measured and the data analyzed using Statistical package for social science (SPSS) version 25.0.

**Result**: The craniofacial normative average mean value for craniofacial height 22.83±2.7, face width 12.21±1.2, trichon to glabella 4.25±1.4, nasal to subnasal 4.87±1.1, subnasal to menton 6.05±1.9, nose width 4.20±1.4 and eye width 3.80±2.9. There was significant difference between the male and female variables thus significance in sexual dimorphism.

**Conclusion:** The values derived from this study will not only expose the anthropometric parameters of the Ijaws, but can also be used in medical and industrial studies as well as anthropological modelling of structures of the Ijaws of Nigeria.

**Keywords:** Anthropometry; photogrammetry; craniofacial; Ijaw

## Introduction

The Southern part of Nigeria comprises of numerous ethnic groups, among which are the Ijaw people. The Ijaw people (Izon Otu) are a small ethnic group in Nigeria mainly found in the Niger Delta (Bayelsa, Rivers and Delta States) of the Southern region of the country.[1] They can also be found in Ondo and Edo States in Nigeria.[2]

Photogrammetry is a scientific approach which entails deriving precise measurements from photographs.[3] . Anthropometry involves taking standardized measurements of the human body. This is done by means of properly calibrated instruments to take specific measurements of a living human body.[4] Anthropometry provides a scientific base which is essential for evaluation of human body dimensions and proportions.[5]

Craniofacial Anthropometry is a sub-division of anthropometry involving measuring various dimensions on the face and head [6] of individuals. Measurements of craniofacial parameters are put to comparison to establish certain variations within the face. [7] This is an important aspect of anthropology. [8] The approach will help in describing the specific craniofacial parameters of a population using their phenotypic look.

Craniofacial parameters such as nasal width, eye width, total face height, face width, and so on change over time and are influenced by a variety of factors including gender, ethnicity and race, climate, socioeconomic, nutritional, and genetic factors.[9] These are determinants of growth and development.

The origins of anthropometry, in the context of human identification, initially resided in pseudoscientific methods.[10] This was driven by an interest in criminology - with an assumed connection between physical appearance and moral character.[11]

The assessment of face parameters is critical for the examination of facial trauma, congenital and traumatic deformities, and the simpler identification of certain congenital anomalies.[12] Anthropologists, forensic scientists, surgeons, dentists, and anatomists have long been interested in the relationships between craniofacial differences and qualities in different populations for their objectives. Information about cranial dimensions is very useful for determining an individual's age, gender, and ethnic heritage. It also serves as a biomarker for illness conditions, sex determination, and adult skeletal remains' stature estimation. [13]

Various body features are usually affected by ethnicity or race, as a result, there exist differences in measurements of parameters including craniofacial dimensions. This study was centered on the craniofacial parameters of the Ijaw Ethnic group of Nigeria.

## Materials and Methods

### Research Design

A total number of 300 subjects (150 males and 150 females) were used for the study. The study population consisted of only adults between the ages of 18-40, without any deformities and passed all the inclusion criteria. Multistage random sampling technique was used for this study. Minimum sample size was determined using the Taro-Yamane formula, $n=N/(1+N(e)^2)$

where n = minimum sample size

N = total population

e = margin of error = 0.05.

### Study Area

The study was conducted in the environs of the University of Port Harcourt, Rivers State. The school comprise of persons from various tribes but the main subjects were Ijaw people who resided in Port Harcourt. The subjects were interrogated using questionnaires to ascertain their tribe as well as to confirm that both parents and fore grand-parents were all from the required tribe. They also confirmed that none of the fore parents had undergone any orthodontics or surgery.

### Methodology for facial photogrammetry

Photographs for the craniofacial photogrammetry was obtained in the frontal and lateral planes using a digital camera (Sony DSC-W800). To achieve a standardized background, the subjects were asked to stand in front of a board-like graph sheet. The camera was placed on a tripod stand to standardize the distance between the subject and the camera, 1-1.5m, also for adjustment to the various heights of the subjects. Before any capture, the operator behind the camera, ensured that the ears and hairline of the subjects were visible, had no hair coverings, and no glasses on [14]. For the frontal capture, the subjects were asked to stand facing a mirror placed behind the camera whilst keeping their head in a natural head position (Frankfurt's plane) while for the lateral capture, they were asked to face another laterally placed mirror and look at their eyes in the mirror at a natural head position.

The captured images were analyzed using the WinImager software which quantified the necessary parameters.

