# Measurements of Head Circumference, Near Interpupillary Distance and Distant Interpupillary Distance of Ikwerre School Children in Nigeria

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**Abstract:** The study aimed at determining standard values for head circumference, near interpupillary distance and distant (far) interpupillary distance of Ikwerre school children between the ages of 3-18 years. The measurements of head circumference, near interpupillary distance and distant (far) interpupillary distance were obtained from a randomly selected sample size of one thousand, five hundred and twenty-three (1523) children comprising seven hundred and sixty-four (764) males and seven hundred and fifty-nine (759) females. The mean values for male subjects (10.45±4.61 years) were found to be 52.42±2.22cm for head circumference, 5.76±0.45cm for near interpupillary distance and 6.38±0.45cm for distant interpupillary distance. The mean values for female subjects (11.00±4.62years) were found to be 51.95±2.18cm for head circumference, 5.72±0.47cm for near interpupillary distance and 6.34±0.48cm for distant interpupillary distant. Also mean values were obtained for different ages. Statistical analysis using z-test showed that males had significantly higher values than the females in head circumference measurement ($p<0.05$) but no significant difference was found in near and distant interpupillary distance ($p>0.05$).The knowledge of these values are important because normal values of head circumferences, near interpupillary distance and distant interpupillary distant are useful parameters in the evaluation and treatment of congenital or post traumatic deformities of the cephalic and facial regions.

**Keywords:** Head circumference, Near interpupillary distance, Distant interpupillary distance, Ikwerres, School children.

## INTRODUCTION

Ikwerre is one of the major ethnic groups of Rivers State of Nigeria. It consist 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.

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 [1]. In a study carried out by Bolduc and Shevell [2] corrected head circumference centiles are used as possible predictors of development performance in high-risk neonatal intensive care unit survivors.

Fledelius and Stubgaard [3] studied European Caucasians aged 5 to 80 years and measured distant interpupillary distance using ordinary meter rule. They found out that the rate of interpupillary changes was higher in subjects less than twenty years of age. Osuobeni and Faden [4]; Osuobeni and Al-Musa [5] obtained normal values for both far and near interpupillary distance between inner and outer limbus using a meter rule, for male children (11.87±2.87yrs), 57.43±1.46cm for head circumference, 58.79±2.97mm for near interpupillary distance and 62.10±3.23mm for distant interpupillary distant. In females (11.72±2.75yrs), 56.57±1.24cm for head circumference, 58.16±3.46mm for near interpupillary distance and 61.26±3.66mm for distant interpupillary distance.

A study carried out by Everklioglu *et al*. [6] on head circumference, near interpupillary distance and distant interpupillary distance has been useful to clinicians in description, diagnosis and surgical treatment of abnormal skeletal and facial pattern.

This study was carried out to provide data for head circumference, near interpupillary distance and distant interpupillary distance for Ikwerre Children which has not been documented till date. The data would be vital in forensic medicine, anthropological studies, and clinically in nasal surgery.

## 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

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E-ISSN: 2410-2806/16 

disability, hydrocephalus, strabismus, occulofacial trauma and clinically manifested telecanthus or epicanthus were recruited from nursery, primary and post primary schools of the Ikwerre communities in Rivers State. Informed consent was obtained from the guardians of these children.

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

Distant and near interpupillary distance measurement were performed according to modified Viktorin's method [7] by using a centimeter rule. For near interpupillary distance, the examiner right eye was closed, while subject fixated a finger held up to the open left eye of the examiner. The zero mark on the rule was placed on the (temporal) limbus margin of subjects right eye and the examiner see with the open left eye the point of the ruler that correspond to the inner limbus of the subject left eye. The examiner closes the left eye and asks the subject to look at the examiner's opened right eye moving the fixation finger to the open right eye. This make both eyes to move to the right as result the zero mark of the rule is no longer aligned with the outer (temporal) limbus of the subject's left eye, measurement of the new position of the nasal limbus of the subject's left eye is taken by this measurement.

Cotton wool and methylated spirit were used to clean the metre rule to avoid spread of infections.

