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## A Study of Anthropometric Comparison of the Cephalic Indices of Igbo and Ibibio Students of Madonna University Elele Campus, Rivers State.

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## ABSTRACT

The human head shape is classified by means of the cephalic index. Cephalic index is used to measure the size of the head which is done by determining the ratio of the maximum head breadth to the maximum head length. The present study evaluates the anthropometric comparison of the cephalic indices of Igbo and Ibibio students of Madonna University Elele campus, Rivers State. 400 subjects were involved in this study and measurements were taken with subject sitting on a chair, in a relaxed mood and the head in the anatomical position. Cephalic index was calculated as bi-parietal diameter/length of head x 100. The data was subjected to statistical analysis using Student t-test, Anova (Analysis of Variance) and Bar charts. From this study, the result obtained showed that the Ibibio males had a mean cephalic index (CI) of 88.08, Ibibio females 86.35, Igbo males 84.27 and Igbo females 86.10. It is worthy to note that there is sexual dimorphism where Cephalic index is higher in males than females for the Ibibio and Igbo tribes (p <0.005). On the Average, the mean C.I. in the two tribes were >80 which puts them in the brachycephalic or short headed population. The result of this study showed that Cephalic Index can serve as one of the most reliable body parameter for the determination of sexual dimorphism and Ethnic differences.

Keywords: brachycephalic, cephalic index, tribes, anthropometry

## **INTRODUCTION**

Anthropometry is a series of systematized measuring techniques that express qualitatively the dimensions of the human body and the skeleton. The shape of the head is useful in forensic medicine, paediatrics, in genetic counselling, reconstructive surgeries and diagnostic understanding between patient and normal populations. Anthropometric characteristics have direct relationship with sex, shape and form of an individual and these factors are intimately linked with each other and are manifestations of the internal structure and tissue components which in turn, are influenced by environmental and genetic factors<sup>6</sup>

<sup>8</sup>Oladipo & Paul studied the anthropometric comparison of cephalic indices between the Urhobo and Itsekiri ethnic groups of Nigeria. The head (length and breadth) of the subjects were measured; where head breath was divided by head length and multiplying by 100. The cephalic index showed brachycephalic population. The study was stated to be of importance in forensic medicine, anthropology and in genetics.

<sup>3</sup>Introna *et al.* in his work correlated cephalofacial diameters and height successfully he was able to propose a mathematical formula for determining the

stature in an Italian population. He then concluded that the higher the proportion of the cephalofacial diameter the greater the height of the individual.

<sup>5</sup>Kewal also attempted to estimate stature from the various anthropometric measurements of cephalofacial region of individuals belonging to an endogamous group in north India, 996 adult male Gujjars of north India 18-30 years of age were used in the study. The results indicate that all the cephalo-facial measurements are strongly and positively correlated (p>0.001) with stature.

<sup>10</sup>Pelin and Duyar, his work studied the correlation between nine different anthropometric measurements which includes facial length, head circumference, facial width, body mass index, length of both arms, length of humerus, foot arch and femur length and measured standing height in 286 healthy, living, male Turkish subjects.

<sup>9</sup>Oladipo et al. studied the cephalic indices of the

Ogonis in Nigeria. The subjects (25-26 years) were measured for head length and head breath and cephalic index was worked out by dividing the head breath by head length and multiplying by 100. They also observed that cephalic index is an important parameter for classifying populations.

<sup>4</sup>Jervas et al. studied the cephalic index of the Igbos schooling at the Federal University of Technology Owerri in order to establish their head patterns. A total of 202 subjects participated in the study where it was observed that the most prominent cephalic index was Dolicocephalic, which was observed to be common in males while mesocephalic and brachycephalic were common in females. The documented head pattern or shape would be useful to Forensic Anthropologist and craniofacial surgeons.

<sup>7</sup>Mehesh carried out research on modeling the height on the basis of cranial dimensions. The study was carried on 800 Haryanvi adults (400 males and 400 females). Prior informed written consent was obtained from subjects. The measurements were taken by using standard anthropometric instruments. The sole aim was to access the head length, head breath, horizontal circumference of head, facial length, bigonial diameter, stature and to find out the correlation of the parameters with stature. The result obtained shows a positive correlation between the stature and all the cephalofacial region measurements except for maximum head breadth which shows an insignificant correlation with stature in both males and females.

## **MATERIALS AND METHODS**

The Study population included males and females within the age range of 18 years to 25 years of the selected ethnic groups living within the selected areas. A clearance was gotten from the institutional ethics committee as well as the consent of the study subjects before taking the readings.