The linear facial parameters included:

- Craniofacial height: Distance from the vertex to the lowest point of the chin.
- Forehead height I (Trichon to glabella): Distance between the hair line to the mid point of the eye brows.
- Nasion to subnasal: Distance from the highest point of the nose to beneath the nose.
- Lower face height (Subnasale to Menton): Distance from beneath the nose to the chin.
- Nasal Width (Al-Al): Distance in between the left and right alar
- Eye Width (Ex-En): Distance between the exocanthion to endocanthion.
- Facial Width (Zy-Zy): Zygion to zygion.

### Statistical Analysis

The statistical analysis was done using Statistical Package for Social Sciences (SPSS version 25.0). The variables were presented as mean±SD, minimum and maximum. Independent sample t-test was thus carried out to determine significant difference in the measured anthropometric variables across age and BMI groups. P-value of $p< 0.05$ was considered significant.

## Results

Table 1 shows the descriptive statistics of the anthropometric parameters for the general population showing the mean scores. Table 2 and 3 shows the descriptive statistics of the anthropometric parameters of male and female subjects respectively.

Table 1 shows that for the general population, the mean craniofacial height (vertex-Gn), the face width (Zy-Zy), the Trichion to

glabella length, the length from the nasion to subnasale, subnasal to menton, nose width and eye width were 23.50±2.4, 12.21±2.41,12.21±1.20, 4.87±1.41, 6.05±1.85, 4.20±1.38, 3.80±2.97 respectively.

Table 2 gives the values for the male sample as craniofacial height (vertex-Gn) 23.8±3.29, face width (Zy-Zy) 12.64±1.03, trichion to glabella length 4.15±1.56, nasion to subnasale 4.85±1.23, subnasale to menton 5.93±2.26, nose width 4.17±1.59 and eye width 4.04±4.03.

Table 3 showed the female subjects had average values for the variables as follows- craniofacial height (vertex-Gn) 22.52±1.90, face width 11.77±1.21, trichion to glabella 4.35±2.18, nasion to subnasale 4.89±1.03, subnasale to menton 6.17±1.29, nose width 4.24±1.13 and eye width 3.54±1.02.

**Table 1:** Descriptive statistics of the measured anthropometric parameters for the general population

| Parameters | Min | Max | Mean | SD |
|---|---|---|---|---|
| age (years) | 18.00 | 38.00 | 22.83 | 2.41 |
| Craniofacial height (vertex-Gn) | 2.50 | 27.00 | 23.50 | 2.70 |
| Face width (Zy-Zy) | 5.50 | 17.00 | 12.21 | 1.20 |
| trichon to glabela | 1.24 | 11.30 | 4.25 | 1.41 |
| Nasion to subnasal | 2.43 | 15.57 | 4.87 | 1.13 |
| Subnasal to menton | 3.00 | 28.14 | 6.05 | 1.85 |
| Nose width | 2.00 | 12.52 | 4.20 | 1.38 |
| Eye width | 2.11 | 53.13 | 3.80 | 2.97 |

***Min*** = *Minimum,* ***Max*** = *Maximum,* ***SD*** = *Standard deviation*

**Table 2:** Descriptive statistics of the measured anthropometric parameters in male subjects

| Parameters | Min | Max | Mean | SD |
|---|---|---|---|---|
| age (years) | 18.00 | 38.00 | 23.12 | 2.57 |
| Craniofacial height (vertex-Gn) | 2.50 | 27.00 | 23.80 | 3.29 |
| Face width (Zy-Zy) | 10.00 | 17.00 | 12.64 | 1.03 |
| trichon to glabela | 1.24 | 11.30 | 4.15 | 1.56 |
| Nasion to subnasal | 2.43 | 15.57 | 4.85 | 1.23 |
| Subnasal to menton | 3.00 | 28.14 | 5.93 | 2.26 |
| Nose width | 2.00 | 12.52 | 4.17 | 1.59 |
| Eye width | 2.11 | 53.13 | 4.04 | 4.03 |

