# Asian Journal of Scientific Research

ISSN 1992-1454

science alert
http://www.scialert.net

ANSInet
an open access publisher
http://ansinet.com

Asian Journal of Scientific Research 5 (3): 178-184, 2012
ISSN 1992-1454 / DOI: 10.3923/ajsr.2012.178.184


# Cephalic Anthropometry of Ndi Igbo of Abia State of Nigeria

U.G. Esomonu and M.I. Badamasi
Department of Anatomy, Bayero University Kano, Nigeria

*Corresponding Author: U.G. Esomonu, Department of Anatomy, Bayero University Kano, Nigeria*

## ABSTRACT

The aim of the present work was to determine some relevant cephalic parameters, in relation to sex and age and to study the distribution of basic head types among Ndi Igbo of Abia state indigenes of Nigeria. The study sample comprised 600 subjects of both sex (300 male and 300 female) aged 7 to 40. They were grouped into adults, young adults and children. Fronto occipital circumference, head length and head breadth were measured and the cephalic index was calculated for all groups. Significant differences were found in some of the measured variables. Higher significant values in males were observed in the fronto-occipital circumference in age group 16-25 years (young adults) and in the overall group. Males also recorded higher significant value in the maximum head length in children, adults and in the overall group. Maximum head breadth value for females was significantly higher in young adults (16-25 years) while in the adult group it was significantly higher in male. Cephalic index values for the females were significantly higher in the overall group, in children and in adults but in the young adult group, the male value was significantly higher. According to the cephalic index, male values revealed that dolicocephalic type was dominant in children; brachycephalic type was dominant in young adults while in adults mesocephally was dominant. In females the dominant head type was brachycephaly in all age groups. The data collected will be of utmost importance in forensic medicine, anthropology and in genetics.

**Key words:** Ndi Igbo, fronto-occipital circumference, head length, head breadth, cephalic index

## INTRODUCTION

The study of the cephalic relations and variations in man has long been used to differentiate various racial groups in physical anthropology. Morphology features of different races and ethnic groups have been shown to appear in geographic clusters (Argyropoulos and Sassouni, 1989). Conducting anthropometrical studies with the aim of obtaining the characteristics of ethnical groups inhabiting a particular geographical region, not only assist in understanding the frequency distribution of human morphologies but also in providing the basis for a comparison among different races (Golalipour *et al*., 2003, 2005; Everekliogluet *et al*., 2002). Also cephalometry is helpful in identification, head and face reconstruction, plastic surgery, oral and maxillofacial surgery, orthodontics and clinical diagnosis and treatment planning (Soames, 1995).

There are publications that have highlighted the cephalofacial anthropometry of the various Nigerian ethnic groups. Some of them concentrate on foetuses and revealed that the fetal skulls were mesocephalic in the early weeks and brachycephalic at term (Mador *et al*., 2010). Others worked on newborns or infants (Danborno *et al*., 2008; Garba *et al*., 2008) or on specific regions of the cephalofacial framework (Oladipo *et al*., 2009; Charles *et al*., 2008; Anas and Esomonu,

2008; Esomonu *et al*., 2011; Maina *et al*., 2011). Irrespective of these, publications among the Igbo ethnic group of Nigeria are few. Recognition of these factors has given encouragement for this study.

Abia people are of the Igbo ethnic group who predominates much of the South eastern part of Nigeria. Their traditional language is Igbo. Abia's 2.4 million people are mainly Christians and entrepreneurial. They are known and reputed to be industrious, highly market oriented, very hospitable and accommodating, probably due to their migratory nature. Abia state was carved out of the former Imo State in 1991 (Enensha, 1995).

The objectives of the present study include documenting the anthropometric variation pattern and establishment of standards for the following cephalic values among Ndi Igbo of Abia state of Nigeria: Fronto-occipital circumference, Head length, Head width and Cephalic index with advancing age and to study the distribution of basic head types particularly in relation to sex and age.

## MATERIALS AND SUBJECT

**Sample size:** The subjects are from Abia state of Nigeria, which is one of the five states of Nigeria where the Igbo ethnic group is dominant. In this cross-sectional extensive study, the subjects were invited to participate if they met the following criteria: Age 7 through 40 years, Normal craniofacial configuration, No known history of neurologic disease, No Developmental disability, No oculofacial trauma, No Craniofacial congenital anomaly, Both parents must come from Abia state.