Individuals who met the criteria and gave their consent were chosen.

All measurements were taken with subject sitting on a chair, in a relaxed mood and the head in the anatomical position. Cephalic index was calculated as bi-parietal diameter/length of head x 100. The data was subjected to statistical analysis using Student t-test, Anova( Analysis of Variance) and Bar charts.



Figure 1: Image of how one of the subjects was measured

The sample size was determined using Fisher's formula for populations infinite or large population > 10,000 (Cochran, 1963)

$$SS = \underline{Z^2 x n x q} a^2$$

**Inclusion Criteria:** Informed consents were sort and obtained from the participants before measurements were taken.

- 1. Age range of 18-25 years was considered.
- 2. All subjects have normal head shape and skull. They were observed not to have any form of symptomatic deformity of the face.
- 3. Both parents and grandparents must be indigenes of the two Ethnic groups under study (Genealogy).
- 4. The participants were born and bred in their respective communities of study.

# **Exclusion Criteria**

- 1. Deformed subjects were excluded.
- 2. Subjects that have done surgery like facial or limbs were excluded.
- 3. Subjects of mixed traits like a white man and black woman (American and Nigerian) origins were excluded.

# RESULTS

# Limitations of the Study

- 1. The Covid-19 Pandemic was also a limiting factor.
- 2. Timeline: This was the most limiting factor due to the demands of course works and examination.
- 3. Some subjects refused to be measured due to their religious beliefs.



Figure 2: Distribution of the Subjects by Ethnicity





Parameters	Sex	Ν	Mean	SD	Min	Max
	Male	100	20.01	2.27	16.00	24.00
Age (years)	Female	100	20.02	2.22	16.00	24.00
	Total	200	20.02	2.24	16.00	24.00
	Male	100	19.29	1.14	16.90	21.10
MHL (mm)	Female	100	18.80	0.67	16.50	20.10
	Total	200	19.04	0.96	16.50	21.10
	Male	100	16.97	1.25	13.90	19.20
MHB (mm)	Female	100	16.22	0.90	13.50	18.50
	Total	200	16.59	1.15	13.50	19.20
	Male	100	88.08	5.76	73.27	104.02
CI	Female	100	86.35	4.87	71.81	96.34
	Total	200	87.21	5.39	71.81	104.02

 Table 1: Descriptive statistics of the measured parameters in Ibibio subjects

MHL = Maximum Head Length, MHB = Maximum Head Breadth, CI = Cephalic Index, SD = Standard Deviation, Min = Maximum, Max = Maximum, N = Number of Subjects

Parameters	Sex	Ν	Mean	SD	Min	Max
	Male	100	20.06	2.26	16.00	24.00
Age (years)	Female	100	20.53	1.82	16.00	25.00
	Total	200	20.30	2.06	16.00	25.00
MHL (mm)	Male	100	19.32	0.88	17.50	21.50
	Female	100	18.86	0.78	17.10	21.10
	Total	200	19.09	0.86	17.10	21.50
	Male	100	16.26	0.97	14.00	19.30
MHB (mm)	Female	100	16.23	1.02	13.10	19.30
	Total	200	16.24	0.99	13.10	19.30
	Male	100	86.10	5.52	72.00	95.14
CI	Female	100	84.27	5.00	72.04	98.31
	Total	200	85.19	5.33	72.00	98.31

Table 2: Descriptive statistics of the measured parameters in Igbo subjects

MHL = Maximum Head Length, MHB = Maximum Head Breadth, CI = Cephalic Index, SD = Standard Deviation, Min = Maximum, Max = Maximum, N = Number of Subjects

Table 3: Independent sample t-test comparing the measured parameters in Ibibio subjects

Parameters	MD	SE	95% C.I Diff Lower	of the Upper	df	t- value	p- value	Inference
Age (years)	-0.01	0.32	-0.64	0.62	198.00	-0.03	0.97	Not significant
MHL (mm)	0.49	0.13	0.23	0.75	160.01	3.69	0.00	Significant
MHB (mm)	0.75	0.15	0.44	1.05	180.14	4.85	0.00	Significant
CI	1.73	0.75	0.24	3.22	198.00	2.29	0.02	Significant

MHL = Maximum Head Length, MHB = Maximum Head Breadth, CI = Cephalic Index, MD = Mean Difference, SE = Standard Error of Mean Difference, df = Degree of Freedom, C.I = Confidence Interval, Diff = Difference