***Min*** = *Minimum,* ***Max*** = *Maximum,* ***SD*** = *Standard deviation*

**Table 3:** Descriptive statistics of the measured anthropometric parameters in female subjects

| Parameters | Min | Max | Mean | SD |
|---|---|---|---|---|
| age (years) | 18.00 | 29.00 | 22.52 | 2.21 |
| Craniofacial height (vertex-Gn) | 15.00 | 27.00 | 23.20 | 1.90 |

| | | | | |
|---|---|---|---|---|
| Face width (Zy-Zy) | 5.50 | 14.30 | 11.77 | 1.21 |
| trichon to glabela | 1.74 | 7.82 | 4.35 | 1.24 |
| Nasion to subnasal | 2.92 | 7.82 | 4.89 | 1.03 |
| Subnasal to menton | 3.42 | 10.87 | 6.17 | 1.29 |
| Nose width | 2.89 | 10.25 | 4.24 | 1.13 |
| Eye width | 2.15 | 8.41 | 3.54 | 1.02 |

*Min = Minimum, Max = Maximum, SD = Standard deviation*

**Table 4:** Test for sexual dimorphism in the measured parameters using independent sample t-test

| Parameters | MD | S.E.D | t-value | P-value | Inference |
|---|---|---|---|---|---|
| age (years) | 0.60 | 0.27 | 2.25 | 0.03 | **S** |
| Craniofacial height (vertex-Gn) | 0.60 | 0.30 | 1.99 | 0.05 | NS |
| Face width (Zy-Zy) | 0.86 | 0.13 | 6.76 | 0.00 | **S** |
| trichon to glabela | -0.20 | 0.16 | -1.31 | 0.19 | NS |
| Nasion to subnasal | -0.04 | 0.13 | -0.34 | 0.73 | NS |
| Subnasal to menton | -0.24 | 0.20 | -1.17 | 0.24 | NS |
| Nose width | -0.07 | 0.15 | -0.46 | 0.64 | NS |
| Eye width | 0.51 | 0.33 | 1.55 | 0.12 | NS |

***MD*** *= Mean difference,* ***S.E.D*** *= Standard error of the difference,* ***S*** *= Significant,* ***NS*** *= Not significant*

## Discussion

Some specific linear measurements were considered in the study and the resulting values were derived as the average measurements for the craniofacial height, face width, trichion to glabella, nasion to subnasal, subnasal to menton, nose width and eye width.

This study showed that there was sexual variation in the face widths of Ijaws. This is in an accordance with the study carried out by Ngeow and Aljunid [15], who reported that the face widths of male and female Malays were 13.25±7.0 and 14.01±4.9 respectively. In addition to variation in facial morphology as aa result of sexual dimorphism, other factors have been shown to influence facial morphology. According to Papaccio [16] environmental factors and choice of nutritional intake were contributors to variations in facial morphology.

In the present study, the nasal width of Ijaw was 4.2±1.38. The Ijaw ethnic group of Nigeria could be said to have a slightly higher nasal width when compared to ethnicities in the Eastern and Western regions of Nigeria, according to the study by Okoh and Fawehinmi,[17] the Hausa of northern Nigeria.[18] and much higher compared to the Caucasian-Americans [19]. Therefore, the Ijaws will appear to possess a wider nose than these ethnicities and Caucasians.

The eye width for the Ijaw in this study was 3.80±2.97. Compared to Malaysians [15] the Ijaws have a higher width from the exocanthion to endocanthion (eye width). Similarly, compared to the Igbo and Yoruba in Nigeria, [17] the Ijaw have a higher eye width. For the nasal height (Nasion-Subnasale) in the present study, sexual dimorphism was observed as the mean female value was higher than the male's. This is in agreement with the finding of Ngeow and Aljunidin Malaysian population [15].

The forehead height I (trichion to glabella) in the present study was 4.25±1.41. Igbos and Yorubas had a significantly higher values, 5.67±3.40 and 5.84±3.41 respectively according to the study carried out by Okoh and Fawehinmi [17]. Also, the lower face height (subnasal-menton) for the Ijaws was lower at 6.05±1.85 than Igbo (6.74±2.47) and Yoruba (6.67±2.46). This parameter was sexual dimorphic as the mean female value was higher than the male value. Adamu *et* al. [18] also reported that the average mean values for the lower facial height of Hausa males and females were also sexual dimorphic however, their study showed that males had a higher value than the females. These differences could be due to ethnic variation. These variations could also be as a result of environmental factors as well as nutrition [20]. Factors such as ancestral background, method used in carrying out the research and instruments/equipment used could also influence the result.

## Conclusion

This study demonstrated sexual dimorphism in some variables. Although, there were variations from other studies, the values derived were within the normal range. This study will be useful for industrial design, medicine, anthropological modelling and forensics.

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## Conflict of Interest

None

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