



DETERMINATION OF STATURE FROM CEPHALIC INDICES AMONG OKUN AND EBIRA ETHNIC GROUPS OF KOGI STATE IN NIGERIA.

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ABSTRACT

Cephalic index is an important feature that characterizes different races. The study aimed at comparing the cephalic indices between the two genders and to determine the stature among Okun and Ebira ethnic groups in Nigeria. The subjects were measured for cephalic length, breadth and subject height and the cephalic indices were calculated by dividing the cephalic breadth by cephalic length, and then multiply by 100. 844 subjects of Okun and Ebira origin of Kogi state were measured, 211 males and 211 females for each tribe were measured. Fischer's formula was used to determine the sample size because the population size is > 10,000. The cephalic breadth and length was measured using a spreading caliper and the subject height was measured with a stadiometer. The data was analyzed using Pearson's Chi-square analysis test for association, trends and distribution difference of the pattern (confidence level at 95%). The mean cephalic indices of both Okun and Ebira ethnic group were >75 and >70 which belongs to mesocephalic and doliocephalic group respectively. There were significant differences in cephalic indices between both ethnic groups ($p < 0.001$). There was no significant difference in cephalic indices between males and females of each ethnic group. Stature was better predicted from cephalic indices for Ebira males ($r = 0.386$) when compared to the Ebira females ($r = 0.127$), Okun males ($r = 0.296$) and Okun females ($r = 0.268$). All predictions were significant except for Ebira females.

Keywords: mesocephalic, doliocephalic, cephalic indices, stature, sex.

INTRODUCTION

Cephalic index anthropometry is important features which characterize different races. Some ethnic groups have similarities and differences in cephalic indices. It is a widely used anthropometric parameter in determining the racial variation and unusually used to determine sex differences, especially in individuals whose identity is unknown (Shah *et al.*, 2004). Head dimension changes followed pattern in different population (Kelly *et al.*, 1999). Head growth occurs as its most rapid rate during the first year of life. The head grows to almost 80% of the adult size during the first year of life then grows at slower pace. If the head is too large or growing too quickly or on the other hand if the head is too slow or growing too slowly, these are signs of possible problems (Danborno *et al.*, 1997). The measurements of the head in anthropometric study are usually carried out

carefully by understanding some anthropometric landmarks which must be maintained in a better orientation (Iscan, 2001; Iscan, 2005). On basis of cephalic index, head shapes are grouped into four international categories, which are dolichocephal, brachycephal, mesocephal, and hyperbrachycephal (Williams, 1995). The first classification based on cranial morphology is attributed to the professor of anatomy Anders Retzius (1840). An index of less than 75 means that the skull is long and narrow when seen from the top such skull is called dolichocephalic and are typical of Australian aborigines and native Southern Africans. An index of 75 -80 means that the skull is nearly oval; such skulls are called mesocephalic and are typical of Europeans and the Chinese. A skull having an index of over 80 is broad and short and is called brachycephalic; such skulls are common among Mongolians and

the Andaman islanders (Nair, 2014). A study on cephalic indices of Igbos and Ijaw ethnic groups; the Ijaw males has a mean of 80.98 and Ijaw females 78.04, the Ijaw males are in brachycephalic group while the Ijaw females are in mesocephalic group (Oladipo *et al.*, 2006). A study on the estimation of stature from cephalic parameters in south- eastern Nigeria population was done which the findings showed that the cephalic indices are positively and significantly correlated with stature (Ewunonu and Anibeze, 2013). Cephalic index has been researched on by several authors for gender, ethnicity, race,

growth, age and clinical uses, hereby classifying the head sizes but there is less research work on the relationship between cephalic indices with respect to stature amongst Okun and Ebira ethnic groups of Kogi state in Nigeria. The research is aimed at comparing the cephalic indices between the two genders and to determine stature from the cephalic indices among the Okun and Ebira ethnic groups of Kogi state in Nigeria. The cephalic indices sexually dimorphic or not among both ethnic groups. Finally, classifying the head sizes and shape among the both ethnic groups.