After informed consent had been obtained, the following measurements were made:

- Fronto-occipital circumference
- Head length
- Head width

A total number of six hundred subjects were selected. The sample size comprised of 100 males and 100 females for each group comprising of:

- Adults (26-45 years)
- Young adults (16-25 years)
- Children (7-15 years)

### Measurements

**Fronto-occipital circumference:** A non-stretchable plastic tape was used for the measurement of fronto-occipital circumference. Maximal fronto-occipital circumference was obtained by placing the tape just on the occipital prominence and the supraorbital ridges while an assistant viewed the subject laterally. Subjects with obstructive hairstyles were avoided.

**Head length and breadth:** All the measurements were taken with the subjects sitting on the chair with head in anatomical position and the measurements were taken to the nearest 1 mm. The head length was measured with a spreading calliper from glabella to Inion. Glabella is a point above the nasal root between the eyebrows and intersected by mid sagittal plane while the Inion is the distal most point placed on the external occipital protuberance in the mid sagittal plane.

Head breadth was measured as the maximum transverse diameter between the two euryons using a spreading calliper. The Euryon is the lateral most point as the calliper is placed on the side of the head.

**Cephalic index:** Cephalic index was calculated based on the formula given below (Soames, 1995):

$$\text{Cephalic index} = \frac{\text{Head width}}{\text{Head length}} \times 100$$

| Head shape | Cephalic index range (%) |
|---|---|
| Dolicocephalic | CI < 74.9 |
| Mesocephalic | 75<CI<79.9 |
| Brachiocephalic | 80<CI<84.9 |
| Hyperbrachiocephalic | 85<CI<89.9 and CI>89.9 |

**Statistical analysis:** Statistical analysis was carried out using student t-test to compare the measured parameters between the males and the females. The differences were accepted as significant when $p<0.05$. The analysis was carried out using SPSS version 16.

## RESULTS

Mean values, standard deviation, two-tailed significance are shown in Table 1. Some of the variables have equivalent proportions between the sexes while others appear to be sexually dimorphic relative to the age group.

Analysis of the parameters in Table 1 showed statistically significant differences ($p<0.05$) between males and females in the anthropometrical measurements used to characterize the cephalic region. Higher significant values of 57.01±1.5 cm was observed in males in the fronto-occipital circumference in age group 16-25 years (young adults) while in the overall group, male value of 56.33±2.4 cm was also significantly higher than the female value of 55.86±2.3 cm. Males also recorded higher significant value in the maximum head length in children (male, 19.23±1.2 cm, female 18.82±1.3 cm), adults (male, 19.87±.74 cm, female, 19.47±.66 cm) and in the overall group (male, 19.62±1.1 cm, female, 19.36±1.0 cm). Maximum head breadth value for male which was found to be 16.22±.88 cm was significantly higher than the female value of 15.94±.81 cm recorded in young adults (16-25 years) but in the adult group the maximum head breadth was significantly higher in female (16.11±.69 cm) when compared to their male counterpart which recorded a value of 15.80±.50 cm. Cephalic index values for the females were significantly higher in the overall group (female, 81.41±4.9, male, 80.41±5.5 ), in children (female, 80.95±5.6, male, 79.13±6.1) and in adults (female, 82.83±4.4, male, 79.59±3.1) but in the young adult group, the male value which was found to be 82.71±5.7 was significantly higher than the female value of 80.68±4.4 (Table 1). Head was classified by cephalic index, so that in the overall female group, brachycephalic head type was dominant while dolichocephalic type of head shape was rare (Table 3) but in males mesocephaly head shape was dominant in adults, brachycephaly was dominant in young adults while in children dolichocephaly was the dominant head shape (Table 2).

Table 1: Comparison of fronto-occipital circumference, head length, head breadth, and the cephalic index between males and females groups in Abia state

| Age (year) | FOC (cm) | HL (cm) | HB (cm) | CI |
|---|---|---|---|---|
| **7-15** | | | | |
| Male | 54.10±2.4 | 19.23±1.2$^{C}$ | 15.18±1.10 | 79.13±6.1$^{H}$ |
| Female | 53.87±2.2 | 18.82±1.3$^{C}$ | 15.20±0.98 | 80.95±5.6$^{H}$ |
| **16-25** | | | | |
| Male | 57.01±1.5$^{A}$ | 19.65±0.85 | 16.22±0.88$^{F}$ | 82.71±5.7$^{I}$ |
| Female | 56.34±1.5$^{A}$ | 19.77±0.70 | 15.94±0.81$^{F}$ | 80.68±4.4$^{I}$ |
| **26-40** | | | | |
| Male | 57.72±1.7 | 19.87±0.74$^{D}$ | 15.80±0.50$^{G}$ | 79.59±3.1$^{J}$ |
| Female | 57.53±1.2 | 19.47±0.66$^{D}$ | 16.11±0.69$^{G}$ | 82.83±4.4$^{J}$ |
| **7-40** | | | | |
| Male | 56.33±2.4$^{B}$ | 19.62±1.1$^{E}$ | 15.75±0.95 | 80.41±5.5$^{K}$ |
| Female | 55.86±2.3$^{B}$ | 19.36±1.0$^{E}$ | 15.74±0.92 | 81.41±4.9$^{K}$ |

