

Anthropometric study of the Facial Morphology in a South-Eastern Nigerian Population

E.O. Ewunonu and C.I.P. Anibeze

Department of Anatomy, Ebonyi State University, Abakaliki, Nigeria
Corresponding Author: Dr. E. O.Ewunonu EO, Department of Anatomy, Ebonyi State University, Abakaliki, Nigeria.
+2348033388817 Email: ediojims02@yahoo.com

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ABSTRACT

The 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. The aim of this study is to document facial parameters of Igbo people of South-Eastern Nigeria resident in Abakaliki Area of Ebonyi State. A randomly selected sample of 1000 subjects whose age-range falls within 12 years to 45 years were measured directly with a pair of metal spreading calipers and measuring tape. The subjects cover a selection of 669 males and 331 females comprising 266 students below 20 years of age; 587 students between 20 years and 29 years of age; as well as 147 other adults between 30 and 45 years of age. Seven facial parameters were measured directly with a pair of metal spreading calipers and steel tape from each subject following internationally recommended standard methods and techniques. Facial and Nasal indices were then calculated. The result shows the mean values of the parameters as follows; Bizygomatic Diameter, 13.50 cm; Bigonial Diameter, 12.02 cm; Facial Length, 12.13 cm; Nasal Length, 5.54 cm; Nasal Breadth, 3.87 cm; Ear Length, 5.87 cm and Ear Breadth, 3.34 cm. Also, Facial and Nasal Indices were 90.02 and 70.37 respectively. There was sexual dimorphism with male values statistically higher than females in most of the parameters. This could be useful in forensic investigation as well as in plastic and reconstructive surgery of the face.

Keywords: *Anthropometric, Dimensions, Dimorphism, Facial, South-Eastern, Population, Igbo people, Bizygomatic Diameter, Bigonial Diameter, Nigerian.*

INTRODUCTION

Anthropometry is the measurement of human beings, whether living or dead or of skeletal materials and constitutes a series of systematised measuring techniques of expressing quantitatively the form of the human body and skeleton (Krishan, 2007). Cephalometry is an important branch of anthropometry which involves measurements of the head and face (Heidari *et. al.*, 2004; Will *et. al.*, 1995; Jahanshahi *et. al.*, 2008). It is helpful in forensic medicine, plastic and reconstructive surgery, orthodontics and

clinical diagnosis (Heidari *et. al.*, 2004; William *et. al.*, 1995; Meibodi and Mastari, 1996). Features distinguishing various races and ethnic groups have been discovered when anthropometric methods were introduced into clinical practice to quantify changes in the craniofacial framework. To treat congenital or post-traumatic facial disfigurements in members of these groups successfully, surgeons require access to craniofacial databases based on accurate anthropometric measurements (Farkas *et. al.*, 2005). Also, for evaluation of deviations in craniofacial morphology, standards of anthropometrical measurements should be established for a particular population (Basciftel *et. al.*, 2004) since normative data of facial measurements are indispensable to precise determination of the degree of deviations from the normal (Farkas *et. al.*, 2005). Facial features have been known to differ amongst different races and ethnic groups (Basciftel *et. al.*, 2004). And, facial dimensions are among important cephalometric results that have been used to describe racial and sexual differences (Heidari *et. al.*, 2006; Franciscus, 1991; Zhang *et. al.*, 1990; Porter and Olson, 2003). Consequently, researchers on craniofacial study of different ethnic groups are on going with the intention to establish ethnic specific anthropometric data for populations with different ethnic background (Krishan and Kumar, 2007).

The face is the part of the front of the head between the ears and from the chin to the hairline. It is the anterior part of the head that includes the forehead, eyes, nose, mouth and chin (Sinnatamby, 1999). The shape of the face is determined by underlying bone, thickness and distribution of the underlying fat as well as the facial muscles (Moore & Dalley, 1999).