MATERIALS AND METHOD

Sample sizes of eight hundred and forty-four subjects were used from the population of both ethnic groups of Kogi state in Nigeria for this study. Two hundred and eleven males and two hundred and eleven females of each ethnic group were used. Fischer's formula was used to determine the sample size because the population size is > 10,000.

$$S = \frac{z^2 \times p \times q}{d^2}$$

Subjects belonged to either Okun or Ebira ethnic group of Kogi state, Nigeria traced to grandparents within adults from 18 -65 years of age. Subjects must have been born and bred in Nigeria to avoid any environmental changes on the subjects. Subjects with obstructive hairstyles were not used. Subjects with limbs deformity or craniofacial deformity or had previous surgery was not included in the study. The research is aimed at comparing the cephalic indices between the two genders and to determine

stature among the Okun and Ebira ethnic groups of Kogi state. The subjects were made to stand and sit at various points in time at comfort to take all the measurements after adequate explanation of the procedure. The procedure was neither painful nor harmful to the volunteers. Extreme care was taken to avoid any form of discomfort to subjects. The study was conducted with the understanding and the consent of the subjects.

Anthropometric measurements: Cephalic length: the straight distance between glabella and inion.

Glabella: the point midway between the two supercilliary ridges. Inion: the external occipital protuberance. Cephalic breadth: the maximum transverse diameter between two fixed points over the parietal bones. Cephalic index is calculated as;

$$\frac{\text{Cephalic breadth}}{\text{Cephalic length}} \times 100$$



Figure 1: Measurement of the cephalic breadth using a spreading caliper.



Figure 2: Measurement of the cephalic length using a spreading caliper.



Figure 3: Measurement of the height using a stadiometer.

The stature was measured in a standing position using a stadiometer. Measurements were taken by subjects being asked to stand in an upright position. All dimensions of cephalic breadth, length was to be measured using a spreading caliper while stature measured using stadiometer. All measurements were taken by one observer to avoid error. To improve accuracy, all measurements were taken twice

and the average value recorded as the main value. All measurements were centimeters (cm).

SPSS version 21 was used to analyze the data. Descriptive statistics was used to appropriately categorize demographic frequency and distribution of patterns. Pearson’s Chi-square analysis test for association, trends and distribution difference of the pattern (confidence level at 95%).

RESULTS

The mean values of males and females in the different ethnic were presented in Table 1a. The Okun males and females had the larger head

breadth $14.45 \pm 0.73 \text{cm}$ and 14.05 ± 0.78 respectively, when compared to the Ebira males; $13.41 \pm 0.70 \text{cm}$ and female; $12.88 \pm 0.74 \text{cm}$.

Table 1a. Descriptive characteristics of cephalic dimensions and index among the tribes stratified by sex.

Variable	Tribe/Sex	N	Mean±S.D	Minimum	Maximum
CEPHALIC BREADTH (cm)	Ebira (M)	211	13.41 ± 0.70	11	15
	Ebira (F)	211	12.88 ± 0.74	11	15
	Okun (M)	211	14.45 ± 0.73	12	17
	Okun (F)	211	14.05 ± 0.78	12	16
	Total	844	13.70 ± 0.95	11	17
CEPHALIC LENGTH (cm)	Ebira (M)	211	18.91 ± 0.83	17	21
	Ebira (F)	211	18.23 ± 0.74	16	20
	Okun (M)	211	18.80 ± 0.93	16	21
	Okun (F)	211	18.23 ± 0.84	16	20
	Total	844	18.54 ± 0.89	16	21
CEPHALIC INDICES (%)	Ebira (M)	211	71.04 ± 4.45	57.89	83.33
	Ebira (F)	211	70.77 ± 4.58	60	88.2
	Okun (M)	211	77.00 ± 4.40	60	88.24
	Okun (F)	211	77.28 ± 5.16	63.16	88.24
	Total	844	74.02 ± 5.60	57.89	88.24

