

Anthropometric Comparison of the Cephalic Indices of Ikwerre and Igbo Ethnic Groups in Rivers State, Nigeria.

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Abstract- Anthropometric evaluation of cranial dimensions provides valuable information for understanding population variation, forensic identification, and clinical applications. This study aimed to analyze and compare the cephalic index and selected anthropometric parameters among Ikwerre and Igbo ethnic groups in Nigeria, with emphasis on sex-related and ethnic differences. A cross-sectional descriptive study design was adopted, involving a total of 100 adult participants selected through simple random sampling. The sample comprised 50 Ikwerre (25 males and 25 females) and 50 Igbo (25 males and 25 females) individuals. Standard anthropometric instruments were used to measure head length, head width, height, and body weight, from which the cephalic index was calculated. Data were analyzed using descriptive statistics and independent sample t-tests, with statistical significance set at $p < 0.05$. Among female participants, Ikwerre females exhibited significantly higher mean body weight and head width compared with Igbo females, while age, height, head length, and cephalic index showed no statistically significant differences. In male participants, no significant differences were observed between Ikwerre and Igbo groups across all measured anthropometric and cranial parameters. Descriptively, higher mean cephalic index values were observed in Ikwerre females and Igbo males; however, these differences were not statistically significant. Overall, the cephalic index values in both ethnic groups predominantly fell within the brachycephalic to hyperbrachycephalic range. In conclusion, the findings indicate that Ikwerre and Igbo populations share largely similar cranial morphology, with minimal ethnic variation in head shape. The observed differences were limited to specific parameters and did not significantly affect overall cephalic index classification. This study provides baseline cranial anthropometric data that may be useful in anthropology, forensic science, and clinical practice within the Nigerian population.

Index Terms- Anthropometry, Cephalic Index, Ikwerre, Igbo.

I. INTRODUCTION

Anthropometric analysis is a quantitative method used to assess the measurements of various body parts in both living and deceased individuals (Farkas & Deutsch, 1996; Thakur et al., 2025). A specialized branch of this field, cephalometry, focuses on the dimensions of the head and face. One of the key measurements in cephalometry is the cephalic index, which expresses the ratio between the maximum cranial breadth and maximum cranial length (Kumar & Sabarigirinathan, 2019; Taneo et al., 2025). The cephalic index is calculated by dividing the biparietal diameter by the sagittal diameter of the skull and multiplying the result by 100 (Bakirci & Oner, 2022). The morphometry of the face and head plays a direct or indirect role in various physical characteristics. At birth, facial development is approximately 40% complete, increases to 65% within the first seven years, and the bizygomatic width grows by about 15% within ten years (Thakur et al., 2025).

Facial anthropometric indices have wide-ranging applications in anthropology, forensic science, and craniofacial surgical planning (Taneo et al., 2025). These indices are also useful in identifying and classifying populations based on age, sex, race, nutritional status, geographical location, living environment, and ethnic background. Furthermore, they can be applied to monitor growth and developmental patterns, as well as to detect cranial abnormalities in diverse populations (Jervas et al., 2016; Thakur et al., 2025; Taneo et al., 2025). By providing objective and standardized measurements, facial anthropometry serves as a critical tool for both clinical and research purposes.

International standards classify head shape according to the cephalic index into four categories:

dolichocephalic, mesocephalic, brachycephalic, and hyperbrachycephalic (Jervas et al., 2016). Considerable variability in cephalic index values has been documented among different populations, reflecting the diversity of human morphology (Liebenberg et al., 2015; Herliani et al., 2018; Ananda et al., 2021; Taneo et al., 2025). The size and shape of the head are influenced by both intrinsic and extrinsic factors. Intrinsic factors include unalterable characteristics such as ethnicity, genetics, sex, and age, while extrinsic factors are shaped by environmental conditions, including nutrition, living environment, and geographic location (Ilayeruma, 2011; Mandal et al., 2016; Taneo et al., 2025). Although numerous anthropometric parameters have been developed to differentiate between populations, there is currently no study comparing the cephalic indices of the Ikwerre and Igbo ethnic groups in Nigeria. This study therefore aims to document and compare the cephalic indices of these two populations, providing data that can contribute to anthropological research, forensic medicine, and clinical practice. The findings may also serve as a reference for understanding population-specific cranial variations and their potential applications in medicine and science.