Values with similar superscript are significant at $p<0.05$

Table 2: Distribution of head shape in male group of Igbos of Abia state

| | Age (year) | | | |
|---|---|---|---|---|
| Head shape | 7-15 | 16-25 | 26-40 | 7-40 |
| Dolichocephaly | 29.7 | 5.1 | 3.1 | 12.3 |
| Mesocephaly | 26.3 | 26.5 | 50.0 | 35.1 |
| Brachycephaly | 27.5 | 33.7 | 40.6 | 34.0 |
| Hyperbrachycephaly | 14.3 | 34.7 | 6.3 | 18.6 |

Table 3: Distribution of head shape in female group of Igbos of Abia state

| | Age (year) | | | |
|---|---|---|---|---|
| Head shape | 7-15 | 16-25 | 26-40 | 7-40 |
| Dolichocephaly | 13.5 | 7.1 | 3.8 | 8.3 |
| Mesocephaly | 31.0 | 35.7 | 26.9 | 31.7 |
| Brachycephaly | 32.0 | 40.8 | 38.5 | 37.0 |
| Hyperbrachycephaly | 23.6 | 16.3 | 30.8 | 23.0 |

## DISCUSSION

The present study revealed the anthropometric variation pattern of the fronto-occipital circumference. In children, young adults and adults the values of 53.84, 56.91 and 57.73 cm were noted in males while female values were 54.12, 56.31 and 57.51 cm, respectively. It is assumed that this increase involves the combined effects of some increase in the bony elements of the cranium via surface apposition or due to increases in muscle mass and the deposition of subcutaneous fat with advancing age. Higher significant values were noted in young adult and adult males. These higher values observed in males might be attributed to the greater but later adolescent growth spurt observed in boys than girls (Largo *et al*., 1978) and because of the longer post-adolescent growth in boys (Bishara *et al*., 1998). The mean head circumference for Omoku ethnic group in Rivers State of Nigeria showed that the Omoku male and female had mean head circumference of 55.72 and 54.89 cm, respectively (Oladipo *et al*., 2011). This study shows that the mean value in male is significantly larger than those of female ($p<0.05$) this is similar to the trend observed in Ndi Igbo from Abia state of Nigeria where the male values of the fronto-occipital circumference were significantly higher than their female counterpart.

Head dimension changes is supposed to follow different prototype in different population however the key feature in the process of head dimension variations is expressed as minute increase in the growth rate in specific direction during infancy and childhood. These increases involve the posterior cranial base and occur in a posterior inferior or lateral direction resulting in significant changes of the vault shape (Kouchi, 2000).

The result obtained revealed that head length, head breadth and cephalic index showed significant difference between male and female. Head length showed significant difference from childhood to adulthood. The difference shown could be due to slight increase in head growth at these ages. Differences shown from young adults to adults could be due to changes in growth at attainment of pubertal age. Male value of 19.53 cm for the overall population of the Igbos is significantly higher than the female value (18.28 cm). This is speculated to be due to the fact that head length is related to posterior growth of the brain and development of super structures (Trinkaus and Lemay, 1982). It is reasonable to deduce that causes of secular changes are different or that reactions to common factors between males and females are different. It has also been was speculated that earlier attainment of adult size reduces the time used for later posterior growth of the head and this leads to shorter cranial length (Kouchi, 2000).

Regarding head breadth significant difference were noted in young adults and in adults. It was observed that the mean head breadth in female was significantly greater than that of male in adults group but in the children group although the value was higher in females statistical test showed insignificant difference between the mean head breadth in children. The higher significant rate observed in females could be due to dominant lateral direction of expanding neural mass by neural fibers in females. In young adults group the male value was significantly higher than the female value.

