

Title: Measurements of Head Circumference, Intercanthal Distances, Canthal Index and Circumference Interorbital Index of Ikwerre School Children in Nigeria

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Abstract

The study was aimed at determining standard values for head circumference, inner canthal distance, outer canthal distance, canthal index and circumference interorbital index of Ikwerre school children between the ages of 3-18 years.

The measurements of head circumference, inner and outer canthal distances, canthal index and circumference interorbital index were obtained from a randomly selected sample size of one thousand, five hundred and twenty-three(1523) children, Seven hundred and sixty-four males(764) and Seven hundred and fifty-nine females(759).

The mean values for male subjects (10.45±4.61 years) were found to be, 52.42±2.22cm for head circumference, 3.39±0.30cm for inner canthal distance, 9.118±0.65cm for outer canthal distance, 37.00±2.48 for canthal index and 6.84±0.47 for circumference interorbital index.

The mean values for female subjects (11.00±4.62years) were found to be 51.95±2.18cm for head circumference, 3.38±0.33cm for inner canthal distance, 9.31±0.75cm for outer canthal distance, 36.46±3.11cm for canthal index and 6.51±0.54cm for circumference interorbital index.

Statistical analysis using z-test showed that males had significantly higher values than the females in all the parameters measured ($p < 0.05$), except inner canthal distance where there was no significant difference ($p > 0.05$) showing some form sexual dimorphism

The knowledge of these values are important because normal values of head circumferences, inner and outer canthal distances, canthal index and circumference interorbital index are useful parameters in the evaluation and treatment of congenital or post traumatic deformities of the cephalic and facial regions such as telecanthus, ocular hypotaylorism and craniosynostosis.

Key Words: Head circumference, inner canthal distance, outer canthal distance, canthal index, circumference interorbital index and Ikwerre

Introduction

Ikwerre is one of the major ethnic groups of Rivers State of Nigeria. It consists of five local government areas: Ikwerre, Emuoha, Obio Akpo, Port Harcourt South and Port Harcourt North local government areas. It has population of about 980,000(Census,1991).

The standard proportion for the human head can help to place facial features and finds their orientation (Larman, 2008; Jefferson, 2004). However, facial proportion changes with age and sex in a given race as a result of variation in skeletal dimensions, muscle development and are dependent on environmental factors such as diet, health and climatic influences which are important determinants of growth and development (Francis,2000).

Head circumference can be used to determine the rate of growth of children and also give a clue about the development of a child's brain. In a study carried out by Bolduc and Shevell (2005) corrected head circumference centiles were used as possible predictors of developmental performance in high-risk neonatal intensive care unit survivors.

A study carried out by Everklioglu *et al.* (2001) on head circumference, inner canthal distance, outer canthal distance, canthal index and circumference interorbital index has been useful to clinicians in description, diagnosis and surgical treatment of abnormal skeletal and facial pattern.

Saheeb *et al.* (2004) conducted a study on normal values for medial and lateral canthal distances in 3 to 18 year old Nigerians, comprising of 468 males and 408 females. The values for Nigerians were compared with those of

Caucasians, the mean value for medial canthal distance was slightly higher in Nigerian males compare to their Caucasian counterparts and the difference was significant ($p < 0.05$).

Oladipo et al. (2008) compared the canthal indices of Ijaw and Igbo tribes of Nigeria and reported the mean canthal index to be 37.04 and 32.59 in Ijaw and Igbo males respectively

It is a useful tool in medical genetics, because many of the syndromes present at birth involve the head and the face, so this can assist clinicians to describe what they see. Children with distinctive craniofacial phenotype are usually associated with microcephaly, mental retardation and short stature (Goncalves and Rojas, 2000)

However no study on the facial parameters studied in relations to head circumference of children and adolescents of the ethnic group under investigation has been carried out before now. Thus the study was aimed at documenting the studied facial parameters and head circumference of this ethnic group, which could be of important in anthropological study, forensic medicine and clinical practice (plastic surgery and orthodontics).

Materials And Methods

In this study a total number of 1523 children (764 males and 759 females) within the age range of 3-18 years with normal craniofacial configuration and no history of neurological disease, developmental disability, hydrocephalus, strabismus, oculofacial trauma and clinically manifested telecanthus or epicanthus were recruited from nursery, primary and post primary schools of the Ikwerre communities in Rivers State.

Head circumference was obtained by placing a measuring tape on the occipital prominence and the supraorbital ridges.