The human face is used for expression, appearance and identity amongst others. It is widely recognized as the feature which best distinguishes a person, often at first glance (Didia and Dapper, 2005). Variation in facial shape is an easy way to explain phenotypes in humans to people who do not understand biology all that well. Monozygotic twins have almost identical faces and siblings usually have more similar faces than unrelated people, implying our facial morphology is under genetic regulation (Liu *et. al.*, 2012).

In Nigeria, different parameters of the facial morphology have been studied including, facial height, mandibular height and maxillary height (Oladipo *et. al.*, 2008; Didia and Dapper, 2005; Ewunonu *et. al.*, 2006; Ewunonu *et. el.*, 2007) orbital dimentions and canthal distances (Oyinbo *et. al.*, 2008; Oladipo and Olotu, 2008;

Egwu *et. al.*, 2008) as well as nasal parameters (Akpa *et.al.*, 2003; Oladipo *et. al.*, 2007; Olotu *et. al.*, 2009). The present study is carried out to document the facial parameters of the Igbo people resident at Abakaliki in Ebonyi State. The study serves as a data base for future references in clinical, forensic and orthopaedic practices.

MATERIALS AND METHODS

The sample population is drawn from a selection of 1000 subjects whose age-range falls within 12 years to 45 years and cover a selection of 669 males and 331 females comprising 266 students below 20 years of age; 587 students between 20 years and 29 years; as well as 147 other adults between 30 and 45 years of age. The subjects were born, bred and live in Abakaliki area of Ebonyi State. Seven facial parameters were measured directly from each subject, including Bizygomatic diameter (BZD), Bigonial diameter (BGD), Maximum Facial Length (MFL), Nasal Length (NL), Nasal Breadth (NB), Ear Length (EL) and Ear Breadth (EB) with a pair of metal spreading calipers and steel tape in centimeters to the nearest millimeter (0.1cm) according to the land marks, techniques and procedures recommended by Krishan and Kumar, (2007); Weiner and Lourie, (1981); Lohman *et. al.*, (1988); and Hall *et. al.*, (2003). The anatomical landmarks used were identified keeping the head in Frankfurt Horizontal plane. The measurements were taken after obtaining informed consent from the selected subjects. All the subjects measured were healthy and free from apparent symptomatic cephalic deformity and there was no evidence of treatment or surgery of cephalofacial disorders. Facial and Nasal indices were then calculated and the data collected were recorded and subjected to statistical analysis. Facial Index has been classified as, euriprosopic, up to 83.9; mesoprosopic, between 84.0 and 87.9 and leptoprosopic, up to 88.0 and above while Nasal index is classified as Leptorrhine or fine nose, 69.9 or less; Mesorrhine or medium nose, between 70.0 and 84.9; and Platyrrhine or short and broad nose, 85.0 and above (Williams *et. al.*, 1995).

Anthropometry

Maximum facial length (MFL): measured as the straight distance from the nasal root (nasion) to the lowest point on the lower border of mandible in the mid-sagittal plane (gnathion).

Bizygomatic diameter (BZD): measured as the maximum distance between the most lateral points on the zygomatic arches (left zygon to right zygon).

Bigonial diameter (BGD): measured as the maximum breadth of the lower jaw between two gonion points on the angles of mandibles (gonion is the most posterior, inferior and laterally situated point on the external angles of the mandible).

Nasal height (NH): measured as the distance from the nasal root (nasion) to the nasal base (subnasale).

Nasal breadth (NB): measured as the distance between the lateral most aspect of one ala nasi to the lateral most aspect of the other ala nasi.

Ear length (EL): measured as the maximum distance from the superior aspect (supra-aurale) to the inferior aspect of the external ear (sub-aurale).

Ear breadth (EB): maximum width of the external ear (pinna) taken from pre-aurale to post-aurale.

Method of calculation of indices

Facial Index = (Nasion-Gnathion Length/Bizygomatic Breadth) X 100

Nasal Index = (Maximum Nasal Breadth/ Maximum Nasal Length) X 100

Data analysis

The Data collected were recorded and subjected to statistical analysis like Mean, Standard Deviation (S.D.) and Student t-test used to show significant difference. They were analysed using Statistical Package for Social Sciences (SPSS) for Windows XP-Professional.