The Ebira males had the largest head length 18.91 ± 0.83 . The Okun males had a larger head length 18.80 ± 0.93 while compared to Okun females head length 18.23 ± 0.84 and Ebira females head length 18.23 ± 0.74 . The Okun females had larger cephalic indices 77.28 ± 5.16 and Okun males 77.00 ± 4.40 , then Ebira male

and female cephalic indices; 71.04 ± 4.45 and 70.77 ± 4.58 respectively. Table 1b. Compared the dimensions of both sexes of both tribes and found that the difference in the cephalic breadth between the different sexes of both tribes was statistically significant ($P < 0.001$).

Table 1b. Post Hoc test of multiple comparison of the cephalic dimensions and index between males and females of both tribes.

Dependent Variable	I	J	Mean Difference (I-J)	P-value
CEPHALIC BREADTH (cm)	Ebira (M)	Ebira (F)	0.531	<0.001
		Okun (M)	-1.043	<0.001
		Okun (F)	-0.645	<0.001
	Ebira (F)	Okun (M)	-1.573	<0.001
		Okun (F)	-1.175	<0.001
	Okun (M)	Okun (F)	0.398	<0.001
CEPHALIC LENGTH (cm)	Ebira (M)	Ebira (F)	0.678	<0.001
		Okun (M)	0.109	0.744
		Okun (F)	0.682	<0.001
	Ebira (F)	Okun (M)	-0.569	<0.001
		Okun (F)	0.005	1.000
	Okun (M)	Okun (F)	0.573	<0.001
CEPHALIC INDICES (%)	Ebira (M)	Ebira (F)	0.275	0.989
		Okun (M)	-5.954	<0.001
		Okun (F)	-6.237	<0.001
	Ebira (F)	Okun (M)	-6.228	<0.001
		Okun (F)	-6.512	<0.001
	Okun (M)	Okun (F)	-0.284	0.991

Ebira males had significantly larger cephalic breadth than Ebira females (MD= 0.531; P<0.001), but smaller dimensions when compared to Okun males and females (MD= 1.043; P<0.001). The Ebira females also had narrower cephalic breadth when compared to Okun males and females (P<0.001), while the Okun males had a larger dimension than their females (P<0.001). The Ebira males has significant larger cephalic length than Ebira females (p<0.001), larger when compared to Okun males and females (p<0.001). The Ebira female’s cephalic length was not significantly

different from Okun female’s cephalic length (p=1) but smaller when compared to Okun males (p<0.001). The cephalic indices differences between the Ebira males and females were not statistically significant (p≤1), also the differences in the cephalic indices were not significant between the Okun males and females (p≤1). The cephalic indices between the Ebira males and Okun males were statistically different (p<0.001), also when compared to Okun females (p<0.001). The Ebira females and Okun females’ cephalic indices were statistically different (p<0.001).

Table 2a. Correlation and accuracy of predictors for stature.

Model	R	R-Square	Adjusted Square	R-
Ebira Male	0.386	0.149	0.136	
Ebira Female	0.127	0.016	0.002	
Okun Male	0.296	0.088	0.074	
Okun Female	0.268	0.072	0.058	

Table 2b: Analysis of Variance (ANOVA) for significance of the predictor variables in the model

Model	Sum of Squares	Df	Mean Square	F-value	P-value
Ebira Male	1817.79	3	605.93	12.047	0.000
Ebira Female	122.95	3	40.98	1.126	0.339
Okun Male	1054.60	3	351.53	6.629	0.000
Okun Female	601.35	3	200.45	5.338	0.001

Table 2c: Analysis of variance (ANOVA) for significance of the predictor variables in the model.