Parameters	MD	<b>SE</b>	95% C.I o	95% C.I of the Diff		df t-		Informa
	MD	SE	Lower	Upper	ai	value	value	Interence
Age (years)	-0.47	0.29	-1.04	0.10	-1.62	189.65	0.11	Not significant
MHL (mm)	0.46	0.12	0.23	0.69	3.94	198.00	0.00	Significant
MHB (mm)	0.03	0.14	-0.24	0.31	0.23	198.00	0.82	Not significant
CI	-1.83	0.74	-3.30	-0.36	-2.46	198.00	0.01	Significant

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Table 4:	independent	sample t-test	comparing t	ne measured	parameters in	igoo si	ubjects

MHL = Maximum Head Length, MHB = Maximum Head Breadth, CI = Cephalic Index, MD = Mean Difference, SE = Standard Error of Mean Difference, df = Degree of Freedom, C.I = Confidence Interval, Diff = Difference

			95% C.I	l of the				
Paramet ers	M D	S E	Diff Lo we r	Up pe r	df	t- val ue	p- val ue	Inference
Age (years)	0. 05	0. 3 2	- 0.6 8	0.5 8	0. 16	198. 00	0.88	Not significan t
MHL (mm)	0. 03	0. 1 4	0.3 2	0.2 5	0. 23	185. 88	0.82	Not significan t
MHB (mm)	0.7 1	0. 1 6	0.40	1.0 2	4.4 9	186. 35	0.00	Significant
CI	3.8 1	0. 8 0	2.23	5.3 8	4.7 7	198. 00	0.00	Significant

**Table 5:** Ethnic differences in the measured parameters in male subjects using independent sample t-test

MHL = Maximum Head Length, MHB = Maximum Head Breadth, CI = Cephalic Index, MD = Mean Difference, SE = Standard Error of Mean Difference, df = Degree of Freedom, C.I = Confidence Interval, Diff = Difference

Paramet ers	M D	SE	95% C.I Diff Low er	of the Upp er	df	t- val ue	p- val ue	Inferenc e
Age (years)	- 0.5 1	0.2 9	- 1.08	0.06	190. 91	- 1.7 8	0.0 8	Not signific ant
MHL (mm)	- 0.0 6	0.1 0	- 0.26	0.15	198. 00	- 0.5 5	0.5 8	Not signific ant
MHB (mm0	$\begin{array}{c} 0.0\\ 0 \end{array}$	0.1 4	0.27	0.26	198. 00	- 0.0 4	0.9 7	Not signific ant
CI	0.2 5	0.7 0	- 1.13	1.62	198. 00	0.3 5	0.7 2	Not signific ant

Table 6: Ethnic differences in the measured parameters in female subjects using independent sample t-test

MHL = Maximum Head Length, MHB = Maximum Head Breadth, CI = Cephalic Index, MD = Mean Difference, SE = Standard Error of Mean Difference, df = Degree of Freedom, C.I = Confidence Interval, Diff = Difference

Demonsterre		Male [N	t = 100]			Female [N = 100]			
Parameters		Age	MHL	MHB	CI	Age	MHL	MHB	CI
Age	r	1	0.066	0.196	0.159	1	0.145	0.169	0.070
	P- value		0.517	0.050	0.115		0.150	0.092	0.486
NUT	r	0.066	1	0.524**	-0.302**	0.145	1	0.292**	-0.354**
MHL	P- value	0.517		0.000	0.002	0.150		0.003	0.000
MUD	r	0.196	0.524**	1	0.653**	0.169	0.292**	1	0.791**
МНВ	P- value	0.050	0.000		0.000	0.092	.003		0.000
	r	0.159	-0.302**	0.653**	1	0.070	-0.354**	0.791**	1
CI	P- value	0.115	0.002	0.000		0.486	0.000	0.000	

Table 7: Pearson correlation between the measured parameters in male and female Ibibio subjects

\*\* = Correlation is significant at the 0.01 level (2-tailed), MHL = Maximum Head Length, MHB = Maximum Head Breadth, CI = Cephalic Index

