Anthropometric Assessment of Cephalic Indices among Adults of Efik Ethnic Group of Cross River State, Nigeria

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Abstract: Cephalic index has been of massive importance to the anatomist, anthropologist and even to the forensic scientist in determination of head shapes and also for medico-legal cases. This research was aimed at studying the cephalic parameters of the Efiks of Cross River State. Five hundred (500) subjects (250 males and 250 females) of age range 18-45years were recruited for this study. Cephalic measurements which include head length and head width were done using a spreading calliper, whereas the cephalic index was obtained as the ratio of head width and head length multiplied by 100. The results revealed that mean head width for male and female individuals of Efik ethnic group was 14.66 ± 0.13cm and 14.15 ± 0.12cm respectively, whereas their head lengths were 18.11 ± 0.11cm and 17.94 ± 0.09cm respectively. More so, the mean cephalic index for male was 81.58 ± 1.12 and for female it was 79.23 ± 0.88. Statistical analysis revealed that the difference in cephalic index between male and female subjects was not significant at $p<0.05$ using t-Test. Also, in males brachycephalic (broad head) head shape had the highest frequency whereas, in female mesocephalic (moderate head) head shape was predominant. Overall, Brachycephalic head type was predominant in the Efiks. This study will be of immense importance to anatomists for comparison of cephalic indices, to the anthropologists for racial head shape classification and forensic scientists in medico-legal cases.

Key words: Anthropometry, cephalic index, head width, head length, Efik Ethnic group, Nigeria.

I. Introduction

Anthropometry is a series of systematized measuring techniques that express qualitatively the dimensions of the human body and the skeleton [1]. The shape of the head is useful in forensic medicine, paediatrics, in genetic counselling, reconstructive surgeries and diagnostic understanding between patient and normal populations [2]. The term cephalic index (CI) was however developed by the professor of Anatomy, Anders Retzius in (1842) as a method of describing head shape. He used the term 'cephalic index' for head lengths involving living individuals and 'cranial index' for head lengths involving dry skulls. The Cephalic Index, which is derived by dividing maximum head breadth (eu-eu) by maximum head length (g-op) and multiplying the result by 100, gives the

ratio of head breadth to head length. It is widely used not only to categorise human populations, but also to describe an individual's appearance and estimate the age of foetuses for legal and obstetrical purposes [3]

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 [4]. On international standard humans head shape are dolicocephalic (< 74.9), mesocephalic (75 – 79.9), brachiocephalic (80 – 84.9) or hyperbrachicephalic (85 – 89.9) See Table 1 [5].The normal range is 74–83% [6]. The relevant data on cephalic index of a population is very much essential in designing various orthopaedic and physiotherapic equipment of head and face like cranial remodelling band (helmet), head phones, goggles etc. by formulating standard sizes [7]. It had been revealed that people who are doliocephalic are prone to otitis media less often than those that are brachycephalic [8]. In the same vein, [9] reported that individuals with Apert's syndrome are hyperbrachycephalic.

Cross River State is a coastal state in South-South Nigeria, named after the Cross River, which passes through the state. The State has different ethnic groups with the major ones being Efik, Ejagham and Bekwarra, and all three are mainly located in the three senatorial districts namely Southern, Central and Northern, respectively. The Efik ethnic group is one of the major Ethnic groups in Cross River State of Nigeria. The aim of this work was to obtain normal values of head length and head width and also the cephalic index of adults of the Efik ethnic group of Cross River State, Nigeria.

II. Materials and Methods

For the present study, five hundred (500) subjects (250 males and 250 were females) whose age ranged from 18-45 years were selected at random from Calabar municipality, Calabar south and Akpabuyo local government areas. The age range is chosen because it is the active age range and the skull is fully developed which will give the exact head size with no shrinkage as one advances in age. The study was carried out between October 2015 and April 2016. To be eligible for selection in this study, subjects were supposed to be residing in the study area and both parents and grandparents were of to be of Efik descent. However, Subjects that presented with craniofacial defects were excluded from the study. The materials used for this study include spreading calliper, chair, exercise book and pen. The objectives and the methods of the study were explained to each subject. Informed consent was gotten from the subjects before measurements were taken.

Head length (glabella-inion length): This was measured by placing the anterior calliper tip on the glabella while allowing the posterior calliper tip to slide inferiorly along the median plain of the occipital bone until the maximum length was reached [2].

Head width (biparietal diameter): This was measured by allowing both tips of the spreading calliper to slide down along the lateral aspects of the parietal bones until the maximum width was recorded [2].

Cephalic index was calculated using the following equation;

$$\text{Cephalic index} = \frac{\text{Maximum head width}}{\text{Maximum head length}} \times \frac{\mathbf{100}}{\mathbf{1}}$$

Statistical Package For Social Sciences (SPSS) Version 17.0 (Chicago, SPSS, Inc.) was used for the statistical analysis. Results were expressed as Mean ± Standard error of mean. Comparisons were made of the cephalic dimensions studied between males

and females using the Student's *t*-test. The differences were considered significant at 95% confidence level (that is, when $P < 0.05$).

Ethical Approval

The objectives of the research was explained to each subject and written informed consent was obtained from each of them before commencement of measurement. In line with Helsinki Declaration of 1975, as revised in 2000, ethical approval was obtained from the Ethics/Research Committee of the Faculty of Basic Medical Sciences, Cross River University of Technology, CRUTECH Okuku Campus, Yala, Nigeria.

