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Age-specific sex differences in weight, height and cephalofacial dimensions among Ebonyi Indigenes in Nigeria

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ABSTRACT

Introduction: Anatomy of the human body and its measurements are affected by biological, ecological, age and sex factors. Anthropometric measurements determine the morphological characteristics of the face and head.

Aim: To assess age-specific sex differences in weight, height and cephalofacial dimensions among Igbo tribe in Nigeria.

Materials and methods: This research is conducted on 300 subjects, 150 males and 150 females in the age of 15-18 years. In addition to the height and weight of the subjects, cephalofacial parameters were measured and then cephalic and facial index is calculated. The cranial and prosopic indices were sharply higher in age 17 years for both sexes at level $p < 0.005$. The weight of males was slightly higher than females at 18 years and above ($p < 0.005$).

Conclusion: There were predominantly mesoprosopic and mesocephalic face and head forms in both sexes.

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INTRODUCTION

Sex and age differences are important in forensic science, biological education, clinical research and pathophysiology, but they also important in cephalofacial studies. Biomedical studies used the relationship between sex and age to access human behaviors, investigates disease and advances science.¹ There are studies about cephalofacial on sexual dimorphism, cephalic indices in older children and adolescents in Nigeria. However, this is not enough in the body of knowledge for a country with a population of over 140 million. Hence, the importance of this study is in sex and age differences of Ebonyi population.

Cephalofacial parameters have been used to determine racial

variability.^{2,3} Reliably, unknown individuals have been identified with the help of cranial and facial variables in the human population.^{3,4} Sexual dimorphism and cephalofacial characters in the investigation of deformities of the head and have been very reliable and valid.^{4,5,6} In biological anthropology, facial and cephalic indices have been reliable indicators for a genetic relationship; parents, offspring and siblings in skeletal forms.^{1,6,7} The important ratio of the head measurement is obtained from height and width.^{4,6,7} This has helped in the international classification of the head into dolichocephalic, brachycephalic, mesocephalic and hyperbrachycephalic.^{6,7} In a case of the disease, the length and width of the head are useful parameters to classify craniosynostosis, microcephaly and hydrocephalus at the embryonic stage of human formation.^{4,7} Facial indices are formed from the musculoskeletal system of the face. There is a standard classification of the human face using indices into mesoprosopic, europrosopic and hyperleptoprosopic, this is useful in forensic sciences, determination of variability in human population and developmental biology.^{8,9} The aim of this

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research was to determine the age-sex relationship, cephalofacial parameters of Ebonyi population, and to form an anthropometric database containing a baseline value of face and head for forensic, anthropological and clinical sciences.

MATERIALS AND METHODS

Study Location

Ebonyi is a state in Eastern Nigeria, and primarily populated by the Igbo.

Method of Data Collection

This was a descriptive study and as reported from previous works.^{6,9} The research was conducted on 15th June 2016 to 7th November 2017 at the Department of Anatomy, Faculty of Basic Medical Sciences, Federal University Ndufu Alike Ikwo in Ebonyi State. The Ethical and Research Committee approved the study. The students (150 female and 150) between 15 and 18 years of age in Afikpo, Ikwo and Abakaliki Local Government Areas were used in the study as shown in figures (1-3). Informed consent forms were given, filled and returned before the measurement was taken.

Anthropometric Measurement

Body Height: The measurement was done by stadiometer. The subject mounted the measuring board, standing upright in the middle of the board with subject's heels and knees pressed firmly against the board by the assistant while head, shoulders, buttocks, knees and heels touched the board. All reads and measurement were made to the nearest 0.1 cm.^{6,7,9}

Weight: The electronic scale was placed on a flat, level surface, checked and readjusted the weight reading to zero and all measurements are done with a minimal/light dress. The subject stood on the middle of the scale's surface. When the subject was settled, the weight reading is stable and record the weight to the nearest 100 g. The reading and announcement of the value from the scale made. The assistant repeated the value for verification and recorded it immediately.

Cephalic length: Measured as the straight distance from the glabella to the opisthocranium. Glabella is the most prominent point between the two supraorbital ridges above the frontonasal suture in the mid-sagittal plane. Opisthocranium is the most posterior point from the glabella in the mid-sagittal plane, excluding the inion. The instrument used was spreading caliper as reported in previous studies.⁶

Cephalic breadth: Is measured as a straight distance between the two euryon points. Euryon is the most lateral point on the skull. The instrument used for measurement was spreading caliper.

Prosopic length (Upper Facial Height): Measured as the straight distance from the nasion to prosthion as shown in figure 1. Nasion is the meeting point of the frontonasal and inter-nasal sutures. If this junction is not in the mid-sagittal plane, then the mid-sagittal plane of the frontonasal suture is taken as the nasion. Prosthion is the lowest point of the intermaxillary suture on the alveolar border between the two middle incisors.

