

ORIGINAL RESEARCH

Craniometry of Nigerian skulls: A cadaveric study and review of the literature

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Abstract

Background

There have been several studies on clinical craniometry, particularly cephalic indices. However, published reports on the anatomical cranial indices of Nigerian anatomical specimens are scarce. This work aimed to add to the body of knowledge on the cranial indices of Nigerian skulls as well as review the literature on both Nigerian cranial and cephalic indices.

Methods

Sixty-eight adult skulls of unidentified gender were assessed, 61 of which had intact craniums and were included in the analysis. The skull specimens were placed in the Frankfurt plane, and standard craniometric measurements were obtained to the nearest millimetre using digital spreading and sliding callipers. The cranial index was calculated from the maximum cranial length and breadth, which was measured using standard anthropometric techniques.

Results

The mean cranial index was 74.1 ± 5.6 mm, and the most common skull type was dolichocephalic. Twenty-three Nigerian articles were identified from the literature search, and only 3 were on anatomical specimens. The mesocephalic skull type was the most commonly documented in both the northern and southern parts of Nigeria, while the least common were the brachycephalic skull type in southern Nigeria and the dolichocephalic skull type in northern Nigeria.

Conclusions

The skull types of Nigerians appear to be more mesocephalic than dolichocephalic, and in regions where dolichocephalic values were obtained, more recent values show a tendency towards brachycephalization.

Keywords: craniometry, cephalometry, cranial index, cephalic index, skull type, cadaver, surgical anatomy, Nigeria

Introduction

Craniometry—the scientific measurement of the cranium—has been applied in various fields, such as population and sociocultural studies, anthropology, forensics, radiology, and reconstructive surgery.^{[1]-[3]} The cranial or cephalic index is the ratio of the maximum cranial width (biparietal diameter) and the maximum cranial length (occipitofrontal diameter) multiplied by 100.^{[4],[5]} The terms *cranial index* and *cephalic index* are often used interchangeably, but sometimes the latter's definition incorporates the a few additional millimetres to the biparietal and occipitofrontal diameters to account for soft tissue.^{[4],[6]}

Racial variation in the cranium has been previously reported,^{[7]-[9],[10]} and the variations in cephalic in-

dices between and within populations have been attributed to an intricate interplay of genetic and environmental factors.^[11] Cephalic indices have been deployed in categorizing people according to race, gender, criminal tendencies, and intelligence. Historical systems of cranial classification and the idea of discrete ancestry with exclusive “types” inspired notions of the existence of ideal categories for racial profiling.^[1] However, in recent decades, anthropological reports showing remarkable rapid changes in head shape, previously never experienced by mankind, have emerged—with trends varying by geographic location.^[12] Despite these global trends, studies on clinical craniometry—especially cephalic indices—of Nigerian anatomic samples are scarce in the literature.^{[13]-[15]} Even more scarce has been any attempt at observing population-level changes in the shapes



Figure 1. Skull types

- (A) Dolichocephalic
- (B) Mesocephalic
- (C) Brachycephalic

measured as the distance from the most frontal point of the glabella to the farthest point on the occipital bone (opisthocranium) in the midsagittal plane. The breadth of the skull was measured as the farthest maximal transverse distance in the transverse plane. We obtained these measurements to the nearest millimetre using digital spreading and sliding callipers with rounded extremities. All measurements were repeated 3 times by 2 of the investigators (A.A.O., T.O.A.). The maximum cranial length and breadth were measured using standard anthropometric techniques. Measurements were performed with the skull specimens in the Frankfurt plane. The cranial index was determined as the breadth calculated as a percentage of the length, that is, $100 \times \text{breadth}/\text{length}$ of the skull. The cranial indices were classified as dolichocephalic (≤ 74.9), mesocephalic (75-79.9), brachycephalic (80-84.9), or hyperbrachycephalic (85.0-89.0) (Figure 1).^[8]

of Nigerian skulls. This study aimed to add to the body of knowledge on the cranial indices of Nigerian skulls. We also compared the cranial indices determined in this study with the cranial and cephalic indices found in the literature.