The intercanthal distances were measured using a meter rule. The inner canthal distance was measured with the meter rule held tightly against the bridge of the subject's nose; it is the measure between the medial palpebral fissures of the two eyes. While the outer canthal distance the subject is made to look upwards, this was to minimize the error between the skin and the sclera and measurement is between the lateral palpebral fissures of the two eyes.

The canthal index was calculated mathematically by $(100 \times \text{inner canthal distance} / \text{outer canthal distance in centimeters})$ (Anderson, 1945).

The circumference interorbital index (CI-I) is calculated mathematically by $(100 \times \text{inner canthal distance in centimeters} / \text{head circumference in centimeters})$. The data was subjected to statistical analysis using z-test at significant level of 0.05

Results

The results of this study are shown in Tables 1-3 and figure 1. The mean and standard deviation values for head circumferences, inner canthal distance, outer canthal distance, canthal index and circumference interorbital index of Ikwerre children and adolescents were arranged in age groups of one interval (table 1-2). Table 3 shows a z-test comparison of head circumference, inner canthal distance, outer canthal distance, canthal index and circumference interorbital index of male and female subjects. Figure 1 show a graph of comparison of the head circumference of male and female subjects.

The highest mean for head circumference was found to both at age 18 in males and females. The highest mean for inner canthal distance was found at age 18 in males and age 15 in female. The highest mean for outer canthal distance in males is at age 18 and a female is at age 18. The highest mean values for canthal index in males is at age 10 and females at age 15. While the highest mean for circumference interorbital index for at age 18 in males and female at age 15

Discussion

In this study the predictive value of head circumference, inner canthal distance, outer canthal distance is to compare the craniofacial anatomy of age group between 3-18 years in both males and females school children of Ikwerre ethnic group of Nigeria. This age ranged was chosen because measurements become stable in the mid to late twenties (Roy, 1985; Pryor, 1969; Fledelius and Stubgard, 1986).

Head circumferences measurements are highly valuable for recognizing pathology associated with delay or impaired head growth (Oyedeyi et al., 1997). In a research carried out by Oyedeyi et al., 1997 in Western Nigeria on the head circumference of 644 nourished and malnourished Nigerian children, a relationship was established between the head circumference of growing children and nutrition (Oyedeyi et al., 1997)

In this study, the mean values for males subjects were 52.42 ± 2.22 cm for head circumference, 3.39 ± 0.30 cm for inner canthal distance, 9.18 ± 0.65 cm for outer canthal distance, 37.00 ± 2.48 for canthal index, 6.48 ± 0.48 for circumference interorbital index. And those of female subjects were 51.95 ± 2.18 cm, 3.38 ± 0.33 cm, 9.31 ± 0.75 cm, 6.34 ± 0.48 and 6.51 ± 0.54 respectively.

The values obtained from this study are similar to the result from a previous study by Evereklioglu et al. (2001), who reported normal values for children in a Turkish population with Males having mean value of 53.25 ± 2.26 cm for head circumference, 30.01 ± 2.51 mm for inner canthal distance, 85.77 ± 4.08 mm, for outer

canthal distance 34.98 ± 2.39 mm, and 5.65 ± 0.44 for circumference interorbital index. The corresponding values for females were 53.57 ± 2.19 cm, 30.02 ± 2.53 mm, 86.19 ± 4.13 mm, 34.82 ± 2.42 and 5.60 ± 0.43 respectively. Freihorfer (1980); Murphy and Laskin (1990) reported the mean inter canthal distance in black population to be 31.2 ± 2.5 mm and 33.9 ± 3.0 mm respectively, which is similar to our findings in this study. Observation in the study showed that craniofacial parameters were larger in males than in the female subjects ($P < 0.05$), except inner canthal distance where no difference was observed.

Conclusion

The result of this study has helped to establish the mean values for head circumference, intercanthal distances, canthal index and circumference interorbital index for Ikwerre children in Nigeria. Normal values of head circumference, inner canthal and outer canthal distances can be used by clinicians in the evaluation and treatment of congenital or post traumatic deformities of cephalic and facial regions. The results of this study could also be used for anthropometric and forensic purposes.

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Table 1. Mean and Standard deviation values for Head circumference, intercanthal distances, canthal index and circumference interorbital index for male subjects.

