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MEASUREMENTS OF HEAD CIRCUMFERENCE, INTERCANTHAL DISTANCES, CANTHAL INDEX AND CIRCUMFERENCE INTERORBITAL INDEX OF CHILDREN AND ADOLESCENTS IN BAYELSA STATE IN NIGERIA.

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ABSTRACT

The study was carried out to determine standard values for head circumference, inner canthal distance, outer canthal distance, canthal index and circumference interorbital index of children and adolescents in the four ethnic groups of Bayelsa state, between the ages of 3-18 years. Measurements was done using a digital venier calliper, non – stretchable measuring tape and a ruler. Subjects were obtained from a randomly selected sample size of eight hundred and one (801) children, four hundred (400) males and four hundred and one (401) females. Mean value and standard deviation of Inner canthal distance (ICD) for males is 2.80±0.24cm while that for females is 2.75±0.32cm. Outer canthal distance (OCD) for males is 9.26±0.73cm while that for females is 9.15±0.68cm. Canthal index (CI) for males is 30.32±1.33cm while that for females is 30.01±1.07cm. Head circumference (HC) for males is 53.24±1.95cm while that for females is 52.42±1.98cm. Circumference interorbital index (CI-I) for males is 5.25±0.33cm while that for females is 5.25±0.53cm at $P < 0.05$. Statistical analysis using T-test showed that males had significantly higher values than the females in measured parameters ($p<0.05$) indicating that sexual dimorphism exist. There is also statistical significant difference in inner canthal distance, canthal index and circumference interorbital index among the various ethnic groups. The knowledge of these values are important because normal values of craniofacial dimensions are useful parameters in the evaluation and treatment of congenital or post

traumatic deformities of the cephalic and facial regions such as telecanthus, occular hypotailorism and craniosynostosis.

KEYWORDS: Head circumference, inner canthal distance, canthal index, circumference interorbital index and Bayelsa state.

INTRODUCTION

The face can be described as the part of the head, anteriorly placed which runs through the hairline between the ears and chin. It includes the forehead, eyes, nose, mouth and chin.[1] Sociologically and physiognomically, the human face tells each other about our countenance (how we feel or what we think) and establish look; however, anatomically the face can be used to identify people.[2] Functions of the face includes expression and physical looks; which is subject to basic arrangement of the soft-tissues correspond to the under-lying bones morphology. The differences established by individual faces is primarily the results of the existence of anatomical variation in the shape and relative prominence of the features of the underlying cranium.[3]

The use of facial muscles to make alterations in the features that constitute facial expression, may in one way or other determine our perceptions.[4] A face considered to be beautiful could be appealing to the eyes; nevertheless the description of a beautiful face is influenced by several factors such as inheritance, age, ethnic background personality, culture and lifestyle.[5,6]

Dimensional proportion for the human head can be of help to place facial structures and their orientation which eventually can be used as a classification for the individual's face. In evaluating facial dimensions, and classification, the sex of an individual in any given race, influences skeletal dimensions and muscle formation, thus varying the facial proportions which is also age dependent[7,8] however, some disease conditions could influence soft and hard tissue organisation. Billions of people exist all over the world and in other to categorise the face even within a race, craniofacial dimensions have been proven to be useful in understanding and appreciating the extent of distribution differences of human morphologies.[9,10] The head circumference which is also known as the frontaloccipital circumference (FOC) can be used to ascertain the growth rate of children and as a pointer of normal brain development.[11,12]

Determination of facial parameters is of great importance to evaluate facial trauma, congenital and traumatic deformities.[13,14,15,16,17] Among Ikwerre children and adolescents the mean values for male subjects were 52.42±2.22cm for head circumference, 3. 39±0.30cm for inner canthal distance, 9.118±0.65cm for outer canthal distance, 37.00±2.48c m for canthal index and 6.84±0.47cm for circumference interorbital index. The mean values for female subjects were found to be 51.95±2.18cm for head circumference, 3.38±0.33cm for inner canthal distance, 9.31±0.75cm for outer canthal distance, 36.46±3.11cm for canthal index and 6.51±0.54cm for circumference interorbital index. Males had significantly higher values than the females in all the parameters measured ($p<0.05$), except inner canthal distance were there was no significant difference ($p>0.05$) showing some form sexual dimorphism.[18]

It was reported that normal values of inner intercanthal, outer intercanthal, head circumference and interpupillary distance of 3-21 years old Nigerians is 28.30±4.16mm, 92.49±6.30mm, 54.46±2.19cm, 57.64±4.49mm and 60.47±4.48mm for males, while for the females, the values were 28.15±2.75mm, 91.96±5.81mm, 54.27±2.00cm, 56.86±4.92mm and 59.77±4.95mm respectively.[19] Among the Kalabari's it was reported that mean inner canthal distance is 1.85±0.30cm and 2.07±0.29cm (males vs. females, p= 0.000); mean outer canthal distance is 10.39±0.56cm and 10.40±0.98cm (males vs. female, p= 0.899).[20]

