IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 7, Issue 1 Ver. II. (Jan.- Feb .2018), PP 55-59
www.iosrjournals.org

Sonographic Assessment Of Foetal Cephalic Index Among The Fulanis In Maiduguri, Borno State.

Mohammed Yusuf Mohammed,[1] Ugwu Anthony C,[2] Ali Alhaji Modu, [3]Abba Mohammed.[4]

[1](*Department of Radiology, University of Maiduguri Teaching Hospital Maiduguri, Borno State, Nigeria).*
[2](*Department of Radiography and Radiological Sciences, Faculty of Health Sciences and Technology, Nnamdi Azikwe University, Nnewi Campus, Anambra State, Nigeria).*
[3](*Department of Radiology, Federal Neuro Psychiatric Hospital, Maiduguri, Borno state, Nigeria).*
[4](*Department of Medical Radiography, Faculty of Allied Health Sciences, Bayero University Kano, Nigeria).*
**Corresponding author. Mohammed Yusuf Mohammed*

Abstract: *Limited information on the foetal craniofacial dimensions of Fulani population is a great hindrance in the exact estimation of gestational age not only in medicolegal cases but also in obstetric management. Sonographic measurement of Biparietal diameter is commonly used to assess foetal age and growth; but gives misleading conclusions due to differing craniofacial dimensions arising out of ethnic diversity. This study was aimed to establish a normogram for foetal cephalic index and derive the correction factor for adjusting atypical head shapes to the ideal shape. A cross sectional study was used, and Trans-abdominal sonography was conducted with a 3.5 MHz transducer, the BPD and were measured in the same axial plane of the head at the level of thalami; and the cephalic index was computed as ratio of BPD and OFD multiply by hundred. The foetal gestational age was determined from the average measurements of BPD, OFD and FL. The mean CI was 79.06 (±3.52) and the mean ± 2SD range was 72.02 to 86.10. The mean cephalic indices of transverse and breech presenting foetuses were 92.99 (±3.96) and 78.19 (±3.85) respectively. This study has established a nomorgram for foetal cephalic index and a correction equation for atypical head shape in a Nigerian population of Fulani descent.*

Keywords*: Cephalic index, Mesocephalic, Obstetric, Sonography, Nigerian.*

Date of Submission:27-12-2017 Date of acceptance: 14-01-2018

I. Introduction

Cephalic index (CI) is the ratio of the maximum breadth of the head to its maximum length[1]. Cephalic index is derived from the Greek word "Kephalic" meaning "Head" and the Latin word "Index" meaning "that which points out". In the twentieth century, the cephalic index was widely used by anthropologists to categorize human population [1]. Today it is mainly used to describe individuals' appearances and estimating the age of foetuses for legal and obstetrical reasons [2]. Cephalometric results are also used in paediatrics, forensic medicine, plastic surgery, oral surgery, dentistry and diagnostic comprehension between patient and normal population [3]. Cephalic index is the most frequently investigated craniofacial parameter as it utilizes the length and breadth of the head, which are useful indices in the study of racial differences [4]. On the basis of the cephalic index, head shapes are categorized into dolichocephaly (<74.9), mesocephaly (75-79.9), brachycephaly (80-84.9) and hyperbrachycephly (85-89.9) [5]. Cephalic indices play a crucial role in comparison of cephalic morphometry between parents, offspring's and siblings and provide information on inheritance pattern [1]. Also, it provides the information for diagnostic comparison as in cases of dolichocephaly, and in the individuals with Apert's syndrome which usually associated with hyperbrachycephaly [6]. Down's syndrome infants have been recognized to have a head with normal biparietal diameter (BPD) and a shortened occipito-frontal diametre (OFD), or brachycephaly. This occipital flattening result in a higher cephalic index in children with Down's syndrome than in normal children [7]. Thehead that is too elongated is dolichocephaly and will give a wrong foetal dating [8]. Thedolichocephalic head shape is often associated with the anhydramnious or breech presentation, a round head termed "brachycephaly" suggests the presence of a genetic abnormality and a lemon shape head is usually a sign of spina bifida in the foetus [9].