Another interesting finding is seen in cephalic index where sexual dimorphisms were noted in all age groups (Table 1). Male value for cephalic index was significantly higher in young adult group while females showed higher significant value in children and adult groups. A study on cephalic index carried on subjects from Ogbia tribe of Bayelsa state in the Niger delta region of Nigeria by Eroje *et al.* (2010) revealed that the cephalic index of male was significantly higher than those of female, but unlike in the current study the cephalic index was higher in females, the reason for this difference cannot also be explained but it shows that the sexual dimorphism that exist in the values of cephalic index, is not sex dependant but rather it could be population specific.

It was also observed that the head form in female for all the age group falls under brachycephaly. Whereas in males there was a gradual change in head form from mesocephally in children, brachycephaly in young adult group which transcends back to mesocephally in adult group. However, the predominant head form in males and females as a whole is brachycephaly.

Danborno *et al.* (2008) reported that cephalic index showed no association to boys weight, height and girls height but it showed significant difference to girls weight. This finding according to them provides the basis why mean cephalic index of girls was relatively larger than that of boys as witnessed in the present study.

In the current study the dominant head type in female group was brachycephalic (37.0%) while in males the dominant head type was found to be mesocephalic (35.1%). In both groups dolichocephaly was the rarest (female, 8.3 and male, 12.3%). This is contrary to the revealed work of Salve *et al.* (2011) on the Cephalic Index of Andhra Region (India) in which they reported that the mean cephalic index for male was 75.68±2.05 and for female was 78.20±2.33 and on classifying the head shape types they concluded that the majority of male of Andhra region in India are dolicocephalic or mesocephalic while females are mesocephalic.

A study aimed at comparing craniofacial morphological characteristics of young women (18-25 years old) in two aborigines of Sistani (Fars) and Baluchi who were resident in southeast of Iran were carried out by Heidari *et al.* (2006). They revealed that the mean cephalic indices were 78.4±4.15 and 81.94±4.99 for Sistani and Baluchi women, respectively and when they did the morphological classification of the head according to the cephalic index it was ascertained that among Sistani women the dominant type was mesocephalic with a frequency of 41.3% and the rare type was the hyperbrachycephalic (6%), but brachiocephalic constitutes 31.5% and dolichocephalic head type constitutes 21.3% of the total head types while in Baluchi women the dominant and rare types were brachycephalic 42% and dolichocephalic (5.5%), respectively and the frequency of mesocephalic and hyperbrachycephalic types were 29.5 and 23%, respectively. The frequency distribution of the of the head types as noted in the Baluchi women is similar to the distribution of the head types as noted in the present study.

In Eroje *et al.* (2010) study on Ogba tribe of Bayelsa state in Nigeria, the dominant type of head shape reported was dolichocephalic (66.82%). This finding is similar to the dominant head type observed in children in the present study. We could therefore deduce that the percentage of head types varies in different populations and as shown in the present study, it also varies with age.

This apparent difference in changes of head shape in different populations may be ascribed to differences in the genetic factors which may also act in determining the dominant direction of the growth vectors (Hossain *et al.*, 2005). Although, the precise mechanism driving the processes of differences in cephalofacial dimensions are still subject of debate, it can still be deduced that, social well being or economic development could provide reasons for this variations (Kouchi, 1996). It is also believed that head forms especially brachycephaly have been selected as a consequence of evolutionary forces (Henneberg, 1976).

## CONCLUSION

In conclusion, the present study documents the anthropometric variation pattern of the head length, head breadth and fronto-occipital circumference with advancing age and sex. The result of this study will be of immense use in forensic medicine and anthropology and will also serve as a future framework for estimating and appreciating the cephalic anthropometry variations of Nigerians.

## REFERENCES

Anas, I.Y. and U.G. Esomonu, 2008. Studies on the facial dimension among Hausa ethnic group. Best J., 5: 177-180.

Argyropoulos, E. and V. Sassouni, 1989. Comparison of the dentofacial patterns for native Greek and American-Caucasian adolescents. Am. J. Orthodontics Dentofacial Orthoped., 95: 238-249.

Bishara, S.E., J.R. Jakobsen, T.J. Hession and J.E. Treder, 1998. Soft tissue profile changes from 5 to 45 years of age. Am. J. Orthodontics Dentofacial Orthoped., 114: 698-706.

Charles, O.A., F.B. Hakeem, D.W. Nervey and B.A. Mildred, 2008. Normal outer and inner canthal measurements of the Ijaws of Southern Nigeria. Eur. J. Sci. Res., 22: 163-167.