RESULTS

Table 1 shows the average mean values of the parameters (ages and sexes combined) as follows; Bizygomatic Diameter, 13.50 cm; Bigonial Diameter, 12.02 cm; Maximum Facial Length, 12.13 cm; Nasal Length, 5.54 cm; Nasal Breadth, 3.87 cm; Ear Length, 5.87 cm and Ear Breadth, 3.34 cm. There is a gradual increase of the mean values of all the facial measurements in the three age groups studied ($P < 0.05$).

Table 2 presents the mean facial and nasal indices of the Igbo people (ages and sexes combined) resident in Abakaliki. The mean values are 90.02 (leptoprosopic) for Facial Index and 70.37 (mesorrhine) for Nasal Index. Also, the table reveals that facial and nasal indices of the people did not increase with age ($P > 0.05$).

Table 3 presents the mean values, standard deviations and range of values of the seven facial parameters of Igbo people resident in Abakaliki according to sex. The table shows sexual dimorphism in all the measurements with the mean values of the males statistically higher than the females ($P < 0.05$).

Table 1: Descriptive Statistics of the Facial Measurements (cm) of Abakaliki Igbo Residents showing Mean, S.D., and S.E.

Variable	Age	N	Mean (cm)	Std. Deviation	Std. Error
Bizygomatic Diameter (BZD)	<=20yrs	266	12.89	0.81	0.05
	20-29yrs	587	13.65	0.74	0.03
	30-45yrs	147	14.06	0.62	0.05
	Total	1000	13.50	0.85	0.03
Bigonial Diameter (BGD)	<=20yrs	266	11.57	1.03	0.06
	20-29yrs	587	12.08	0.89	0.04
	30-45yrs	147	12.62	0.90	0.07
	Total	1000	12.02	0.99	0.03
Maximum Facial Length (MFL)	<=20yrs	266	11.75	0.78	0.05
	20-29yrs	587	12.20	0.83	0.03
	30-45yrs	147	12.59	0.66	0.05
	Total	1000	12.13	0.84	0.03
Nasal Length (NL)	<=20yrs	266	5.49	0.42	0.03
	20-29yrs	587	5.50	0.49	0.02
	30-45yrs	147	5.79	0.36	0.03
	Total	1000	5.54	0.47	0.02
Nasal Breadth (NB)	<=20yrs	266	3.84	0.37	0.02
	20-29yrs	587	3.88	0.38	0.02
	30-45yrs	147	3.89	0.34	0.03
	Total	1000	3.87	0.38	0.01
Ear Length (EL)	<=20yrs	266	5.73	0.10	0.02
	20-29yrs	587	5.89	0.43	0.02
	30-45yrs	147	6.02	0.46	0.04
	Total	1000	5.87	0.43	0.01
Ear Breadth (EB)	<=20yrs	266	3.21	0.25	0.02
	20-29yrs	587	3.37	0.31	0.01
	30-45yrs	147	3.45	0.30	0.03
	Total	1000	3.34	0.30	0.01

(P < 0.05)

Table 2: Descriptive Statistics of the Facial Indices of Igbo People in Abakaliki showing Mean, S.D., and S.E. by Age

Variable	Age	Mean (cm)	Std. Deviation	Std Error
Facial Index	<=20yrs	91.33	6.39	0.39
	20-29yrs	89.52	6.63	0.27
	30-45yrs	89.63	4.26	0.35
	Total	90.02	6.32	0.20
Nasal Index	<=20yrs	70.29	8.35	0.51
	20-29yrs	71.17	9.67	0.40
	30-45yrs	67.34	6.15	0.51
	Total	70.37	8.99	0.28