Age(yrs.)	n	HC(cm) Mean \pm SD	IC(cm) Mean \pm SD	OC(cm) Mean \pm SD	CI(cm) Mean \pm SD	CI-I(cm) Mean \pm SD
3	48	49.94 \pm 1.723	3.08 \pm 0.249	8.61 \pm 0.590	35.85 \pm 2.648	6.17 \pm 0.458
4	49	50.05 \pm 1.482	3.10 \pm 0.225	8.62 \pm 0.563	36.04 \pm 2.784	6.19 \pm 0.392
5	49	50.29 \pm 1.953	3.14 \pm 0.252	8.66 \pm 0.534	36.31 \pm 2.748	6.25 \pm 0.496
6	48	51.28 \pm 1.441	3.30 \pm 0.251	8.91 \pm 0.567	37.05 \pm 2.627	6.43 \pm 0.456
7	46	51.58 \pm 1.340	3.34 \pm 0.217	8.83 \pm 0.557	37.92 \pm 0.275	6.48 \pm 0.419
8	49	52.36 \pm 2.109	3.30 \pm 0.228	9.05 \pm 0.513	36.49 \pm 0.369	6.30 \pm 0.437
9	47	52.24 \pm 1.608	3.35 \pm 0.273	9.13 \pm 0.565	36.76 \pm 0.332	6.41 \pm 0.474
10	48	52.34 \pm 1.763	3.51 \pm 0.223	9.12 \pm 0.500	38.57 \pm 0.219	6.71 \pm 0.397
11	49	53.09 \pm 1.510	3.55 \pm 0.252	9.34 \pm 0.564	38.01 \pm 0.295	6.69 \pm 0.474
12	48	53.19 \pm 1.633	3.58 \pm 0.195	9.19 \pm 0.407	36.78 \pm 0.303	6.36 \pm 0.337
13	49	52.99 \pm 1.451	3.56 \pm 0.286	9.36 \pm 0.394	38.07 \pm 0.286	6.72 \pm 0.512
14	48	52.96 \pm 1.675	3.50 \pm 0.235	9.44 \pm 0.514	37.08 \pm 0.310	6.61 \pm 0.414
15	47	53.63 \pm 1.249	3.45 \pm 0.240	9.24 \pm 0.410	37.33 \pm 0.321	6.43 \pm 0.386
16	46	53.97 \pm 1.505	3.48 \pm 0.234	9.51 \pm 0.336	36.62 \pm 0.274	6.45 \pm 0.352
17	44	54.30 \pm 1.237	3.59 \pm 0.196	9.72 \pm 0.370	36.98 \pm 0.257	6.61 \pm 0.343
18	49	55.27 \pm 1.721	3.74 \pm 0.254	10.20 \pm 0.466	36.70 \pm 0.335	6.77 \pm 0.394

Table 2: Mean and Standard deviation values for Head circumference, intercanthal distance, canthal index and circumference interorbital index for female subjects