Figure 1. Picture showing the measurement of upper facial length.

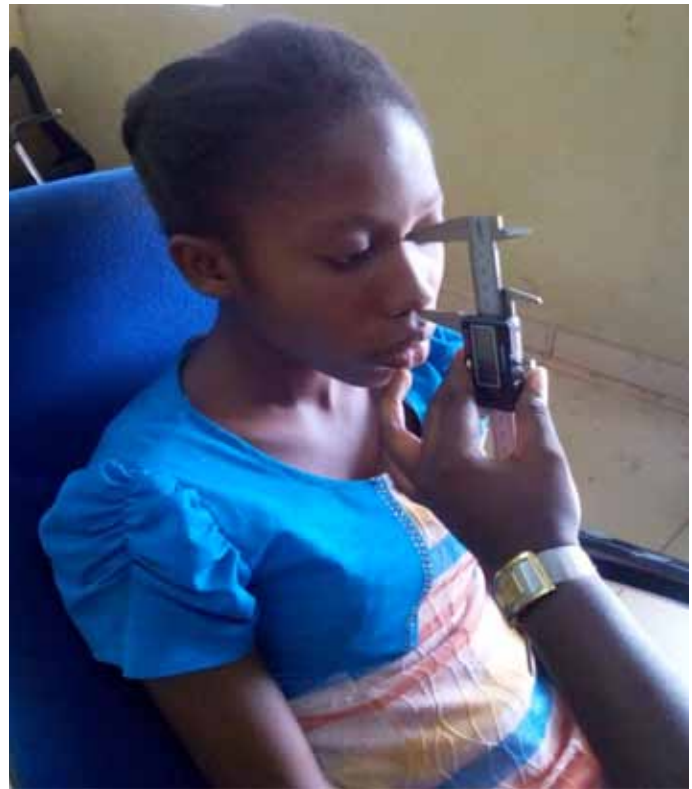


Figure 2. Picture showing the measurement of lower facial length.



Prosopic breadth (Lower Facial Height): Measured from the prosthion as the lowest point of the intermaxillary suture on the alveolar border between the two middle incisors bone to the submental ridge in the mandibular region as shown in Figure 2.

Cephalic Index (CI) is the ratio of the maximum breadth to the maximum length of the skull, multiplied by 100. A cranial index of less than 80 was dolichocephalic while over 80 was brachycephalic (wide head).

Prosopic (facial) Index is calculated as a ratio between Proscopic height and Proscopic width multiplied by 100.

All measurements were in millimeters and instruments used were vernier caliper, Body measuring tape and stadiometer.

Statistical analysis

The IBM Statistical Package for Social Sciences (SPSS) software (SPSS 16.0 version, Inc., Chicago, IL, USA) was used to form descriptive statistical methods using the arithmetic mean, and standard mean error. Data are presented as mean and standard deviation for numerical variables while independent t-test was used to compare facial and cranial parameters between males and females. It was considered statistically significant for $p < 0.005$.

RESULTS

The means of all the measurements for height, weight and cephalic circumference in table 1 and 2 were higher in males than females. Statistical significance and sexual variations were observed in all the measurements ($p < 0.05$). Also, in the present study, the means of the upper facial measurements were generally higher, and there was statistically significant differences and sexually dimorphic ($p < 0.05$) in males than females.

In table 1, the mean heights of subjects were 170.92 ± 6.74 cm and 156.70 ± 4.20 cm for both male and female age 15 years respectively. Important indices with their respective formulae and classification were calculated in table 2 Between 80 and 84 the cranial index is classified brachycephalic. Here, it is the wide type of head form. Also, mesocephalic type of head form (less than 80) is associated with a long face. For facial forms, several indices have been calculated. In table 3, prosopic index were higher in males than females and significant ($p < 0.001$). The shape of the face was mesoprosopic, meaning they were considered rounded.

DISCUSSION

The present study provided evidence that age and sex are related to cephalofacial parameters. Ethnicity is difficult to define on the basis of somatic cephalofacial region. This work aimed to find a selected anthropometric measurement of Ikwo indigenes of Ebonyi State in the South East. Cephalofacial traits are affected by many factors including genetics, nutrition and temperature.⁹⁻¹¹

Also, the argument on a face and head variables of the Nigerian subjects is being there for long.¹² From our research, sexual dimorphic appeared for the Ikwo subjects and significant ($p < 0.05$). Many previous studies have documented dimorphism in weight as a measure of evolutionary quantitative genetic studies.^{13,14}

Table 1. The descriptive analysis of age, height and weight of Igbo males and females in South-Eastern Nigeria.

