

## Ultrasonographic Biometry: Biparietal Diameter of Nigerian fetuses

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### ABSTRACT

**Background:** Foetal biparietal diameter has been studied previously in Nigerian fetuses but populations have been too small to make categorical conclusions regarding the reference values/data. **Materials and Methods:** In a cross sectional study, the foetal biparietal diameter (BPD) of 13,740 fetuses in Jos were measured with grey ultrasound machine in 13,740 Nigerian women during normal pregnancy and the mean BPD values for each week of pregnancy between 12 and 42 weeks were determined. **Results:** The mean biparietal diameter value was 29.4mm at 14 weeks, 49.4mm at 20 weeks, 78.4mm at 30 weeks, 91.5 at 37 weeks and 95.6mm at 40 weeks. There was a positive relationship between gestational age and biparietal diameter with correlation coefficient of  $R^2 = 0.9996$  ( $P < 0.001$ ), and with fetal weight. The increase in BPD with increasing age in the study population showed a curve similar to that of Europeans. **Conclusions:** Ultrasonographic measurement of biparietal diameter in Nigerian fetuses showed a linear correlation exists between BPD and gestational age, as well as BPD and foetal weight in normal fetuses.

**Key words:** Biparietal diameter, Nigerian fetuses, Gestational age, Foetal weight

### INTRODUCTION

Biparietal diameter (BPD) in foetus has been reported to correlate well with gestational age. BPD is used to estimate gestational age<sup>1,2</sup>, foetal growth<sup>3</sup> and in the detection of foetal abnormalities<sup>4</sup>. Ultrasound technology has demonstrated that biparietal diameter is useful and accurate in determining gestational age of the foetus<sup>5-8</sup>. In Nigeria, several authors<sup>5, 9-11</sup> reported foetal BPD results without any definite relationship between gestational age and biparietal diameter due to the very small populations studied. The present study aims to determine the biparietal diameter values of Nigerian fetuses from 12 to 42 weeks of gestation, and establish the relationship between biparietal diameter and gestational age of fetuses.

### SUBJECTS AND METHOD

This was a cross sectional study of

uncomplicated pregnant women of between 12 and 42 weeks of gestation, who presented for routine ultrasound at Centre for Reproductive Health Research Jos, between December 1997 and April 2002.

The study was approved by the Ethics Committee at the Jos University Teaching Hospital. Informed consent was obtained from the patients before inclusion in the study. Only singleton pregnancies were included. Exclusion criteria included pregnant women who had concomitant disease that could possibly affect fetal growth (e.g. diabetes mellitus, asthma, hypertension, renal disease, thyroid disease), complicate pregnancy (e.g. bleeding, pre-eclampsia), foetal abnormality detected during the examination, women with a history of obstetric complications, intrauterine growth retardation and macrosomia.

The data collected included the gestational age, date of the last menstrual period, maternal age and parity, and BPD. Maternal age was calculated in completed years at the time of the scanning. All BPD measurements were performed by the same investigator using Philips SDR 1000 Real time ultrasound machine equipped with 3.5MHz transducer and an

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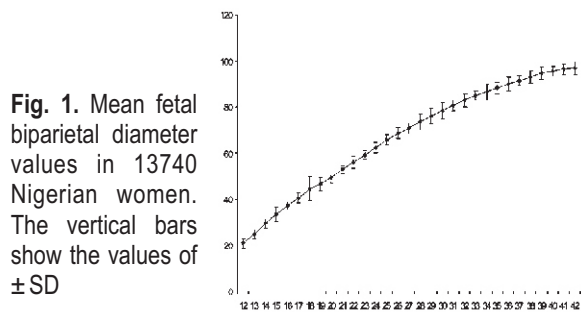
electronic caliper system set at a velocity of 1540m/s. Fetal biparietal diameter measurements were made in an axial plane at the level where the continuous midline echo is broken by the cavum septum pellucidum in the anterior third and that includes the thalamus. Measurement of BPD was from the outer edge of the closest temporomandibular bone to the outer edge of the opposite temporomandibular bone.

Transverse section through the fetal head at the level where the septum pellucidum cavum breaks the midline echo approximately one third of the way from the anterior border of the skull.

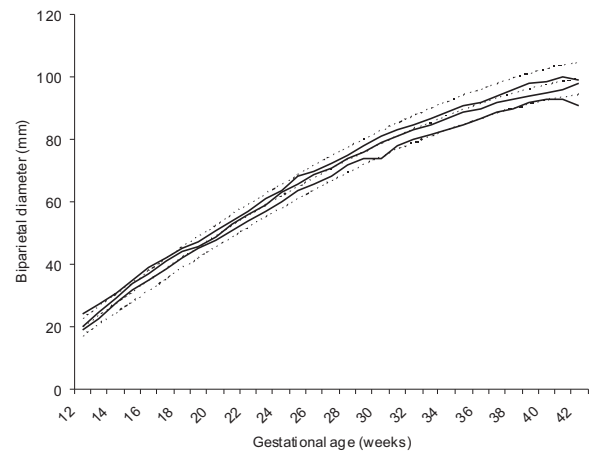
Statistical analyses were performed using Number cruncher statistical system (NCSS/PASS 2006 Dawson Edition, USA). The normality of biparietal diameter measurements at each week of gestation was assessed using Anderson-Darling test. Given the large sample size, statistically significant nonnormality was accepted unless the normal plot showed clear deviation from a straight line<sup>12</sup>. For the biparietal measurement, a regression analysis was applied, examining linear, logarithmic, polynomial, power, exponential models for association with gestational age in weeks. The best model was selected based on visual inspection of the regression line that best fitted the data scattergram and the p value for significance.