Danborno, B., P. Nuhu and K. Yandev, 2008. Relationship between growth pattern and head dimensions in Nigerian children (5-15 Years). Internet J. Biol. Anthropol.

Enensha, U.D., 1995. *Ndi Igbo* in Perspective. 1st Edn., ABSU Press, Nigeria, pp: 28-40.

Eroje, M.A., H.B. Fawehinmi, B.N. Jaja and L. Yaakor, 2010. Cephalic index of Obia Tibe of Byesla state. Int. J. Morphol., 28: 389-392.

Esomonu, U.G., F.C. Akpuaka and C.I.P. Anibeze, 2011. Anthropological variations of the inner and outer canthal distance of the Igbos of South-Eastern Nigeria. JECA, 10: 9-14.

Evereklioglu, C., S. Doganay, H. Er, A. Gunduz, M. Tercan, A. Balat and T. Cumurcu, 2002. Craniofacial anthropometry in a Turkish population. Cleft Palate Craniofac. J., 39: 208-218.

Garba, S.H., A.I. Numan and I.G. Mishara, 2008. Craniofacial classification of normal newborns in Maiduguri metropolis, Nigeria. Int. J. Morphol., 26: 407-410.

Golalipour, M.J., K. Haidari, M. Jahanshahi and RM. Farahani, 2003. The shapes of head and face in normal male newborns in south east of Caspian sea (Iran-Gorgan). J. Anat. Soc. India, 52: 28-31.

Golalipour, M.J., M. Jahanshahi and K. Haidari, 2005. The variation of head and face shapes in female newborns in the South-East of the Caspian sea (Iran-Gorgan). Eur. J. Anat., 9: 95-98.

Heidari, Z., H.R.M. Sagheb and M.H.N. Mugahi, 2006. Morphological evaluation of head and face in 18-25 years old women in Southeast of Iran. J. Med. Sci., 6: 400-404.

Henneberg, M., 1976. The influence of natural selection on brachycephalization in Poland. Stud. Phys. Anthropol., 2: 3-19.

Hossain, M.D.G., P.E. Lestrel and F. Ohtsuki, 2005. Secular changes in head dimensions of Japanese adult male students over eight decades. HOMO J. Comp. Hum. Biol., 55: 239-250.

Kouchi, M., 1996. Secular change and socio-economic difference in height in Japan. Anthropol. Sci., 101: 325-340.

Kouchi, M., 2000. Brachycephalization in Japan has ceased. Am. J. Phys. Anthropol., 112: 339-347.

Largo, R.H., T. Gasser, A. Prader, W. Stuetzle and P.J. Huber, 1978. Analysis of the adolescent growth spurt using smoothing spline functions. Ann. Hum. Biol., 5: 421-434.

Mador, E.S., H.Y. Goncim, I.C. Pam, J.T. Mutihir, G.I. Adoga and J.O. Ogunranti, 2010. Cephalic index: A fetal gestational age dependent biometric parameter. Asian J. Med. Sci., 1: 45-48.

Maina, M.B., Y.C. Shapu, S.H. Garba, M.A. Muhammad, A.M. Garba, A.U. Yaro and O.N. Omoniyi, 2011. Assessments of cranial capacities in a north-eastern adult Nigerian population. J. Applied Sci., 11: 2662-2665.

Oladipo, G.S., A. Ugboma and M.O. Oyakhire, 2009. The circumference interorbital index of Ijaw and Igbo ethnic groups in Nigeria. Internet J. Biol. Anthropol., Vol. 3.

Oladipo, G.S., P.D. Okoh, P.A. Akande and M.O. Oyakhire, 2011. Anthropometric study of some craniofacial parameters: Head circumference, nasal height, nasal width and nasal index of adult Omoku indigenes of Nigeria. Am. J. Sci. Ind. Res., 2: 54-57.

Salve, V.M., N.R. Thota and A. Patibandla, 2011. The study of cephalic index of Andhra Region (India). Asian J. Med. Sci., 2: 53-55.

Soames, R.W., 1995. Skeletal System. In: Grays Anatomy, Williams, P.L., L.H. Bannister, M.M. Berry, P. Collins, M. Dyson, J.E. Dussek and M.W.J. Ferguesson (Eds.). 38th Edn., Churchil Livingstone, New York, pp: 425-736.

Trinkaus, E. and M. Lemay, 1982. Occipital burning among later *Pleistocene hominids*. Am. J. Phys. Anthropol., 57: 27-35.