## RESULTS

The results of this study is shown in Tables **1-3**, The mean and standard deviation values for head circumferences, near interpupillary distance and distant interpupillary distance of Ikwerre children and adolescents were arranged in age groups of one interval (Tables **1-2**). Table **3** shows a z-test comparison of head circumference, near interpupillary distance and distant papillary distance of male and female subjects.

The highest mean for head circumference was observed at age 18 in males with mean value of 55.27±1.721cm and at age 18 in females with mean value of 54.80±1.593cm. The highest mean for near interpupillary distance was found at age 18 in males with mean value of 6.25±0.323cm and age 15 in females with mean value of 6.18±0.265cm. The highest mean for distant interpupillary distance in males is at age 18 with mean value of 6.84±0.335cm and in

**Table 1: Mean and Standard Deviation (SD) Values for Head Circumference (HC), Near Interpupillary Distant (NIPD) and Distant Interpupillary Distance (DIPD) for Male Subjects**

| Age (yrs.) | n | HC (cm) Mean ±SD | NIPD (cm) Mean±SD | DIPD (cm) Mean±SD |
|---|---|---|---|---|
| 3 | 48 | 49.94±1.723 | 5.21±0.311 | 5.83±0.327 |
| 4 | 49 | 50.05±1.482 | 5.21±0.230 | 5.83±0.307 |
| 5 | 49 | 50.29±1.953 | 5.36±0.338 | 5.96±0.318 |
| 6 | 48 | 51.28±1.441 | 5.47±0.307 | 6.13±0.297 |
| 7 | 46 | 51.58±1.340 | 5.55±0.337 | 6.22±0.275 |
| 8 | 49 | 52.36±2.109 | 5.66±0.261 | 6.30±0.369 |
| 9 | 47 | 52.24±1.608 | 5.70±0.344 | 6.31±0.332 |
| 10 | 48 | 52.34±1.763 | 5.77±0.233 | 6.40±0.219 |
| 11 | 49 | 53.09±1.510 | 5.95±0.271 | 6.56±0.295 |
| 12 | 48 | 53.19±1.633 | 5.90±0.298 | 6.46±0.303 |
| 13 | 49 | 52.99±1.451 | 6.02±0.247 | 6.64±0.286 |
| 14 | 48 | 52.96±1.675 | 6.05±0.252 | 6.65±0.310 |
| 15 | 47 | 53.63±1.249 | 6.00±0.346 | 6.60±0.321 |
| 16 | 46 | 53.97±1.505 | 6.10±0.243 | 6.73±0.274 |
| 17 | 44 | 54.30±1.237 | 6.18±0.242 | 6.76±0.257 |
| 18 | 49 | 55.27±1.721 | 6.25±0.323 | 6.84±0.335 |

**Table 2: Mean and Standard Deviation (SD) Values for Head Circumference (HC), Near Interpupillary Distant (NIPD) and Distant Interpupillary Distance (DIPD) for Female Subjects**

| Age (yrs.) | n | HC (cm) Mean ±SD | NIPD (cm) Mean±SD | DIPD (cm) Mean±SD |
|---|---|---|---|---|
| 3 | 47 | 49.25±1.649 | 5.00±0.316 | 5.60±0.346 |
| 4 | 47 | 49.77±1.508 | 5.16±0.333 | 5.75±0.305 |
| 5 | 48 | 50.30±1.685 | 5.29±0.308 | 5.90±0.303 |
| 6 | 46 | 50.42±1.398 | 5.41±0.234 | 6.06±0.279 |
| 7 | 49 | 51.21±1.712 | 5.46±0.289 | 6.05±0.307 |
| 8 | 48 | 51.06±1.683 | 5.54±0.199 | 6.22±0.236 |
| 9 | 48 | 52.00±1.915 | 5.73±0.331 | 6.26±0.323 |
| 10 | 49 | 51.18±1.712 | 5.65±0.282 | 6.28±0.309 |
| 11 | 46 | 51.96±1.801 | 5.86±0.307 | 6.50±0.280 |
| 12 | 47 | 52.21±1.202 | 6.00±0.338 | 6.62±0.317 |
| 13 | 46 | 52.72±1.161 | 6.03±0.344 | 6.64±0.364 |
| 14 | 45 | 53.38±1.030 | 6.10±0.309 | 6.74±0.324 |
| 15 | 48 | 53.48±1.378 | 6.18±0.265 | 6.81±0.263 |
| 16 | 49 | 53.38±1.491 | 6.02±0.312 | 6.62±0.333 |
| 17 | 48 | 54.07±1.309 | 6.08±0.327 | 6.66±0.350 |
| 18 | 48 | 54.80±1.593 | 6.05±0.309 | 6.65±0.307 |