III. Result

The results obtained in the present study are presented on Tables 2 and 3. The mean head width of Efik male was 14.66 ± 0.13cm while Efik females had a mean head width of 14.15 ± 0.12cm. The females were significantly different ($p<0.05$) from males (Table 2). More so, Efik male had a mean head length of 18.11 ± 0.11cm while females had a mean head length of 17.94 ± 0.09cm. The average cephalic index of the Efik male was 81.58 ± 1.12 while that of the female was 79.23 ± 0.88. The difference between both sexes in Head length and cephalic index were statistically insignificantly (Table 2). Also, the predominant head type observed in Efik males was Brachycephalic with the highest frequency of occurrence in our sample whereas for their female counterparts Mesocephalic head type had the highest frequency and percentage (Table 3). Overall when the total sample was mixed (both sexes), Brachycephalic head type was the predominant (Table 3).

TABLE 1: Classification of head types

Head shape	Cephalic index (CI)	Range
Dolicocephalic (Long head)	>70	70-74.9
Mesocephalic (Moderate head)	>75	75-79.9
Brachycephalic (short head)	> 80	80-84.9
Hyperbrachycephalic (very short head)	> 85	85-89.9

TABLE 2: Sex Difference in parameters studied for Male and Female Efik subjects

Parameter	Male	Female	t	df	Sig. (2 tail)
Head Width (cm)	14.66 ± 0.13[A]	14.15 ± 0.12[A]	2.878	498	.004

Head Length (cm)	18.11 ± 0.11	17.94 ± 0.09	1.190	498	.235
Cephalic Index	81.58 ± 1.12	79.23 ± 0.88	1.651	498	.100

Results are expressed as Mean ± SEM. Values with similar alphabetical superscripts are statistically significant

TABLE 3: Distribution of head shapes in Efik ethnic group

CEPHALIC INDEX/ HEAD TYPE	**SEX**					
	MALE		**FEMALE**		**BOTH**	
	FREQUENCY	**%**	**FREQUENCY**	**%**	**FREQUENCY**	**%**
<70	10	4.0	8	3.2	18	3.6
Dolichocephalic 70 - 74.9	55	22.0	65	26	120	24
Mesocephalic 75-79.9	62	24.8	70	33.6	132	26.4
Brachycephalic 80-84.9	78	31.2	66	20.8	144	28.8
Hyper brachycephalic 85-89.9	32	12.8	32	12.8	64	12.8
> 89.90	13	5.2	9	3.6	22	4.4

IV. Discussion

Variations in cephalic indices between and within populations have been attributed to a complex interaction between genetic and environmental factors [10]. In the present study, Males of Efik ethnic group fell under brachycephalic head shape with a mean cephalic index between 81.58 while Efik females are classified under mesocephalic head shape with cephalic index at 79.23. The result for Efik ethnic group is in conformity with that of Ijaw population [11] as Ijaw males were classified under brachycephalic head shape while Ijaw females were classified under mesocephalic head shape. In a related study on Yoruba ethnic group [12] males were categorized as Brachycephalic while females were classified as mesocephalic. Our findings are also similar to those obtained by [13] on Punjabi Males in India as they had brachycephalic head shape. More so, a study on Gujuarati Indians [14] revealed that their males were brachycephalic, a finding which is similar to the Efik males in the present study. However, the results of the present study differs from what [12] reported on Ibo ethnic group since the predominant head shape was brachycephalic for both sexes. In a similar study like the present one on Efiks [15] reported that both Efik males and female were all dolicephalic. The disparity in result for Efiks may be due to the age range as well as the sample size chosen. Other studies [16] also reported that the main head type for male in the Gujarati population they studied was Mesocephalic whereas the leading head shape for female was dolicephalic which is different from the current study.

The current study on Efiks reveal that the predominant head type was the brachycephalic head type. This agrees with results of previous studies [17] where brachycephalic head type was reported as the predominant head type in both Tiv and Idoma ethnic groups of Benue State. Other studies [18] also informed that the predominant head phenotype in an Iranian population that was

studied was Brachycephalic. However our results disagrees with other findings [19] where mesocephalic head shape was predominant in a sample made up of Ibos, Edos and Urhobos.

Sexual dimorphism is a key concern for the forensic anthropologists as it is a vital to individual identification. Assessing sexual dimorphism eliminates approximately half of the population from further considerations in cases of missing persons or unknown identity. Many morphological differences are sex specific [16]. The present study has revealed that cephalic index is not sexually dimorphic in the Efik ethnic group. This agrees with the findings [12, 16] that reported absence of significant sexual dimorphism cephalic indices of Ibo and Gujarati subjects respectively, although this finding, however disagrees with the other finding [13] on Yoruba ethnic group who exhibited sexual dimorphism. Others authors have also reported significant sexual differences [20, 21, 22] with the males having significantly higher cephalic indices than their female counterpart whereas in similar studies [22] but on different ethnic groups, the females had significantly higher cephalic indices than male subjects which seems to differ from the result of the current study. However, this finding suggests that cephalic index can be higher in any sex depending on the uniqueness of the population under study.

V. Conclusion

The results of the present study shows that the male Efik can be classified as brachycephalic whereas Efik female fall into the Mesocephalic head shape. The study has also shown that overall, the predominant head shape for Efiks is Brachycephalic. More so, the study has revealed that there was no sexual dimorphism in the cephalic index in Efiks. The data from the current study will be useful in bioanthropology, medico-legal cases and forensic science in determination of sex and ethnicity.

Conflicts of Interests: None

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