In Chinese population at the age 7 it was observed that ICD is 33.3mm in male and 34 mm in female[21], in African population the value of ICD was reported as 30.60 ± 0.26 mm in male and 30.50 ± 2.20 mm in female[22] and in Turkish population ICD was reported to be 28.33 ± 2.01 mm in male and 28.14 ± 1.93 mm in female.[23] In a study carried out on Indian population OCD was reported to be 8.44 cm and 8.17 cm for male and female.[24] In Meret regiona study was carried out and they reported OCD to be 11.11 cm. in male and 11.12 cm. in females of 13- 14 years of age.[25]

MATERIALS AND METHODS

A total number of 801 subjects (400 males and 401 females) within the age range of 3-18 years with normal craniofacial configuration and no history of neurological disease and developmental disability were selected in Bayelsa state. Head circumference was obtained by placing a measuring tape on the occipital prominence and the supraorbital ridges. The inner canthal distance was measured with the meter rule held tightly against the bridge of the subject's nose; it is measured as distance between the medial palpebral fissures of the two

eyes, while the outer canthal distance is measurement as distance between the lateral palpebral fissures of the two eyes. The canthal index was calculated mathematically by (100×inner canthal distance/outer canthal distance in centimeters).[26] The circumference interorbital index (CI-I) is calculated mathematically by (100×inner canthal distance in centimeters/head circumference in centimeters). The data was subjected to statistical analysis using t - test at significant level of 0.05. Ethical clearance was obtained from the University of Port Harcourt Ethical Committee.

Conflict of Interest: None.

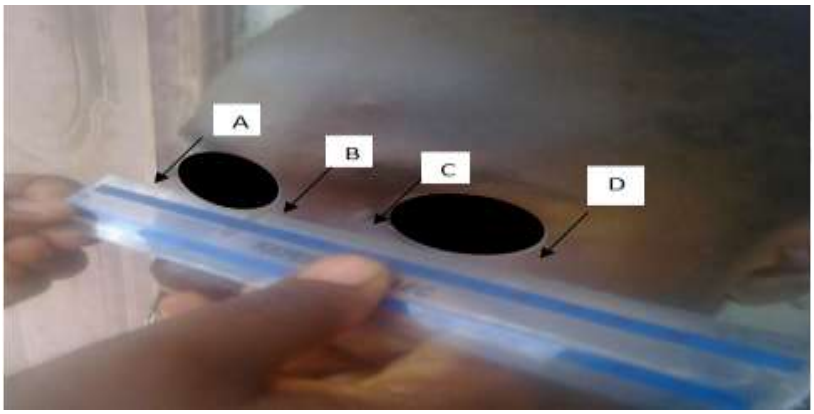

Figure 1: Measurement of outer canthal distance (A - D) and inner canthal distance (B - C).

Figure 2: Measurement of head circumference.

RESULTS

The results are presented in Tables 1–7. Table 1 presents descriptive statistics of the accessed variable according to age groups. Table 2 represents descriptive statistics of the accessed variables according to sex. Table 3 represents descriptive statistics of the accessed variables

according to ethnic groups. Table 4 shows comparism of craniofacial parameters of children and adolescents from different ethnic groups (Epie, Nembe, Ogbia and Ijaw). $P < 0.05$. Table 5 shows multiple comparison of craniofacial parameters of children and adolescents from different ethnic groups (Epie, Nembe, Ogbia and Ijaw). Table 6 represents Comparism of craniofacial parameters of children and adolescents according to sex. Table 7 shows Comparism of craniofacial parameters of children and adolescents according to age groups.

Table 1: Descriptive statistics of the accessed variables according to age groups

Variables	Age	N	Mean	SD
ICD (cm)	3 - 8	299	2.56	0.16
	9 - 12	155	2.75	0.12
	13 - 18	347	2.97	0.28
OCD (cm)	3 - 8	299	8.53	0.47
	9 - 12	155	9.12	0.36
	13 - 18.	347	9.82	0.36
CI (%)	3 - 8	299	30.08	1.27
	9 - 12	155	30.26	1.18
	13 -18	347	30.19	1.18
HC (cm)	3 - 8	299	51.08	1.59
	9 -12	155	52.79	1.09
	13 -18	347	54.35	1.27
CII (%)	3 - 8	299	5.01	0.28
	9 - 12	155	5.21	0.23
	13 -18	347	5.47	0.50

ICD=Inner canthal distance; OCD=Outer canthal distance; CI=Canthal index; HC=Head circumference; CII=Circumference interorbital index; N=sample size; S.D=Standard deviation; 3-8 = early childhood; 9-11 = middle childhood; 12-18 = adolescents.