The head circumference of the males was significantly higher than that of the females (P<0.05). Concurrently the near interpupillary distance and the distance interpupillary distance of the males were insignificantly (P>0.05) higher than that of the females (Table **3**).

females at age 15 with mean value of 6.81±0.263cm (Tables **1-2**).

**Table 3: Z-Test Comparison of the Head Circumference, Near Interpupillary and Distant Interpupillary Distances of Male and Female Subjects**

| Parameters | Subject Class | Inference |
|---|---|---|
| Head Circumference | Males vs. Females | Significant (p<0.05) |
| Near interpupillary distance | Males vs. Females | Not significant (p>0.05) |
| Distance interpupillary distance | Males vs. Females | Not significant (p>0.05) |

## DISCUSSION

In this study the predictive value of head circumference, near interpupillary distance and distant interpupillary distance is to compare the craniofacial anatomy of age group between 3-18 years in both males and females adolescents of the Ikwerre ethnic group of Nigeria. This age range was taken because measurements become stable in the mid to late twenties [8-9, 3].

Head circumferences measurements are highly valuable for recognizing pathology associated with delay or impaired head growth [10]. In the research carried out by Oyedeji *et al*. [10], 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 [10].

The mean values for male subjects (10.45±4.61yrs), (52.42±2.22cm) for head circumference, (5.76±0.45cm) for near papillary distance and (6.38±0.45cm) for distant interpupillary distance and that for female subjects were (11.00±4.26yrs), (51.95±2.18cm) for head circumference, (5.72±0.47cm), for near interpupillary distance and (6.34±0.48cm) distant interpupillary distance in this study are similar to that of Osuobeni and Faden [4]; Osuobeni and Al-Musa [5] who obtained normal values for both far and near interpupillary distance between inner and outer limbus using a meter rule, for male children (11.87±2.87yrs), 57.43±1.46cm for head circumference, 58.79±2.97mm for near interpupillary distance and 62.10±3.23mm for distant interpupillary distant. In females (11.72±2.75yrs), 56.57±1.24cm for head circumference, 58.16±3.46mm for near interpupillary distance and 61.26±3.66mm for distant interpupillary distance.

The values obtained from this study are also similar to the result from a previous study by Evereklioglu *et al*.

[6] who reported mean values of craniofacial dimensions of normal children in Turkish population as, males (11.55±2.85 years) for head circumference to be 53.25±2.26cm, near interpupillary distance of 56.17±3.38mm and distant interpupillary distance of 58.94±3.49mm and the corresponding values for females were (11.56years), 53.57±2.19cm for head circumference, near interpupillary distance of 56.45±3.39mm and distant interpupillary distance of 59.26±3.56mm. The similarities obtained in this study and previous studies can be attributed to the similarities in the age while the differences are due to ethnic difference.

In our study, males had significantly higher values than the females in head circumference ($p<0.05$) but no significant difference was found in near and distant interpupillary distance ($p>0.05$). These values, though similar in sequence to previous studies, are distinct and peculiar to Ikwerre children.

## CONCLUSION

This study has helped to establish the mean values for head circumference, near interpupillary distance and distant interpupillary distance for Ikwerre children in Nigeria.

Normal values of head circumference, near interpupillary distance and distant interpupillary distance can be used by clinicians in the evaluation and treatment of congenital or post traumatic deformities of cephalic and facial regions.

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Received on 04-08-2016 Accepted on 13-12-2016 Published on 20-12-2016

http://dx.doi.org/10.15379/2410-2806.2016.03.02.02