Model	Unstandardized Coefficients		t-value	P-value
	B	Std. Error		
(Constant)	23.632	46.648	0.507	0.613
CEPHALIC BREADTH (cm)	-3.730	3.275	-1.139	0.256
CEPHALIC LENGTH (cm)	6.752	2.367	2.853	0.005
CEPHALIC INDICES	1.012	0.622	1.629	0.105
(Constant)	146.577	40.619	3.609	0.000
CEPHALIC BREADTH (cm)	1.089	3.046	0.358	0.721
CEPHALIC LENGTH (cm)	0.285	2.181	0.131	0.896
CEPHALIC INDICES	-0.040	0.551	-0.073	0.942
(Constant)	163.819	62.995	2.601	0.010
CEPHALIC BREADTH (cm)	1.992	4.165	0.478	0.633
CEPHALIC LENGTH (cm)	0.680	3.251	0.209	0.835
CEPHALIC INDICES	-0.439	0.790	-0.555	0.579
(Constant)	169.543	44.100	3.845	0.000
CEPHALIC BREADTH (cm)	3.223	2.979	1.082	0.281
CEPHALIC LENGTH (cm)	-0.521	2.418	-0.215	0.830
CEPHALIC INDICES	-0.537	0.528	-1.016	0.311

Table 3a: Head shape type (Ebira Male vs. Ebira Female)

Tribe/Sex	Head type	test of association
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	Dolio	Meso	Brachy	Hyperbrachy	Df	chi-square	P-value
Ebira M	184(87.2)	21(10.0)	6 (2.8)	0 (0)	3	5.412	0.144
Ebira F	173(82.0)	34(16.1)	3 (.4%)	1 (0.5)			
Total	357(84.6)	55(13.0)	9 (2.1)	1 (0.2)			

Table 3b: Head shape type (Okun Male vs. Okun Female)

Tribe/Sex	Head type				test of association		
	Dolio	Meso	Brachy	Hyperbrachy	Df	chi-square	P-value
Okun M	65 (30.8)	103 (48.8)	39 (18.5)	4 (1.9)	3	4.541	0.209
Okun F	67 (31.8)	93 (44.1)	39 (18.5)	12 (5.7)			
Total	132 (31.3)	196 (46.4)	78 (18.5)	16 (3.8)			

Table 3c: Head shape type (Ebira Male vs. Okun Male)

Tribe/Sex	Head type				test of association		
	Dolio	Meso	Brachy	Hyperbrachy	Df	chi-square	P-value
Ebira M	184 (87.2)	21 (10)	6 (2.8)	0 (0)	3	139.297	<0.001
Okun M	65 (30.8)	103(48.8)	39(18.5)	4 (1.9)			
Total	249(59.0)	124(29.4)	45(10.7)	4 (0.9)			

Table 3d: Head shape type (Ebira Female vs. Okun Female)

Tribe/Sex	Head type				test of association		
	Dolio	Meso	Brachy	Hyperbrachy	Df	chi-square	P-value
Ebira F	173 (82.0)	34 (16.1)	3 (.4%)	1 (0.5)	3	114.391	<0.001
Okun F	67 (31.8)	93 (44.1)	39 (18.5)	12 (5.7)			
Total	240 (56.9)	127 (30.1)	42 (10.0)	13 (3.1)			

Tables 2a-c shows the correlation coefficient (r) showed that stature was better predicted for the Ebira males (r=0.386), when compared to the Ebira female (r=0.127), Okun males (r=0.296) and Okun females (r=0.268). All predictions were significant except for Ebira female (P=0.339). Tables 3a-3d shows Ebira males (87.2%) and females (82.0%) were predominantly doliocephalic and the difference was not sex associated ($\chi^2=5.412$; P=0.144).

The distribution for the Okun males (48.8 %) and females (44.1%) were predominantly mesocephalic with a mix of doliocephalic (30%) males and females (31.8%). The differences were not sex associated ($\chi^2 = 4.541$; P = 0.209).The head type in Ebira males and females was significantly different from their Okun counterpart; males ($\chi^2=139.297$; P<0.001) and females ($\chi^2=114.391$; P<0.001).