Ultrasound has proved to be a useful and accurate method for determining the gestational ages of the foetuses [10]. Biparietal diameter is the most commonly used ultrasound measurement for foetal age assessment [11]. BPD is a reliable indicator of gestational age up to 26 weeks [12]; provided that there is a normal ovoid transaxial head shape. If the head is too round (brachiocephaly) or too elongated (dolichocephaly), the BPD measurement will be falsely increased or decreased, and gives a wrong foetal dating. In the second trimester, the

head measurements are preferred especially BPD which is the most frequently used foetal biometry measurement while variations in the shape of the foetal skull have a significant effect on the BPD measurements [13]. Hence, there is need to establish a normal range of foetal cephalic index in every population such that the normality of head shapes could be assessed to enable a precise prediction of gestational age with BPD before 26 weeks. The obstetrical standard also suggests that this error may be avoided by obtaining a second linear measurement from the BPD image, called the OFD which will be compared with the BPD in order to determine an accurate foetal age [14]. The BPD and OFD are compared in an equation called the cephalic index (CI): CI = (BPD/OFD) ×100 [9].Normal head shape has a mean CI of 78 with a 2-SD range 70 to 86 [13]. On the contrary,the mean foetal cephalic index among lbos in Nigeria was established to be approximately 86 with a 2-SD range of about 81 to 91 [15].

The knowledge of gestational age is a pre-requisite in the management of conditions such as premature rupture of membranes, preterm labour, postdatism, ante-partum bleeding, and pre-eclampsia [16]. Last menstrual period (LMP) is simple and the most common method of calculating gestational age. However, 45-69% of pregnant women have irregular periods or uncertain information regarding their last menstrual period [16]. For this reason, the use of LMP in most cases is unreliable. An ultrasound scan is particularly useful in most parts of the world where women often cannot account for their last menstrual period [17]. Many foetal age estimation chart for the ultrasound biometric parameters are available [18], some of them have been built based on homogeneous foetal population and still being preferentially used where available [19]. The importance of the choice of reference charts for the assessment of foetal biometry has been emphasized [19]. The use of customized foetal growth charts, taking into consideration factors normally influencing the foetal growth, reduces the number of the false positive [20]. It has been postulated that each population should use their own normograms because of the racial and ethnic differences [16],[10]. This study is therefore designed to assess the cephalic index among the Fulanis in Maiduguri, Borno State.

II. Patients And Methods

Transabdominal sonography was performed in four hundred and one (401) pregnant women coming for obstetric sonongraphy in the second and third trimesters between August, 2015 to Febuary, 2016 at the department of obstetric and gynaecology University of Maiduguri Teaching Hospital, Borno State. All subjects were Fulani by tribal origin and whose husbands were also Fulani. Gestation was confirmed in all cases by sonographic biometric analysis, other criteria for inclusion included the following: a singleton gestation, no maternal medical history of diabetes mellitus, hypertension and good indications of foetal viability. Both cephalic and breech presenting foetuses were studied. Ethical approval was obtained from the research and ethics committee of the University of Maiduguri Teaching Hospital. The subjects were examined using an ultrasound machine equipped with 3.5 MHz curvilinear transducer (GE ultrasound LOGIQ P5, Korea).

The foetal BPD were measured in an axial plane of the head, at the level of the thalami (where the continuous midline echo is broken by the cavum septum pellicidum in the anterior third of the cranium) [21]. The measurement of the BPD was taken from the outer edge of the closest parietal bone to the inner edge of the opposite parietal bone [21]. The overlying soft tissue margin was excluded [15]. The OFD were measured in the same plane between the leading edge of the frontal bone and the outer border of the occiput in the midline so as to avoid indistinct lateral margins of the calvarium [15]. The calipers for both measurements were perpendicular to each other. The foetal cephalic index was therefore calculated as the ratio of the same two diameters and multiplied by hundred"(BPD/OFD)×100".

Data were categorized according to maternal age, parity, and gestational age. Further data were also classified into the cephalic presentation, breech, and transverse lie. Descriptive statistics were used to determine the range, mean, standard deviation and the frequency of the distribution, while the sample normality were tested with Shapiro-Wilk's test. Pearson's product moment correlation were used to assess the degree of relationship between the CI and BPD, CI and OFD and CI and FL. Also, the same Pearson's correlation were used assess the degree of relationship between CI and GA. A multiple regression equation of BPD as dependent variable against BPD+OFD, BPD×OFD and Standard head ratio of the study as independent variables were used to determined the equation for correction factor (BPDa). Student T-test were used to check the mean differences between cephalic index lie in transverse, breech presenting foetuses and their cephalic presenting counterparts.

Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) for Windows® version 16.0 (SPSS Inc, Chicago, Illinois, U.S.A). A p-value of < 0.05 was used as the criterion of statistical significance.

III. Result

The ages of the participants ranged from 15 to 42 years with the mean and standard deviation of 26.48 ± 6.69. The mean maternal parity of the participants is 2.87 ± 2.27 ranging from 0 to 12.