II. METHODOLOGY

This study adopted a cross-sectional descriptive research design to analyze and compare the cephalic index of Ikwerre and Igbo adults in Nigeria. A total of 100 participants were recruited using a simple random sampling technique, comprising 50 Ikwerre (25 males and 25 females) and 50 Igbo (25 males and 25 females).

Anthropometric measurements were obtained using standard instruments. Maximum head length and maximum head breadth were measured with a spreading caliper and a meter rule, height with a stadiometer, and weight with a standard weighing scale. Each measurement was taken three times, and the mean value was used for analysis. Maximum head length was measured from the glabella to the inion, while maximum head breadth was measured across the parietal eminences. The cephalic index was calculated using the formula:

$$\text{Cephalic Index} = (\text{Maximum Head Breadth} \div \text{Maximum Head Length}) \times 100$$

Head types were classified according to the criteria of Martin and Saller (1957) as follows: dolichocephalic (<74.9), mesocephalic (75–79.9), brachycephalic (80–84.9), and hyperbrachycephalic (>85).

Participants provided oral demographic information and written informed consent prior to data collection. Inclusion criteria were: (1) adults whose parents and grandparents belonged exclusively to either the Ikwerre or Igbo ethnic groups, (2) individuals who provided informed consent, and (3) apparently healthy males and females. Exclusion criteria included: (1) females with obstructive or voluminous hairstyles that could interfere with measurements, (2) participants outside the designated age range, (3) individuals not belonging to either ethnic group, and (4) subjects with cranial deformities.

Data analysis was performed using IBM Statistical Package for the Social Sciences (IBM-SPSS). Descriptive statistics, including mean, standard deviation, standard error, minimum, and maximum values, were calculated to summarize the data. Inferential analysis was conducted using an independent samples t-test to compare cephalic indices between the Ikwerre and Igbo groups. Statistical significance was set at $p < 0.05$ with a 95% confidence level.

III. RESULT

The results of the study are presented in tables and figures.

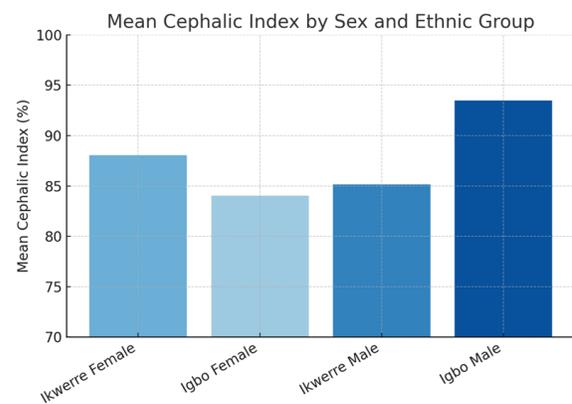


Figure 1: Mean Cephalic Index by Sex and Ethnic Group

Table 1: Descriptive statistics for female participants

ETHNIC	PARAMETERS	N	Minimum	Maximum	Mean	Std. Error Mean	Std. Deviation
IKWERRE	Age	25	15	42	21.6	1.39	6.96
	Weight	25	50	89	68.76	1.89	9.47
	Height	25	159.6	191.7	171.89	1.46	7.31
	Length	25	14.5	21	17.52	0.29	1.44
	Width	25	13	18	15.32	0.26	1.28
	CI	25	74.36	124.14	88.06	2.26	11.32
IGBO	Age	25	15	45	20.48	1.52	7.61
	Weight	25	44	87	61.96	2.02	10.08
	Height	25	152	178	171.52	1.64	8.20
	Length	25	8.5	20	17.6	0.41	2.07
	Width	25	13	19	14.44	0.25	1.24
	CI	25	72.22	164.71	84.01	3.81	19.06