Age of subjects	Gender	Height	Weight	P value
15	Male and female	170.92±6.74, 156.70 cm	67.7± 14.3, 62.2± 3.7 kg	0.001
16	Male and female	171.82±6.84, 155.60±3.42	61.87±11.3, 56.78±2.4 kg	0.001
17	Male and female	168.12±4.20, 157.66±3.68	64.3± 12.4, 62.3± 11.2 kg	0.001
18	Male and female	170.91±6.72, 155.71±4.22 cm	64.2± 12.5, 57.6 ± 3.4 kg	0.001

Table 2. The descriptive analysis of cephalic circumference (mm), cephalic index of both males and females in South-Eastern Nigeria

Age (years)	Gender	Cephalic circumference	Cephalic index	P value
15	Male and female	57.1±2.1, 53.8±1.2	78.71 and 77.72	0.005
16	Male and female	57.2± 2.4, 56.5± 2.3	77.73 and 77.74	0.001
17	Male and female	58.3± 1.4, 54.2± 1.3	79.64 and 79.62	0.001
18	Male and female	58.3± 1.4, 57.4± 1.4	78.92 and 78.87	0.001

Table 3. The prosopic length, breadth and index of male and female Igbos in South-East Nigeria

Sex and age	Prosopic length (UFH)	Prosopic breadth (UFB)	Prosopic index (PI)	P value
Male and female (15)	114± 8.03, 108± 0.91	129±7.40, 124±3.10	88.01, 87.02	0.001
Male and female (16)	114± 4.15, 101± 0.90	134±5.70, 124±2.60	87.60, 85.16	0.001
Male and female (17)	119± 7.01, 109± 0.80	132±3.16, 125±1.8	89.01, 84.41	0.001
Male and female (18)	113± 8.02, 108± 0.90	132±5.71, 122±2.62	87.61, 85.17	0.001

UFH: Upper facial height, LFH: Lower facial height and PI: Prosopic indices

The sexual dimorphism is due to the fact that mating and habitat appeared a certain degree of phylogenetic correlation. Importantly, this study can be used to determine sex differences in physiologic understanding among male and female, especially in disease susceptibility.⁸⁻¹⁰ It is believed that sex chromosomes played a role in sex-age differences in the human population.¹⁴ One of the studies which agreed with our results is the role of the androgen receptors on gene polymorphism.¹⁰ Relationship between cephalofacial variables and sex in table 2 coincided with the previous study.¹⁴ The reason being the prenatal exposure on musculoskeletal systems. Also, a comparative study using Nigerian but prenatal ultrasound exposure corroborated this work on Ikwo people. Again, cephalic indices appeared to be higher in males than females. As reported, it might be that the genetic factors, which exert a substantial influence on the individual difference in body shape and configuration.^{15,16} In table 3, the mean prosopic lengths (upper facial height) were higher than the mean prosopic

lengths (upper facial height) were higher than the mean prosopic breadth (lower facial length) in all age and sex. This agreed with a study carried out on Nigerian adults.¹⁷ The opponent was observed in a survey conducted among Garhwali population of Uttarakhand.⁷ This study believed strongly that the difference could be the shape and length of nose, tribe and environmental conditions. Also, previous report on sexual dimorphism with males having higher mean values as in Binis, Edo State.¹² Facial height depends on sex hormones and sexually dimorphic. These hormonal factors are believed to be regulating the physical features of males and females.¹⁸ In males, the bony size is smaller as direct evidence on the testosterone level of influence on the facial bones.^{10,11} The shape of the face and head among normal male subjects in other populations corroborated this study.^{18,19} In a study conducted of Middle-Belt students Nigeria, there were mesocephalic and hyperprosopic forms.^{17,20} The uniform prosopic and facial forms among Igbo tribe in this study agreed with subjects in Ibibios in their anthropometric study of cephalic length and indices.¹³ The clinical investigations of the human anterior cranial fossa during prenatal period implicated anthropometric relationship between size, age and body forms.¹¹ This study never reported overweight among subjects. However, previous research has shown obesity and craniofacial variables of with obstructive apnea.^{9,10} Again, the correlation between skull size and brain volume occurred with age, weight and height of

individuals.²¹ Also, growth, development of the musculoskeletal system are influenced hormones, which affect the human body shapes.^{22,23} The results showed moderate mesoprosopic and mesocephalic of both Igbo males and females that can be used to investigate diseases, crime and embryological development.

CONCLUSION

There was a strong and positive correlation between cephalofacial parameters in the human population with age and sex. Both cephalic and facial forms were sexually dimorphic, with moderate mesoprosopic and mesocephalic forms among Igbo subjects in the Eastern region, Nigeria. Hence, future research would target bio-markers for anthropometric forms in head and face of subjects for this region in the country.

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CONFLICT OF INTEREST

The author declare no conflict of interest.

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