Among the four hundred and one (401) foetuses which were scanned in this study, two hundred and ninety-eight 298 (74.3%) were cephalic presented, fifty-two 52 (13%) transversely lay and fifty-one 51 (12.3%) were presented breech. A Shapiro-Wilk's test shows that the samples are normally distributed (p=0.82).

The foetal mean cephalic index and standard deviation for this study was 79.06 ± 3.52 and the mean ± 2SD ranged from 72.02 to 86.10. Whereas the mean cephalic index of transverse and breech presented foetuses was 92.99 ± 3.96 and 78.19 ±3.85 respectively. Statistical significant differences were observed between the mean cephalic index of the foetus in cephalic presentation and foetus in a transverse lie (p=0.03). While no statistically significant differences was shown between the cephalic index of foetuses in breech presentation as compared with the foetus in cephalic presentation (p=0.99).

Equation for correcting BPD from atypical head shape is:

BPDa = 0.15+0.422(OFD+BPD) +0.0025(OFD×BPD).

Figure 1. Sonogram of a foetal head in axial plane at the level of thalami.

Table 1 Correlations between CI and BPD, OFD, FL and G.A

Variable		CI	BPD	OFD	FL	GA
CI	Pearson's correlation	1	.286	.274	.194	.177
	Sig. (2- tailed)		.211	.231	.386	.412
	N	298	298	298	298	
BPD	Pearson's correlation	.286	1	.953	.985	.977
	Sig. (2- tailed)	.211		.000	.000	.000
	N	298	298	298	298	

IV. Discussion

The cephalic index is a rating scale that is used to measure head size. The cephalic index rating is obtained by multiplying the maximum width of the head by 100 and dividing that number by the maximum length of the head. It has been proposed as a discriminating parameter to recognize alterations in the growth of the skull. Its valuations when the calculated index is above the ± 2 SD from the mean. The analysis of foetal cephalic index expresses another aspect of growth and development in feotus, likewise permit critical evaluation of unusually large or small head. Also, cephalic index indirectly expresses cranial capacity, which has been used indirectly to reflects the volume of the brain and predict mental ability [22]. Many studies have been reported on

cephalic indices of different populations, both national and internationally, this present study to the best of our knowledge is the first to capture data on foetal cephalic index among the Fulanis in Maiduguri, Borno State.
The result of this study showed a mean cephalic index of 79.06 (±3.52), which indicates that the studied population is mesocephalic in nature according to the international cephalic index categorization [5]. There is an increase in CI as you move from the Sahel savanna to Sudan savanna and to the Guinea savanna, as recorded in the Fulani, Ibo, and Ogonis studies [15],[23], this strongly suggest a possible environmental and racial have an impact on normal CI. A similar idea was presumed [24], the head shape assumed dolichocephaly in the temperate zone and mesocephaly or brachycephaly in the tropical zone. This idea was argued that the human foetus develops in an internal environment in the mother's uterus where the temperature remains almost constant throughout pregnancy [25]. Thus, likely this component may not maintain its influence over the change in the foetal cephalic index.

Foetal age estimation still remains the most common indication for an obstetric sonography due to the maternal uncertainty of their LMP. With the advent of high-resolution, real-time ultrasound, the ability to image various organs in utero has dramatically improved the determination of gestational age and various medical complications in the field of obstetrics and gynaecology. Several recent obstetrical sonographic examinations demonstrated that variations in the shape of the foetal skull (dolichocephaly, brachycephaly, etc) may adversely affect the accuracy of the BPD measurement in establishing foetal age [26]. It is worthy of note that the CI derived in the Fulani population is closer to the values established by Hadlock. This indicates that the obstetric charts for foetal age determination derived by Hadlock which was incorporated in most of the ultrasound machines would give more reliable foetal dating in the Fulani population than in their Southern counterparts. The cephalic index was proposed in the first place as a way of recognizing altered head shape and confirming the validity of BPD measurement. In prospect of this, the equation for correcting BPD from atypical to typical head shape was established [BPDa=0. 15+0.422 (OFD+BPD) +0.0025 (OFD×BPD)] with r^2=0.98. The equation was generated in this study to adjust the atypical head shape, especially when dating foetal age using BPD. Head shape is said to be atypical when the OFD to BPD ratio is far from 1.265 (standard shape head ratio) [27], and much closer value were observed in this study 1.271 (±0.09). In view of the atypical nature of some head shapes, it is suggested that every head shape in this population that deviate from the mean CI ± 2SD should be adjusted using the derived equation. It is worthy of note that, for a standard shaped head, the area corrected BPD (BPDa) is roughly equal to the uncorrected BPD [27].