P > 0.05

DISCUSSION

The use of anthropometry to establish head dimensions has been reported by many authors. Accordingly, the present study has established the facial parameters of the Igbo people resident in Abakaliki. Generally, there is a gradual increase of the mean values of all the facial parameters when the age groups progress from the younger age group to the older age group ($P < 0.05$) among the Igbo people in Abakaliki (table 1). Similar reports have been presented among other races (Krishan, 2008; Krishan and Kumar, 2007). Also, the study has presented the subjects as leptoprosopic, and mesorrhine with mean facial index of 90.02 and mean nasal index of 70.37 (table 2) respectively. This also reflected in the three different age groups studied. The present report on the facial dimensions of Igbo people in Abakaliki however, differs from previous reports which presented Igbo males as euriprosopic (Talbot and Mulhall, 1962) and Igbo males and females as mesoprosopic (Ewunonu *et al.*, 2006). On the nasal dimension, Akpa *et al.*, (2003) studied the morphometry of the nasal parameters in Nigerian Igbos and reported

that the Igbos have a platyrrhine type of nose. Oladipo *et. al.*, (2007) reported similar result and showed that the mean nasal index of Igbos was 94.1 ± 0.39 . The discrepancy between these reports and the present study may be attributed to the longer nasal length observed among the Igbo people in Abakaliki in the present study. Olotu *et. al.*, (2009) worked on the Anthropometric Study of the Facial and Nasal Length of adult Igbo ethnic group in Nigeria and reported that the Nasal Height (NH) for adult Igbo males was $4.87 \text{ cm} \pm 0.84 \text{ cm}$ and $4.40 \text{ cm} \pm 0.76$ for Adult Igbo Females. But, the present

Table 3: Descriptive Statistics of the Cephalofacial Measurements of Igbo People in Abakaliki By Sex showing Mean and Standard Deviation in cm

Variables	Minimum	Maximum	Mean (cm)	Std. Deviation
MALE (N = 669)				
Bizygomatic Diameter	11.30	15.90	13.73	0.79
Bigonial Diameter	9.40	16.40	12.25	0.95
Max. Facial Length	10.10	14.50	12.30	0.79
Nasal Length	4.20	6.70	5.56	0.47
Nasal Breadth	2.80	5.00	3.92	0.39
Ear Length	4.50	7.00	5.89	0.44
Ear Breadth	2.70	4.20	3.37	0.30
FEMALE (N = 331)				
Bizygomatic Diameter	10.00	14.50	13.07	0.77
Bigonial Diameter	9.20	14.70	11.56	0.90
Maximun Facial Length	10.00	14.60	11.80	0.84
Nasal Length	4.10	6.50	5.50	0.47
Nasal Breadth	3.00	4.50	3.77	0.31
Ear Length	4.50	7.00	5.83	0.42
Ear Breadth	2.50	4.00	3.28	0.30

P < 0.05

study presents the mean nasal length of Igbo people in Abakaliki as 5.54 cm (5.56 cm for males and 5.50 cm for females). Generally, on the account of the above differences, Morita and Ohtsuki (1973) reported that variations in head transformation exist even in the same race or group. For instance, while Ikeda *et. al.*, (1953) and Suziki and Suziki

(1963) reported brachycephalization in Japanese people, Suzuki (1967) explained de-brachycephalization phenomenon among the medieval Japan. Morita and Ohtsuki (1973) have implicated hereditary and environmental factors as reasons for such changes. These conditions could also be adduced as reasons for the variations observed between the present report on the Igbo people in Abakaliki and the previous reports on the head dimensions of the Igbo people elsewhere in the South-eastern Nigeria. On sexual differences, the result from the present study (Table 3) shows sexual dimorphism in all the measurements with the mean values of the males statistically higher than the females ($P < 0.05$). The differences may be attributed to the early maturity of girls than boys. Consequently, the boys have two more years of physical growth for the respective completion of ossification processes (Lasker, 1976) and therefore girls attain adult size earlier than boys of the same age (El-Majjar *et. al.*, 1987). This report could be useful for future references concerning the people.

CONCLUSION

The study has established the mean values of facial dimensions of the Igbo people resident in Abakaliki Area of Ebonyi State. This will be used as data base for relevant future references in forensic and medical practices.

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