

Research Article

Dolicocephalization in Cephalic Indices of Adult Yorubas of Nigeria

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Cephalic index is an important parameter useful in establishing racial and sexual dimorphism. This study was carried out to determine the cephalic indices of adult Yorubas of age 18 to 40 years. One thousand and twenty (1020) Yoruba adults consisting of 493 males and 527 females were recruited randomly for the study. These were all residents of Port Harcourt, Rivers State of Nigeria. The mean cephalic index of Yorubas without reference to gender was 74.39 ± 5.41 . Dominant and rare types of head shapes are dolicocephalic (68.33%) and hyperbrachycephalic (5.00%), respectively. The mean cephalic indices were 75.02 ± 4.76 (mesocephalic) in males and 73.75 ± 5.13 (dolicocephalic) in females. We conclude that Yoruba males are mesocephalic while Yoruba females are dolicocephalic. Besides, this study also reveals dolicocephalization tending towards mesocephalization amongst Yorubas. These findings will be very useful in forensic science, physical and medical anthropology, and clinical practice, most especially craniofacial surgery as it presents a characteristic feature of the head configuration for this Nigerian race.

1. Literature Review

Anthropometry deals with the measurement of physical sizes and shapes of human body [1]. Data obtained from such measurements have been very useful in differentiating people of different ethnic backgrounds, nutritional status, and gender. Several measurable anthropometric parameters or variables have been developed over the years for establishing possible differences amongst different groups.

Cephalic index is one of such very useful measurable anthropometric variables used in physical anthropology to determine geographical gender, age, and racial and ethnic variations. Comparison of changes in cephalic index between parents, offspring, and siblings gives clues to genetic transmission of inherited characters or traits which play a role in forensic science [2–4]. Argyropoulos and Sassouni [5] showed that morphological features of different races and ethnic groups are not randomly distributed but appear in geographic clusters.

Arguably, Cephalometry continues to be the most versatile technique in the investigation of the craniofacial skeleton

because of its validity and practicality [6]. Cephalometry is associated with the morphological study of all the structures present in the human head. Cephalometry is the scientific measurement of the dimensions of the head usually through the use of standardized lateral skull radiographs [8]. Based on the above factors, anthropometric studies are conducted on the age, sex, and social or ethnic groups in certain geographical zones [2, 9–17].

Several studies have been conducted on the age, sex, and racial or ethnic groups in different geographical zones [15–19]. These authors have sited various categories of cranium on the basis of head length, breadth, and index and described seven groups of crania.

Okupe et al. [20], in a comparative study of biparietal diameter (BPD) fetuses of some of the Nigerian ethnic groups and Caucasians, showed statistically significant differences until near term when the Nigerian fetuses showed consistently longer BPD.

Cussenot et al. (1990) reported that skeletal measurements were made as the basis of foetal anthropometry and age determination. In a related study, cephalic index varied

TABLE 1: Distribution of head breadth in males and females.

Head breadth (cm)	Males		Females		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
11.01–12.00	17	3.45	—	—	17	1.67
12.01–13.00	85	17.24	51	9.68	136	13.33
13.01–14.00	204	41.38	306	58.06	510	50.00
14.01–15.00	68	13.79	136	25.81	204	20.00
15.01–16.00	51	10.34	34	6.45	85	8.33
16.01–17.00	51	10.34	—	—	51	5.00
17.01–18.00	17	3.45	—	—	17	1.67
Total	493	100	527	100	1020	100

TABLE 2: Distribution of head length in males and females.

Head length (cm)	Males		Females		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
17.01–18.00	51	10.34	85	16.13	136	13.33
18.01–19.00	238	48.28	187	35.48	425	41.67
19.00–20.00	170	34.48	204	38.71	374	36.67
20.00–21.00	34	6.90	51	9.68	85	8.33
Total	493	100	527	100	1020	100

with advancing gestational age with the highest and lowest being 81.5 and 78.0 at weeks 14 and 28, respectively [21].