Weak positive correlations were observed between CI and BPD (r=0.29), between CI and OFD (r=0.27), between CI and FL (r=0.19), and (r=0.18) between CI and GA. This showed that the foetal cephalic index measurements demonstrated no significant changes with increasing gestational age [13],[28]. Some studiesreported that foetal cephalic index varies with advancing gestational age [2].

Strongly positve correlations (r=0. 98) were observed between BPD and OFD (r=0. 99), between BPD and FL and (r= 0.98) between BPD and GA. This indicates that as gestational age advances subsequent BPD, OFD and FL also increases systematically. This indicates that using those parameters together will facilitate in the diagnosis of achondroplasia in the foetus, particularly when the measurements of BPD and OFD found to be in harmony with the gestational age, and FL is not in line with the gestational age, therefore achondroplasia should be suspected.

The studied mean foetal CI were compared with the mean cephalic indices of fetuses in a different lie. The result showed a statistically significant difference between a foetus in cephalic presentation with foetuses in a transverse lie (p=0.03), and no statistically significant difference were observed between the foetus in cephalic presentation and breech lie (p=0.99). The observed difference between the mean CI of cephalic presenting and transverse lies foetuses, could be possibly due to the pressure of lateral abdominal wall from the mother presses the foetal head, and which tend to increase the feotal BPD. The results of this study which varies from those of the South East mean studies [15] and South South mean studies [23], indicate that sonographic cephalometric studies and data should be generated for every ethanic group to enable valid conclusion to be made on the possibility of cranial anomalies on foetuses. Cranial anormalies could be indicated if the CI is outside mean ±2 SD of the generated data in such population.

V. Conclusion

The foetal mean cephalic index of the study was 79.06 (±3.52). This shows that the dominant head shape among Fulanis of northern Nigeria is mesocephaly. A correction factor for adjusting atypical foetal head shape in the Fulani population has also been derived in this study and would be helpful in predicting foetal gestational age.

Acknowledgement

We acknowledge the staff and management of the University of Maiduguri Teaching Hospital, especially Dr Adamu Angeli Malgwi (Dept. of O&G) who helped in the recruitment of participants for the study. we also remain grateful to Dr Isaac Terkimbi Annongu for the wonderful and constructive criticisms he made on the manuscript development. To Mallam Mustaph, we remain grateful for his assistance in statistical analysis. We remain immensely grateful to Dr Zainab Mustapha, Mrs. Osunmola Okedayo and Dr Muhammad Sani Ahmadu for their wonderful technical and moral support in the success of this work. My fellow professional colleagues in the Radiology Department of University of Maiduguri Teaching Hospital are also acknowledged for creating a good working environment necessary for the completion of this research.