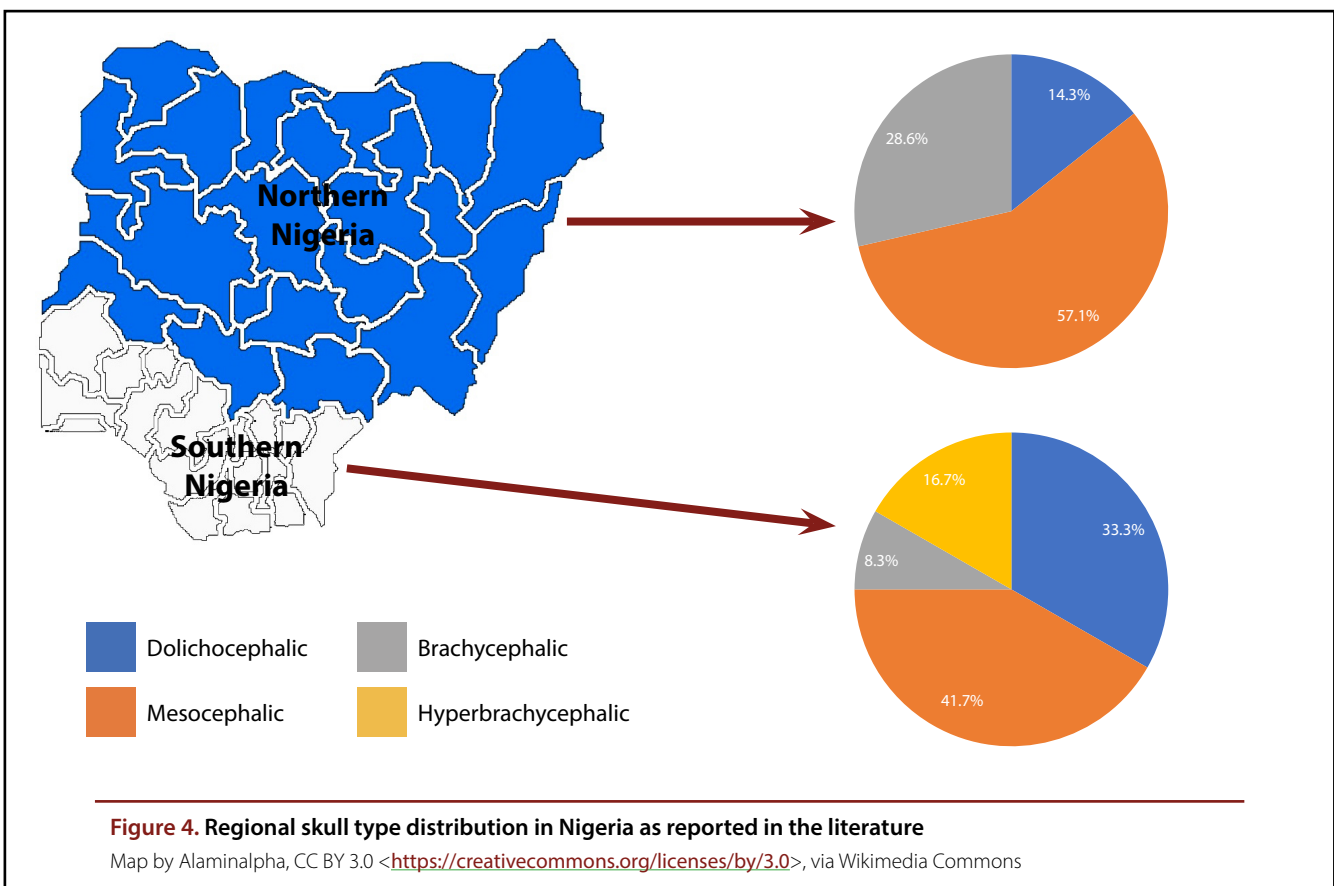
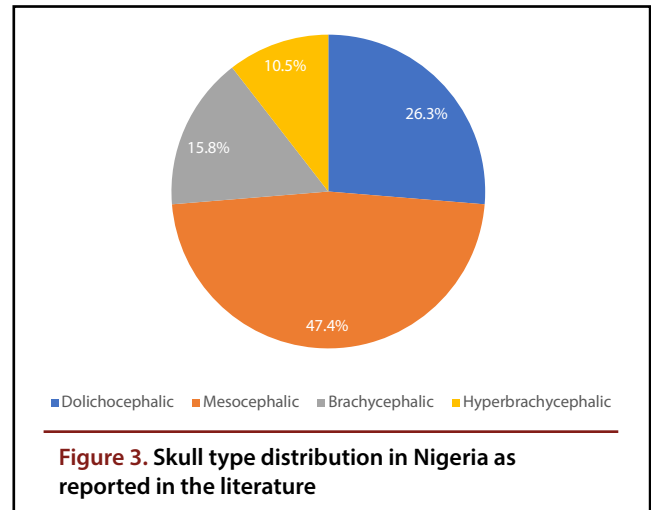
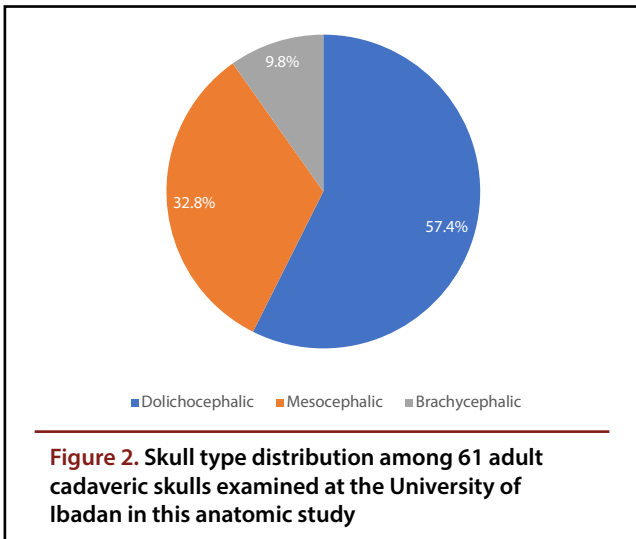
Methods