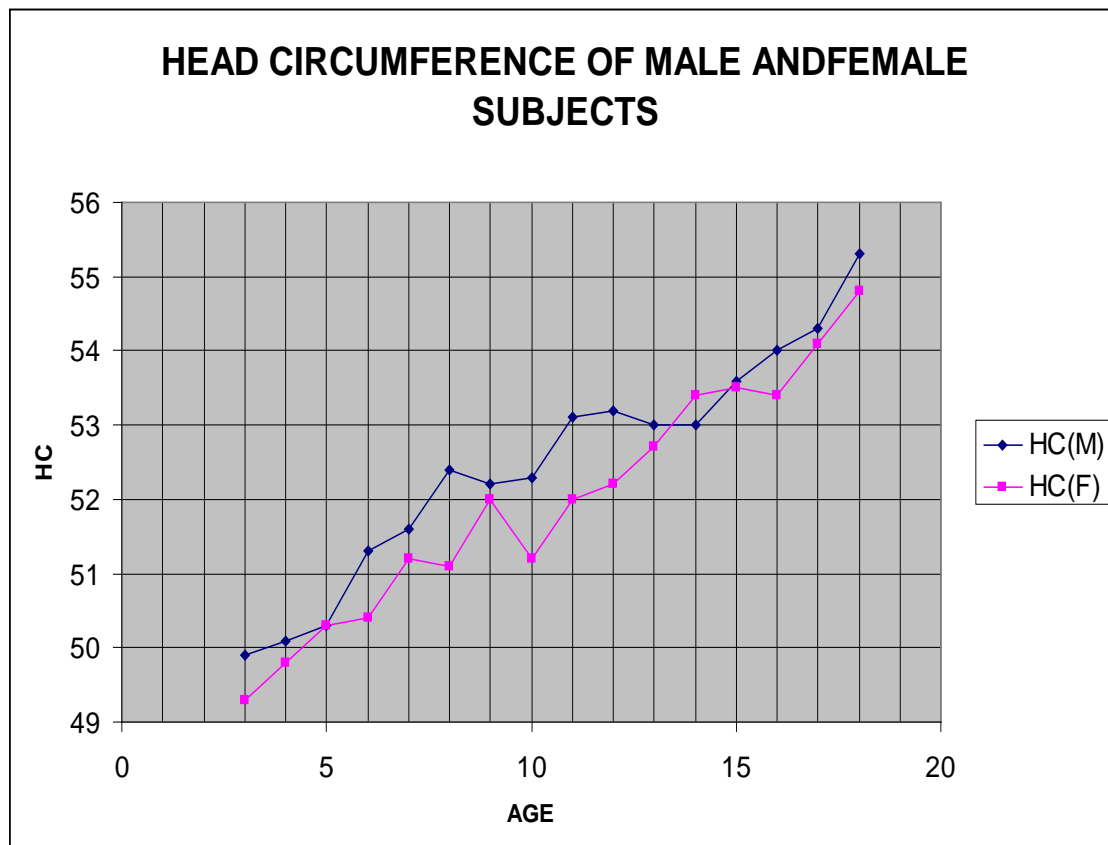
Age(yrs.)	n	HC(cm) Mean \pm SD	IC(cm) Mean \pm SD	OC(cm) Mean \pm SD	CI(cm) Mean \pm SD	CI-I(cm) Mean \pm SD
3	47	49.25 \pm 1.649	3.05 \pm 1.649	8.53 \pm 0.565	35.84 \pm 2.852	6.19 \pm 0.4620
4	47	49.77 \pm 1.508	3.01 \pm 0.270	8.60 \pm 0.557	35.08 \pm 2.596	6.06 \pm 0.5123
5	48	50.30 \pm 1.685	3.10 \pm 0.310	8.83 \pm 0.687	35.23 \pm 3.726	6.17 \pm 0.6173
6	46	50.42 \pm 1.398	3.31 \pm 0.299	9.00 \pm 0.708	36.92 \pm 3.683	6.57 \pm 0.5924
7	49	51.21 \pm 1.712	3.29 \pm 0.265	9.14 \pm 0.662	36.15 \pm 3.234	6.43 \pm 0.4714
8	48	51.06 \pm 1.683	3.29 \pm 0.246	9.33 \pm 0.696	35.37 \pm 3.159	6.44 \pm 0.4617
9	48	52.00 \pm 1.915	3.36 \pm 0.246	9.34 \pm 0.701	36.08 \pm 2.983	6.45 \pm 0.4263
10	49	51.18 \pm 1.712	3.26 \pm 0.285	9.10 \pm 0.592	35.88 \pm 2.795	6.37 \pm 0.4785
11	46	51.96 \pm 1.801	3.45 \pm 0.222	9.44 \pm 0.669	36.71 \pm 2.852	6.65 \pm 0.4130
12	47	52.21 \pm 1.202	3.49 \pm 0.291	9.51 \pm 0.622	36.74 \pm 2.128	6.68 \pm 0.5928
13	46	52.72 \pm 1.161	3.55 \pm 0.249	9.60 \pm 0.765	37.06 \pm 2.604	6.73 \pm 0.4303
14	45	53.38 \pm 1.030	3.60 \pm 0.351	9.69 \pm 0.574	37.19 \pm 3.385	6.74 \pm 0.6212
15	48	53.48 \pm 1.378	3.65 \pm 0.214	9.65 \pm 0.716	37.92 \pm 2.649	6.83 \pm 0.4558
16	49	53.38 \pm 1.491	3.54 \pm 0.289	9.56 \pm 0.630	37.12 \pm 3.053	6.63 \pm 0.5006
17	48	54.07 \pm 1.309	3.57 \pm 0.226	9.53 \pm 0.497	37.52 \pm 1.978	6.60 \pm 0.3931
18	48	54.80 \pm 1.593	3.59 \pm 0.263	10.04 \pm 0.649	35.89 \pm 3.295	6.56 \pm 0.5123

HC=Head Circumference,IC= Inner Canthal Distance ,OC=Outer Canthal Distance,CI=Canthal Index and C-II=Circumference Interorbital Index.

Table3: Z-test comparison of the head circumference intercanthal distances, canthal index and circumference interorbital index of male and female subjects

Parameters	Subject class	Inference
Head Circumference	Males vs. Females	Significant($p < 0.05$)
Inner canthal distance	Males vs. Females	Not Significant($p > 0.05$)
Outer canthal distance	Males vs. Females	Significant($p < 0.05$)
Canthal Index	Males vs. Females	Significant($p < 0.05$)
Circumference interorbital index	Males vs. Females	Significant($p < 0.05$)

Figure1: Graph showing comparison of head circumference of male and female subjects



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