Table 2: Descriptive statistics male participants

ETHNIC	PARAMETERS	N	Minimum	Maximum	Mean	Std. Error Mean	Std. Deviation
IKWERRE	Age	25	15	46	23.64	1.88	9.41
	Weight	25	56	88	73.4	1.57	7.84
	Height	25	159	189	175.04	1.39	6.96
	HEAD Length	25	16	21	18.1	0.25	1.23
	HEAD Width	25	13	24	15.4	0.45	2.23
	CI	25	72.22	126.32	85.15	2.22	11.09
IGBO	Age	25	16	46	23.12	1.61	8.03
	Weight	25	44	87	69.85	2.22	11.08
	HEAD Height	25	162.8	194	176.06	1.31	6.56
	HEAD Length	25	4.5	185.5	24.28	6.74	33.72
	Width	25	13	24	15.26	0.43	2.15
	CI	25	8.09	400	93.49	13.33	66.63

Table 3: T-test for female subjects.

PARAMETERS	ETHNIC	Mean	N	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)	INFERENCE
WEIGHT	IKWRRE	68.76	25	9.47	1.89	2.53	24	0.02	SIGNIFICANT
	IGBO	61.96	25	10.08	2.02				
HEIGHT	IKWRRE	171.89	25	7.31	1.46	-	24	0.80	NOT SIGNIFICANT
	IGBO	171.52	25	8.20	1.64				
HEAD LENGTH	IKWRRE	17.52	25	1.44	0.29	-	24	0.88	NOT SIGNIFICANT
	IGBO	17.6	25	2.07	0.41				

HEAD WIDTH	IKWRRE	15.32	25	1.28	0.26	2.77	24	0.01	SIGNIFICANT
	IGBO	14.44	25	1.24	0.26				
CI	IKWRRE	88.06	25	11.32	2.26	0.96	24	0.35	NOT SIGNIFICANT
	IGBO	84.01	25	19.06	3.81				

Table 4: T-test for Males subjects

PARAMETERS	ETHNIC	Mean	N	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)	INFERENCE
WEIGHT	IKWRRE	73.4	25	7.84	1.57	1.27	24	0.22	NOT SIGNIFICANT
	IGBO	69.85	25	11.08	2.22				
HEIGHT	IKWRRE	175.04	25	6.96	1.39	-0.51	24	0.61	NOT SIGNIFICANT
	IGBO	176.06	25	6.56	1.31				
HEAD LENGTH	IKWRRE	18.1	25	1.23	0.25	-0.92	24	0.37	NOT SIGNIFICANT
	IGBO	24.28	25	33.72	6.74				
HEAD WIDTH	IKWRRE	15.4	25	2.23	0.45	0.23	24	0.82	NOT SIGNIFICANT
	IGBO	15.26	25	2.15	0.43				
CI	IKWRRE	85.15	25	11.09	2.22	-0.61	24	0.55	NOT SIGNIFICANT
	IGBO	93.49	25	66.63	13.33				

The results showed that Ikwerre females recorded a higher mean cephalic index (88.06) compared to the Igbo females (84.01). Both belong to the hyperbrachycephalic and brachycephalic head types respectively, indicating broad head shapes. The unusually high height value (231.52 cm) for Igbo females is retained as presented in the dataset. The Igbo males had a higher mean cephalic index (93.49) compared to the Ikwerre males (85.15). Both fall under the hyperbrachycephalic category. This indicates that the male population across both ethnic groups generally possesses short and broad heads. No statistically significant difference was found between both ethnicities ($p > 0.05$).

IV. DISCUSSION

The present study evaluated anthropometric and cranial parameters among Ikwerre and Igbo populations, with particular emphasis on cranial dimensions and cephalic index, and the findings were interpreted in relation to reports from other