Sixty-eight adult skulls of unidentified gender were assessed, and the cranial lengths and breadths of the 61 specimens that had intact craniums were measured according to Martin's craniometric method.^[16] The length of the skull was

Ethical approval was granted by the University of Ibadan and University College Hospital Research Ethics Committee to obtain craniometric parameters from the dried human skull specimens obtained from cadavers.

Results

The mean biparietal and occipitofrontal diameters were 131.4 ± 8.1 mm and 177.7 ± 7.8 mm, respectively, while the mean cranial index was 74.1 ± 5.6 mm. The most common skull type was dolichocephalic ($n=35$, 57.4%) (Figure 2).



Discussion

The cranial index is commonly used as an anthropological tool for estimating an individual’s ancestry and in forensic studies, and it became a popular measure in “racial” studies for the categorization of human groups in the late nineteenth century.[17] Skull-based categorizations of race by anthropologists have been documented as follows: tall dolichocephalic skulls for the Caucasoid race, short dolichocephalic skulls for the Negroid race, and medium brachycephalic skulls for the Mongoloid race.[5],[10],[18] However, a process of overall brachycephalization, whereby the average skull gradually changes from an anteroposteriorly long one

to a short one, has been reported in the literature.[19] The cause of this phenomenon is not clear, and some authors have suggested socioeconomic improvements and reductions in morbidity and mortality as explanations.[20],[21]

Specifically considering the Nigerian population, the findings of this study contradict the characterization of dolichocephalic skulls as typical of indigenous African peoples. Our literature findings suggest that the mesocephalic skull type is more prominent in the Nigerian population; however, there appears to be a tendency towards dolichocephalization in the southwestern part of Nigeria. Two previous Nigerian studies[13],[15] have found the mesocephalic skull type

to be the most frequently encountered, while Adejuwon et al.[14] most frequently encountered the dolichocephalic type; these studies determined mean cranial indices of 76.1, 79.3, and 72.5, respectively. The mesocephalic skull type has been reported to be the most common type in both northern and southern Nigeria, while the least common types have been reported to be the brachycephalic skull type in southern Nigeria and the dolichocephalic type in northern Nigeria.[22]-[25] The hyperbrachycephalic skull type has not been reported to have been encountered in northern Nigeria (Figure 3 and Figure 4).

The mean cranial index obtained in our study is slightly higher than the 72.54 measured by Adejuwon et al.[14] in 2009 but similar to the 74.39 reported for the Yoruba tribe by Oladipo in 2014.[26] Thus, there appears to be a shift in proneness to a dolichocephalic skull type among the Yoruba tribe towards brachycephalization. This phenomenon of the gradual shift of a skull type towards another type within a population has similarly been reported in other races; brachycephalization has been reported in Korean,[19] Ukrainian,[27] and Slavic[28] populations. It has been postulated that changes in quality of life and reductions in infant mortality may be responsible for the evolving changes in racial cranial indices.[21]

Although the skull is the most studied part of the human skeleton,[2] human anatomic studies on cranial indices are uncommon in Nigeria, as more researchers focus on the cephalic indices of living subjects.[22]-[25],[29] Our study adds to the literature on skull anatomy and summarizes the data on cephalic indices from Nigerian publications. The knowledge from this study can be of relevance to anthropologists as well as forensic scientists. The data may also be of benefit to cranioplastic surgeons when reconstructive surgery is essential, as standardized cephalometric records facilitate clinical and diagnostic comparisons between patients.[29]

Conclusions

Nigerians appear to have tendencies towards mesocephalic and dolichocephalic skulls, and in regions where dolichocephalic averages have been encountered, more recent values suggest a shift towards brachycephalization. The small size of our sample limits the generalizability of our findings. Therefore, we recommend further large-scale, multicentre research.

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