Reference

[1]. Praveen K, Janaki C, Vijayaraghavan V, Delhi R. A Study on Measurement and Correlation of Cephalic and Facial Indices in Male of South Indian Population. *International Journal of Medical Reseach and Health Sciences* 2(3), 2013, 439-446.
[2]. Gray D, Songster G, Parvin C, Crane J. Cephalic Index: A gestational Age-Dependent Biometric Parameter. *Obstetrics and Gynaecology* 4(4), 1989, 600-603.
[3]. William P, Dyson M, Dussaak J, Bannister L, Berry M, Collins P.*Gray's Anatomy In Skeleton System* 38th ed. London: Churchill Livingston; 1995.
[4]. Konchi M. Brachycephalization in Japan has Ceased. *American Journal Physical Anthropology* 112, 2000, 339-347.
[5]. Eroje M, Fawehinmi H, Jaja B, Yaakor L. Cephalic Index of Ogbia Tribe of Bayelsa State. *International Journal of Morphology* 28(2), 2010, 389-392.
[6]. Cohen M, Kreiborg S. Cranial Size and Configuration in the Apert's Syndrome. *Journal of Craniofacial Genetics and Developmental Biology* 14(3), 1994, 153-62.
[7]. Smith G, Berg J. *Down Syndrome Anormaly* 2nd ed. New York: Churchill Livingstone; 1976.
[8]. Ugwu A, Nwobi I, Eteudo A, Ovuoba K. The Effect of Normocephalic Fetal Skull on Fetal Dating Using Biparental Diameter. *Online Journal of Health and Allied Sciences* 7(2), 2008, 5-7.
[9]. Chudleigh T, Thilaganathan B. *Obstetric Ultrasound How, Why and When* 3rd ed. London: Elsevier Churchill Livingstone; 2004.
[10]. Beigi A, Zarrinkoub F. Ultrasound Assessment of Fetal Biparietal Diameter and Femur Length During Normal Pregnancy in Iranian Women. *International Journal of Gynaecology & Obstetric* 69(3), 2000, 237-42.
[11]. Crane J, Kopta M. Prediction of Intrauterine Growth Retardation Via Ultrasonically Measured Head/Abdominal Circumference Ratios. *Obstetric Gynaecology* 54(5), 1979, 535-668.
[12]. Sabbagha R, Hughey M. Standardization of Sonar Cephalometry and Gestational Age. *Obstetric Gynaecology* 52(4), 1978, 402-406.
[13]. Hadlock FP, Deter R, Carpenter R, Park S. Estimating Fetal Age: Effect of Head Shape on Biparietal Diameter. *American Journal of Radiology* 137, 1981, 83-85.
[14]. Kurtz AB, Wapner RJ, Kurtz RJ, Dershaw DD, Rubin CS, Cole-Beuglet C, Goldberg BB. Analysis of Biparietal Diameter as an Accurate Indicator of Gestational Age. *Journal of Clinical Ultrasound* 8(4), 1980, 319-326.
[15]. Ugwu A, Ewunonu E, Nwobi I, Egwu O, Ovuoba K. Sonographic Assessement of Fetal Cephalic Index in a Nigerian Population. A Novel Paradigm. *Journal of Diagnostic Medical Sonography* 23, 2007, 87-90.
[16]. Hadlock F, Harrist R, Shah Y. Estimating Fetal Age Using Multiple Parameters: a prospective evaluation in racially mixed population. *American Journal of Radiology* 156(4), 1987, 955-959.
[17]. Waldenstrom V, Axlesson O, Nilsson S. A Comparison of the Ability of a Sonographic Biparietal Diameter and the Last Menstrual Period to Predict the Spontaneous Onset of Labour. *American Journal of Radiology* 76(3), 1990, 336-338.
[18]. Giampaolo M. Guideline for Fetal Intrauterine Growth Restriction and Chronic Fetal Hypoxemia. *Timisoara Medical Journal*: 59(2), 2009, 9-12.
[19]. Bernstein I, Mohs G, Rucquoi M. Case for Hybrid Fetal Growth Curves: A Population-Based Estimated of Normal Fetal Size Across Gestational Age. *Journal of Matern Foetal Medicine 5*(3), 1996, 124-127.
[20]. Gardosi J, Chang A, Kalyan B. Customized Antenatal Growth Chart. *The Lancet* 339, 1992, 283-287.
[21]. Mador E, Goncim H, Pam I, Mutihir J, Adoga G, Ogunranti J. Cephalic Index: A Fetal Gestational Age-Dependent Biometric Parameter. *Asian journal of Medical Sciences* 1, 2010, 45-48.
[22]. Maina MB, Shapu YC, Garba SH, Muhammad MA, Garba AM, Yaro AU, Omoniyi ON, Assessment of Cranial Capacity in a North-Eastern Adult Nigerian Population. *Journal of Applied Sciences* 2011, ISSN 1812-5654/ Doi:10.3923/Jas.2011.
[23]. Oladipo G, Yorkum L, Okoh P. Measurements of Head Circumference, Intercanthal Distances, Canthal Index and Circumference Interorbital Index of Ikwerre School Children in Nigeria. *Journal of Natural Sciences Research* 3(4), 2013, 16-20.
[24]. Bharati S, Som S, Bharati P, Vasulu T. Climate and Head Form in India. *American Journal of Human Biology* 13, 2001, 626-634.
[25]. Goyal L, Srivastara C, Agarwa S, Saxena S, Gupa R. An Ultrasonographic Evaluation of Foetal Head Type During Second and Third Trimester of Pregnancy. *Scholars Journal of Applied Medical Sciences* 3(8), 2015, 2899-2902.
[26]. Accardi MC, Magno EL, Eromito S, Dinatale A, Cacciatore A, Cavaliere A, Rossetti D. Echotoography of Craniosynostosis: Review of Literature. *Journal of Prenatal Medicine* 3(2), 2009, 31-33.
[27]. Doubilet P, Greens R. Improved Prediction of Gestational Age from Foetal Head Measurement. *American Journal of Radiology* 142, 1984, 797-800.
[28]. Jeauty P, Cousaert E, Hobbins J, Tack B, Bracken M, Contraine F. A Longitudinal Study of Fetal Head Biometry. *American Journal of Perinatology 2*(1), 1984, 118-128.

Mohammed Yusuf Mohammed "Sonographic Assessment Of Foetal Cephalic Index Among The Fulanis In Maiduguri, Borno State."." IOSR Journal of Nursing and Health Science (IOSR-JNHS) , vol. 7, no.1 , 2018, pp. 55-59.