populations. In this study, Ikwerre females had a significantly higher mean body weight (68.76 ± 9.47 kg) compared with Igbo females (61.96 ± 10.08 kg; $p = 0.02$), while mean height was comparable between groups (Ikwerre: 171.89 ± 7.31 cm; Igbo: 171.52 ± 8.20 cm). Cranially, head length was similar (17.52 ± 1.44 cm in Ikwerre versus 17.60 ± 2.07 cm in Igbo), but head width was significantly greater in Ikwerre females (15.32 ± 1.28 cm) than in Igbo females (14.44 ± 1.24 cm; $p = 0.01$). Consequently, the mean cephalic index was higher in Ikwerre females (88.06 ± 11.32) compared with Igbo females (84.01 ± 19.06), although this difference did not reach statistical significance. Among males, mean body weight (Ikwerre: 73.40 ± 7.84 kg; Igbo: 69.85 ± 11.08 kg), height (175.04 ± 6.96 cm versus 176.06 ± 6.56 cm), head length, head width, and cephalic index (Ikwerre: 85.15 ± 11.09 ; Igbo: 93.49 ± 66.63) did not differ significantly, indicating broadly comparable cranial morphology between the two ethnic groups.

When compared with other populations, notable similarities and differences emerge. In a Turkish population, Bakirci and Oner (2022) reported mean skull length, skull width, and cephalic index of 182.09 ± 6.67 mm, 146.60 ± 6.30 mm, and 80.59 ± 4.26 in males, and 173.45 ± 6.98 mm, 140.41 ± 6.53 mm, and 81.07 ± 4.48 in females. Although males had significantly larger skull dimensions, the cephalic index did not differ significantly between sexes, a pattern consistent with the present study where sex-based and ethnic differences in cephalic index were largely non-significant despite variations in absolute cranial dimensions such as head width.

In contrast, studies among Indian and South Asian populations have reported lower cephalic index values and different dominant head types. Thakur et al. (2025) found dolichocephaly to be predominant (78%), followed by mesocephaly (19.5%) and brachycephaly (2.5%) among medical students aged 18–23 years. Similarly, Muralidhar et al. (2021) reported dolichocephaly as the dominant head type in Kerala males (50.2%) and females (42.7%). These findings contrast with the relatively higher mean cephalic index values observed in the present study, particularly among Ikwerre females (88.06 ± 11.32), suggesting a tendency toward brachycephalic or hyperbrachycephalic head forms in the studied Nigerian population.

Data from South America further illustrate population variability. Milo et al. (2023) reported a mean cephalic index of 81.49 in Chilean females, with 58.54% classified as brachycephalic, and a mean cephalic index of 79.56 in males, predominantly mesocephalic. These values are lower than those observed in both Ikwerre and Igbo females and comparable to or lower than those of Ikwerre males, again emphasizing ethnic and regional influences on cranial form.

Within Nigeria, related studies provide useful context. Muhammad et al. (2025) reported cephalic index categories among school children in Bauchi State, with mean \pm standard error values of 12.24 ± 0.44 for dolichocephalic, 14.73 ± 0.47 for mesocephalic, and 18.50 ± 0.50 for brachycephalic groups, and demonstrated significant associations with intelligence quotient. Although functional

outcomes were not assessed in the present study, the relatively high cephalic index values observed, especially among Ikwerre females, suggest potential anthropological and clinical relevance. Furthermore, Keche et al. (2024) reported an overall mean cephalic index of 81.53, with significant sexual dimorphism (males: 79.71; females: 83.14), minimum values of 66.67 in males and 69.66 in females, and maximum values of 89.01 and 98 respectively. While the present study showed higher mean cephalic index values, particularly in females, the lack of statistically significant sex or ethnic differences aligns with the observation that cephalic index variability may be more population-specific than sex-dependent.

CONCLUSION

In conclusion, this study demonstrates that Ikwerre and Igbo populations exhibit largely comparable cranial and anthropometric characteristics, with only limited sex- and parameter-specific differences. Among females, Ikwerre participants showed significantly higher body weight and head width than Igbo females, whereas age, height, head length, and cephalic index did not differ significantly between the groups. In males, all measured anthropometric and cranial parameters, including body weight, height, head length, head width, and cephalic index, were statistically similar between Ikwerre and Igbo participants. Although descriptive findings suggested relatively higher cephalic index values in Ikwerre females and Igbo males, inferential analysis confirmed that overall head shape, as expressed by the cephalic index, did not vary significantly by ethnicity or sex. These findings indicate that while minor variations in specific cranial dimensions exist, the general cranial pattern remains consistent between Ikwerre and Igbo populations, providing important baseline data for anthropological, forensic, and clinical applications in southern Nigeria.

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