Table 2: Descriptive statistics of the accessed variables according to sex

Variable	Sex	N	Mean	SD
ICD (cm)	Male	400	2.80	0.24
	Female	401	2.75	0.32
OCD (cm)	Male	400	9.26	0.73
	Female	401	9.15	0.68
CI (%)	Male	400	30.32	1.33
	Female	401	30.01	1.07
HC (cm)	Male	400	53.24	1.95
	Female	401	52.42	1.98
CII (%)	Male	400	5.29	0.33
	Female	401	5.25	0.53

ICD=Inner canthal distance; OCD=Outer canthal distance; CI=Canthal index; HC=Head circumference; CII=Circumference interorbital index; N=sample size; S.D=Standard deviation.

Table 3: Descriptive statistics of the accessed variables according to ethnic groups

Variables	Ethnic groups	N	Mean	SD
ICD (cm)	EPIE	132	2.73	0.25
	OGBIA	90	2.80	0.20
	NEMBE	156	2.82	0.42
	IJAW	423	2.77	0.24
OCD (cm)	EPIE	132	9.10	0.79
	OGBIA	90	9.30	0.66
	NEMBE	156	9.18	0.68
	IJAW	423	9.22	0.70
CI (%)	EPIE	132	29.98	1.02
	OGBIA	90	30.26	1.51
	NEMBE	156	30.48	1.21
	IJAW	423	30.09	1.18
HC (cm)	EPIE	132	52.79	1.97
	OGBIA	90	52.50	2.29
	NEMBE	156	52.82	2.07
	IJAW	423	52.92	1.92
CII (%)	EPIE	132	5.17	0.34
	OGBIA	90	5.33	0.27
	NEMBE	156	5.34	0.72
	IJAW	423	5.23	0.34

Table 4: Comparing the craniofacial parameters of children and adolescents from different ethnic groups (Epie, Nembe, Ogbia and Ijaw). P < 0.05

Variables	Sum of Squares	df	Mean Square	F-value	P-value
ICD (cm)	0.68	3	0.23	2.81	**0.04***
OCD (cm)	2.50	3	0.84	1.64	0.172
CI (%)	23.68	3	7.89	5.43	**<0.01***
HC(cm)	13.07	3	4.36	1.08	0.35
CII (%)	2.97	3	0.99	5.22	**<0.01***

Table: 5 Multiple comparison of craniofacial parameters of children and adolescents from different ethnic groups (Epie, Nembe, Ogbia and Ijaw).

Dependent Variable	Ethnic groups (I)	Ethnic groups (J)	M.D (I-J)	S.E of M.D	P-value
	OGBIA	NEMBE	-0.09	0.03	**0.01***
		IJAW	-0.04	0.03	0.18
		NEMBE	-0.02	0.04	0.55
		IJAW	0.03	0.03	0.35
	NEMBE	IJAW	0.05	0.03	**0.04***
CI (%)	EPIE	OGBIA	-0.28	0.16	0.09
		NEMBE	-0.5	0.14	**<0.01***
		IJAW	-0.11	0.12	0.37
	OGBIA	NEMBE	-0.22	0.16	0.17
		IJAW	0.17	0.14	0.22
	NEMBE	IJAW	0.4	0.11	**<0.01***
CII (%)	EPIE	OGBIA	0.16	0.06	**0.01***
		NEMBE	-0.17	0.05	**<0.01***
		IJAW	-0.06	0.04	0.16
	OGBIA	NEMBE	-0.01	0.06	0.88
		IJAW	0.1	0.05	**0.04***
	NEMBE	IJAW	0.11	0.04	**0.01***

Table 6: Comparing the craniofacial parameters of children and adolescents according to sex

Variables	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F-value	P-value(f)	t-value	M.D	S.E of M.D	P-value(t)
ICD	0.6	0.44	2.28	0.05	0.02	**0.02***
OCD	0.52	0.47	-0.34	-0.06	0.18	0.73
CI	11.51	<0.01	3.63	0.31	0.09	**<0.01***
HC	0.11	0.75	5.85	0.81	0.14	**<0.01***
CII	0.74	0.39	0.17	0.01	0.03	0.87

ICD=Inner canthal distance; OCD=Outer canthal distance; CI=Canthal index; HC=Head circumference; CII=Circumference interorbital index; M.D=Mean difference; S.E=Standard Error; F-value= Fischer's value; P-value= probability value; Bolded and red astetrisk = Statistically significant.