Several studies have been carried out to classify head shapes based on cephalic index into four internationally acceptable categories that include dolicocephalic (<74.9), mesocephalic (75–79.9), brachycephalic (80.0–84.9), and hyperbrachycephalic (85.0–89.9) [9, 22]. A study has shown that the people of Gurung community of Nepal of India are brachycephalic with cephalic index of 80.42 [2]. Bhils and Barelas are mesocephalic (76.98 & 79.80) [23, 24]. The Iranian people are predominantly brachycephalic and hyperbrachycephalic [4].

Besides being a predictor of fetal death, early transvaginal measurement of cephalic index had been used for the determination of Down syndrome fetuses [25].

The present study was aimed at determining the head dimensions and classification of head shape based on cephalic index of Yorubas residing in Port Harcourt of Rivers State, Nigeria, which could be used for the purposes of forensic investigation and clinical practice most especially craniofacial surgery.

2. Materials and Methods

Study Design. A cross-sectional survey of Yorubas resident in Port Harcourt of Rivers State was carried out. Subjects were randomly selected. All subjects were of Yoruba by both parents and genealogies and were between 18 and 40 years of age. A total of 493 males and 527 females were measured and their cephalic indices were determined. The research was carried out in Port Harcourt, Rivers State. The materials used were spreading caliper (none calibrated).

Anthropometric Measurement. The anatomical landmarks, gabellas, inions (I), and euryon (eu) were marked. The

anatomical landmarks were defined as follows, gabella: a point above the nasal root between the eyebrows and intersected by mid-sagittal plane; euryon: the most lateral point placed on the side of the head; inion: the distal point most placed on the external occipital protuberance in the mid-sagittal plane.

Procedure. The method used for obtaining the cephalic index was Hrdlicka's method. All measurements were taken with the subjects sitting on a chair with head in anatomical position and measurements were taken in the nearest centimeter. The head length was measured as the maximum transverse diameter between the two euryons using a spreading caliper while head breadth was measured as the biparietal diameter [2]. Data were analyzed statistically and results presented in tabular form.

3. Results

The results of the present study are presented in Tables 1–5. A total of 1020 human subjects (Yorubas) were studied, of which 493 (48.33%) were males and 527 (51.67%) were females. The subjects' ages were between 18 and 40 years. Tables 1 and 2 show the percentage frequencies of the distributions of head breadth and head length, respectively. Table 3 represents the distribution of the cephalic indices of the Yorubas investigated while Table 4 contains the mean values of the head length, head width, and cephalic index of the study.

The mean head breadth was 13.68 ± 1.08 cm and the mean head length was 18.89 ± 0.83 cm. For males, the mean head breadth and head length were 14.05 ± 2.71 and 18.88 ± 0.78 cm, respectively, while for females, the mean head breadth and head length were 13.79 ± 0.74 cm and 18.92 ± 0.89 cm, respectively (Table 4).

TABLE 3: Incidence of the cephalic index in males and females.

Cephalic index	Males		Females		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
<70	153	31.03	136	25.81	289	28.33
70.01–75.00	170	34.48	238	45.16	408	40.00
75.01–80.00	85	17.24	119	22.58	204	20.00
80.01–85.00	34	6.90	—	—	34	3.33
85.01–90.00	17	3.45	34	6.45	51	5.00
90.01–95.00	17	3.45	—	—	17	1.67
95.01–100.00	17	3.45	—	—	17	1.67
Total	493	100	527	100	1020	100

TABLE 4: Descriptive statistics of anthropometric measurements of cephalic index of males and females.

Parameter	Mean (standard deviation)		
	Males	Females	Total
Head breadth (cm)	14.05 \pm 2.71	13.79 \pm 90.74	13.68 \pm 1.08
Head length (cm)	18.88 \pm 0.78	18.92 \pm 0.89	18.89 \pm 0.83
Cephalic index	75.02 \pm 4.78	73.75 \pm 5.13	72.12 \pm 5.41
Sample size	493	527	1020

Z-test: $P < 0.05$.

TABLE 5: Comparative data on cephalic indices of various populations.