Demonstern		Male [N	= 100]			Female []	Female [N = 100]			
Parameters		Age	MHL	MHB	CI	Age	MHL	MHB	CI	
Age	r	1	0.026	0.039	.022	1	-0.006	0.052	0.059	
	p- value		0.797	0.699	0.830		0.952	0.605	0.562	
MIJI	r	0.026	1	0.226*	-0.473**	-0.006	1	0.434**	-0.238*	
MHL	p- value	0.797		0.024	0.000	0.952		0.000	0.017	
MUD	r	0.039	0.226*	1	0.751**	0.052	0.434**	1	0.770**	
мпв	p- value	0.699	0.024		0.000	0.605	0.000		0.000	
CI	r	0.022	-0.473**	0.751**	1	0.059	-0.238*	0.770**	1	
CI	p- value	0.830	0.000	0.000		0.562	0.017	0.000		

Table 8: Pearson correlation between the measured parameters in male and female Igbo subjects

\*\* = Correlation is significant at the 0.01 level (2-tailed), \* = Correlation is significant at the 0.05 level (2-tailed), MHL=Maximum Head Length, MHB=Maximum Head Breadth, CI=Cephalic Index



Figure 4: Scatterplot of maximum head length vs maximum head breadth in Ibibio male subjects

 $MHB \,{=}\, Maximum\, Head\, Breadth, MHL \,{=}\, Maximum\, Head\, Length$ 



Figure 5: Scatter plot of maximum head length vs maximum head breadth in Ibibio female subjects

MHB = Maximum Head Breadth, MHL = Maximum Head Length



Figure 6: Scatter plot of cephalic index vs maximum head length in male and female Ibibio subjects

MHL = Maximum Head Length, CI = Cephalic Index



Figure 7: Scatter plot of cephalic index vs maximum head breadth in male and female Ibibio subjects

MHB = Maximum Head Length, CI = Cephalic Index



Figure 8: Scatter plot of maximum head length vs maximum head breadth in Igbo male subjects

MHB = Maximum Head Breadth, MHL = Maximum Head Length



Figure 9: Scatter plot of maximum head length vs maximum head breadth in Ibibio female subjects

MHB = Maximum Head Breadth, MHL = Maximum Head Length



Figure 10: Scatter plot of cephalic index vs maximum head length in male and female Igbo subjects

MHL = Maximum Head Length, CI = Cephalic Index



Figure 11: Scatter plot of cephalic index vs maximum head breadth in male and female Igbo subjects

MHB = Maximum Head Length, CI = Cephalic Index

#### DISCUSSION

From this study, it is worthy to note that there is sexual dimorphism where Cephalic index is higher in males than females for the Ibibio and Igbo tribes (p < 0.005). This however goes in agreement with previous studies<sup>2</sup>.

Table 1 show that the Cephalic index of Ibibio male (88.08) is greater than that of the Ibibio females (86.35) Table 2 shows that the cephalic index of Igbo males (86.10) is higher than that of the Igbo females (84.27). Table 3 shows that there is a significant difference in cephalic index between the Ibibio male and female. Table 4 shows that there is a significant difference in the Igbo male and female. Table 5 shows that there is a significant difference in the Igbo and Ibibio male. Table 6 shows that there is no significant difference in the cephalic index between the Igbo and Ibibio female.

Table 7 shows the correlation of the male and female Ibibio subjects, the cephalic index for male and female is 1. Table 8 shows correlation of the male and female Igbo subjects, the cephalic index for male is 0.751; correlation is significant at the 0.01 level. For the female is 1.

Figures 2, 3, 4 show the regression equations for the different ethnic groups and their sex.

#### CONCLUSION

The result of this study showed that Cephalic Index can serve as one of the most reliable body parameter for the determination of sexual dimorphism and Ethnic differences.

It is a very important parameter in the anthropological study, so should be used as a key guide in grouping subjects based on their age, sex and stature. Also, it is important in medico-logical cases where cephalic index becomes a prime factor in identification of patients.

This research work has produced a reference data for the ibibios and igbo ethnic groups. I was able to derive regression equations which can be used for both ethnic groups and it will serve as a reference value.

#### RECOMMENDATIONS

The following recommendations should be carried out;

- 1. Factors such as ethnic group and gender must be taken into consideration when using the values for the various parameters in this research work.
- 2. More studies should be carried out among the various other ethnic groups in Nigeria and other parts of the world so as to have standard national and international data on the studied anthropometric parameters.
- 3. Further studies on other ethnic groups for predictive anthropometry, forensic anthropometry and comparative anatomy should also be carried.

# **CONTRIBUTION TO KNOWLEDGE**

- 1. A regression equation for the two ethnic groups was derived, which will serve as a reference purpose.
- 2. This study was able to produce cephalic index of individuals in the two ethnic groups (Ibibio and Igbo) which will serve as a reference purpose.

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