Table 7: Comparing the craniofacial parameters of children and adolescents according to age groups

Variables	Sum of Squares	df	Mean Square	F-value	P-value
ICD (cm)	27.38	2	13.69	294.92	**<0.01***
OCD (cm)	268.50	2	134.23	807.17	**<0.01***
CI (%)	3.98	2	1.99	1.35	0.26
HC (cm)	1713.58	2	856.79	455.43	**<0.01***
CII (%)	33.73	2	16.87	111.86	**<0.01***

DISCUSSION

The present study investigated head circumference, intercanthal distances, canthal index and circumference interorbital index of children and adolescents in Bayelsa state. Anthropometric research has found significant use in clinical and forensic research, as findings have been used as guide in the treatment of craniofacial injuries, congenital and posttraumatic deformities (traumatic tele-canthus).With the knowledge and understanding of normal craniofacial values, better aesthetic reconstruction are possible.[27]

Age differences in craniofacial dimensions

There is significant difference in craniofacial parameter of different age groups, there was an increase with increasing age group, this differences could be as a result of primary spurt of the growth during childhood, there is rapid growth rate of the craniofacial region during childhood and adolescent age but the growth rate is reduced from early to mid-twenties, this is also in agreement with the studies carried out by various researchers who reported similar result where there was an increase in craniofacial parameter with increasing age.[13,20,28,29]

When comparing the results gotten from the present study to report obtained from facial dimension of adult Ijaws, it is apparent that the mean values of facial parameters of adult males and females are higher than those for the craniofacial features of Ijaw children. That is because craniofacial dimensions can be affected by age even within the same ethnic group, increase in age will lead to increase in craniofacial dimensions.[13]

Sexual dimorphism in craniofacial dimensions

Measured craniofacial parameter were significantly higher in males than in females for all age group in the various ethnic groups, this is an indication that sexual dimorphism exist among male and female subject of Bayelsa state, this is in agreement with the studies carried out by researchers who also reported sexual dimorphism among subjects.[3,12,19,28,29]

The distinguishing features in craniofacial dimensions among male and female sexes that have been reported by the present study and by other researchers could be as a result of inheritance pattern which is clear to see as sexual dimorphism.[12,19] Another influence on the distinguishing feature can be as a result of the male sex hormone, testosterone. Testosterone causes an increase in the dimension and mass of muscles and bone, which leads to males having higher values in craniofacial dimension and therefore can also lead to the variation in the shape of the face between male and female.[19]

Comparison of craniofacial dimension among ethnics groups

When comparing the craniofacial parameter of subjects from different ethnic groups, it was observed that statistically significant difference occurred in ICD, CI and CII at $P<0.05$. The ICD and CI was higher among the Nembe ethnic group and least among the Epie ethnic group, the differences in ICD and CI exist between Epie and Nembe ethnic group and between Nembe and Ijaw ethnic group, this is an indication that ICD and CI can be used to differentiate between Nembe, Ijaw and Epie ethnic group but it cannot be used to differentiate between Nembe and Ogbia ethnic group because the differences between them is not statistically significant.

The CII was higher among the Nembe ethnic group and least among the Epie ethnic group, the differences in CII exist between Epie and Nembe, Nembe and Ijaw and Ogbia and Ijaw ethnic group, this is an indication that CII can be used to differentiate between Nembe, Ijaw, Ogbia and Epie ethnic group because the differences between them is statistically significant, this report is in agreement with reports given by other researches that differences exist in

craniofacial parameters of different ethnic groups and that a particular standard cannot be used for diagnosis and treatment plan for people of different ethnicity.[16,27,30]

Forensic implication

The differences observed in some of the measured parameter can be used by a forensic anthropologist to identify a child or an adolescents from a particular ethnic group in Bayelsa state, since there is statistical significant difference in ICD, CI and CI-I. In a case of mass death of children or adolescents where their ethnicity is unknown and the identity of their ethnicity is of importance, these differences can be used to identify children and adolescents from Ijaw, Ogbia, Nembe and Epie ethnic groups in Bayelsa state.

Clinical significance

The differences observed can also be used by clinicians when performing craniofacial surgery in the treatment of craniofacial anomalies (telecanthus, hypertelorism, hypotelorism) among children and adolescents in Bayelsa State because a single normative data in ICD, CI and CI-I cannot be used for the four ethnic groups this is due to the statistical significant difference observed from this study.

In conclusion, this study established the mean facial dimensions of Bayelsa state children and adolescents, and the result showed that facial parameters are sexually dimorphic. The parameters measured, which varied with age, could be influenced by nutrition, growth patterns, climate, and genetic factors. Data concerning facial dimensions of children and adolescent of Bayelsa state could be of importance in age, sex and racial differentiation, in clinical practice and forensic medicine.

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