Race/ethnic group	Cephalic index (mean \pm SD)	N	References
Kvangaja race	79.50	100	Basu (1963) [30]
Bhils race	76.98	100	Bhargava and Kher (1960) [23]
Barelias	79.80	100	Bhargava and Kher (1961) [24]
Gujarati	80.81	500	Shah and Jahhavi, 2004 [2]
Ijaw males	80.98 \pm 6.11	63	Oladiipo and Olotu, 2006 [31]
Ijaw females	78.24 \pm 6.33	37	Oladiipo and Olotu, 2006 [31]
Igbo males	79.04 \pm 5.75	53	Oladiipo and Olotu, 2006 [31]
Igbo females	76.83 \pm 4.94	47	Oladiipo and Olotu, 2006 [31]
Urhobo males	86.50 \pm 9.06	250	Oladiipo and Paul, 2009 [32]
Urhobo females	87.09 \pm 11.30	250	Oladiipo and Paul, 2009 [32]
Itsekiri males	94.41 \pm 34.44	250	Oladiipo and Paul, 2009 [32]
Itsekiri females	82.16 \pm 44.74	250	Oladiipo and Paul, 2009 [32]
Ogoni males	111.18 \pm 10.28	400	Oladiipo et al., 2009 [16]
Ogoni females	75.09 \pm 7.09	400	Oladiipo et al., 2009 [16]
Yoruba males	72.12 \pm 4.78	493	Present study
Yoruba females	73.75 \pm 5.13	527	Present study

SD: standard deviation; N: sample size.

The mean cephalic index was 72.12 (SD = 5.41). The mean cephalic indices of males and females were (75.02 (SD = 4.78) and 73.75 (SD = 5.13).

The head breadth, head length, and cephalic index between males and females were tested for significance. The mean difference in the head length, head breadth, and cephalic index (CI) between males and females was statistically significance ($P < 0.05$). Table 5 represents the cephalic indices of various ethnic groups previously investigated. A large number of them are Nigerian ethnic groups. Characteristic cephalic indices could be observed in the table for different populations.

4. Discussion

In the present study, the mean cephalic indices of Yoruba males and females resident in Port Harcourt are 75.02 \pm 4.76 and 73.75 \pm 5.13, respectively. Thus, the Yoruba males fall within the mesocephalic head type while females are within the dolicocephalic type. The Yoruba population irrespective of gender with cephalic index of 72.12 \pm 5.41 could be classified as dolicocephalic head type. The size of cephalic index varies significantly in different geographical zones. In tropical zones head form is longer (dolicocephalic) but in temperate zones, head form is more round (mesocephalic).

or brachycephalic [26]). Thus, the present classification of Yorubas (dolicocephalic) as observed in our study is in line with variations of cephalic index according to different geographical zones as reported by Bharati et al. [26].

Kondo et al. [27] showed that the head breadth will reach maximum at age of 14. They also showed that, in Japanese population, brachycephalization and secular changes in head length occur [27]. As previously reported, genetic and environmental factors account largely for variations in head shapes [4, 23, 24, 28]. We postulate based on our observations (Table 5) that the head type observed for Yorubas in comparison with other populations within Sub-Saharan region is a true reflection of their location, Tropical Region of West Africa. Further investigation with larger population is however needed to establish this fact. Sparks and Jantz [29] however showed that there is a relatively high genetic component of head shape. This explains the different types of head shape seen in genders of the Yorubas.

5. Conclusion

The results of present survey show that, in general, the Yoruba people can be classified as dolicocephalic. There is however sexual dimorphism ($P < 0.05$) with males showing higher cephalic index than females (males 75.02, mesocephalic, and females 73.75, dolicocephalic). Besides, this study reveals dolicocephalization tending towards mesocephalization occurs amongst Yorubas. From the foregoing, the race but not gender of the deceased may be determined with head measurement. The overlapping distribution of head shape between males and female makes sex determination from the present study impossible. The knowledge from this study can be of great importance to anthropologist as well as forensic scientist. The values obtained here can also be of great importance to plastic surgeons when reconstructive surgery is essential. This study should be considered in forensic investigations and appropriate clinical practices.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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