DISCUSSION

This study has contributed that cephalic indices and stature of sexes of both ethnic groups are useful anatomical structure which plays important roles in forensic investigations, clinical practices and serves as basis for further comparison of other ethnic groups in Nigeria. Stature is one of the various parameters of identification for establishing individuality of the person (Nemade *et al.*, 2015). The cephalic indices attributed to a complex interaction between genetic and environmental factors (Kassai *et al.*, 1993) and the racial characters are best defined in the skull (Oladipo *et al.*, 2009).

Estimation of status is one of the biological profiles used in the identification of individuals in cases of mass disasters, plane crash, fatal auto crash, bombing, homicides and in crime investigations (Jervas *et al.*, 2015).

The cephalic index was positively correlated with stature ($p \leq 0.001$) for Okun males, Okun females and Ebira males of Kogi state except Ebira females which was not significantly correlated with stature. Ewunonu and Anibeze (2013) did estimation of stature from cephalic parameters in south- eastern Nigeria population. The study findings showed that the cephalic indices are positively and significantly correlated with stature. Akhter *et al.* (2009) worked on stature estimation using head measurements in Bangladeshi Garo adult female. The head measurements were the head length and head circumference in which the circumference was found significantly positive with the stature but the head length did not reach statistically significant level. Jadav and Shah (2004) also worked on estimation of stature from head length. The results showed that the age ranges from 17- 22 years, head length and total height has a significant correlation between them.

The cephalic indices were observed not to be sexually dimorphic among the males and females of Okun and Ebira ethnic groups of Kogi state in Nigeria. The cephalic indices were observed to be sexually dimorphic among Itsekiri however no such difference exists among

Urhobo (Oladipo *et al.*, 2009). Another study on Ogonis in Nigeria, the cephalic indices was observed to be sexual dimorphic (Oladipo *et al.*, 2009). Variation in cephalic index between and within population could have been attributed to a complex interaction between genetic and environmental factors (Kassai *et al.*, 1993).

In this study, 87.2 % of the Ebira male population was seen to have a doliocephalic head shape type, 82.0 % of the Ebira female population also seen to have a doliocephalic head shape type while 48.8% of Okun males were mesocephalic and 44.1% of the Okun females were also mesocephalic head type. The predominant head shape type for the Ebira and Okun ethnic were doliocephalic and mesocephalic mixed with doliocephalic respectively. The males in both ethnic groups had higher cephalic indices than females but were not statistically significant. The both sexes of each ethnic group fell under the same head shape type.

Oladipo and Olotu (2006) carried out a study on cephalic indices of Igbos and Ijaw ethnic groups, the Ijaw males are in brachycephalic group while the Ijaw females are in mesocephalic group. Oladipo *et al.* (2010) did anthropometric studies of cephalic length, cephalic breadth and cephalic indices of the Ibibio of Nigeria. The cephalic index showed that the males and females belong to mesocephalic group. Oladipo *et al.* (2009) did also anthropometric studies of cephalic indices of the Ogonis in Nigeria, the both sex belonged to brachycephalic population.

In conclusion, the predominant head shape type for the Ebira and Okun ethnic were doliocephalic and mesocephalic mixed with doliocephalic respectively. The males in both ethnic groups had higher cephalic indices than females but were not statistically significant. The both sexes of each ethnic group fell under the same head shape type. The relationship between the head shape type and stature of both sexes of the two ethnic groups were significant that is better predicted except for Ebira females. Ethnic

groups in the same climatic factors does not have much differences in their cephalic indices based on previous works. For more research work, studies should be carried out on other populations to possibly determine the

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relationship between the cephalic indices and height of subjects in that population group and also determine the head shape type associated with that population group.

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