**RESULTS**

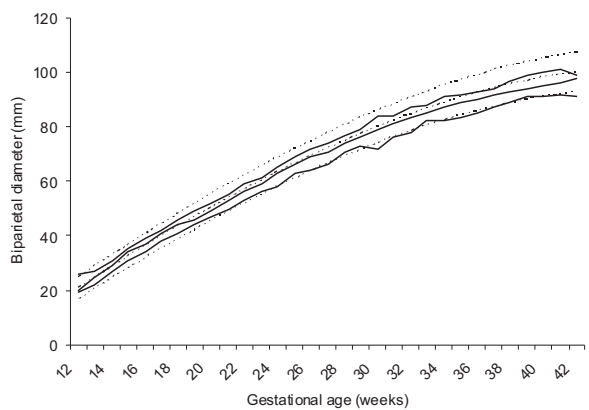
Fetal BPD measurements were obtained in 13,740 pregnant women. The mean ( $\pm$  SD) BPD values between 12 and 42 weeks are shown in Fig. 1. The relationship between gestational age and biparietal diameter was non-linear at p-value < 0.0001. The growth rate of BPD was 3.9mm/week between 13 and 16 weeks, 3.1mm/week between 17 and 25 weeks, 2.5mm/week between 26 and 29 weeks, 2.1mm/week between 30 and 33 weeks, and 1.6mm/week between 34 and term.



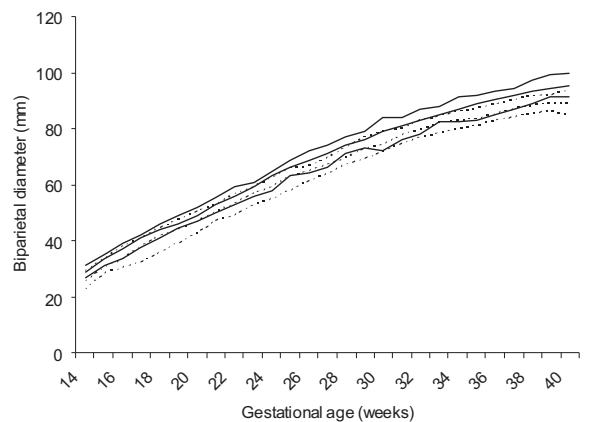
**Fig. 2.** Comparison of our biparietal diameter 3rd, 50th and 97th centiles (solid lines) with those of Chitty et al (dashed lines)



**Fig. 3.** Comparison of our biparietal diameter 5th, 50th and 95th centiles (solid lines) with those of Kurmanavicius et al (dashed lines)



**Fig. 4.** Comparison of our biparietal diameter 5th, 50th and 95th centiles (solid lines) with those of Kankeow (dashed lines).



We compared the derived BPD centiles with those from Europe and Asia; the results are as shown in Fig 2–4.

## DISCUSSION

The knowledge of the size and shape of the foetal head is important in understanding the mechanism and management of labour<sup>14, 15</sup>. In times past, numerous methods of radiologic cephalometry were used<sup>19-21</sup> as index of fetal growth and maturity. Subsequent studies<sup>25</sup>, however, proved the biparietal diameter to be the most important measurement of the fetal head because its values are significantly superior to that of the average cranial circumference<sup>26</sup>.

The use of ultrasound to measure the foetal BPD in utero has afforded the modern obstetrician to know beforehand the relationship between the size and shape of the fetal head and the pelvic brim, and forecast whether or not spontaneous delivery through the vagina would be possible<sup>16, 17</sup>. BPD has several other applications in clinical practice which include determining the gestational age, estimating fetal weight, and evaluating foetal growth.

The BPD values and centiles in this study were significantly lower than those in the Western population<sup>13, 27</sup>. The only time that our values were significantly higher was from 15 – 16 of weeks gestation. This finding is contrary to the one Okupe et al<sup>5</sup> reported. This difference may be attributed to the claim that there is a systematic difference in the ultrasound data sets collected before and after 1974, probably due to the differences that exist in the scanner resolutions before and after that period, and the later introduction of gray scale imaging. On the other hand, our centiles are higher than those of the Asian population<sup>27</sup>. These findings were reports alluded to the differences in foetal biometries among the races.

In conclusion, PBD correlated well with gestational age. It is hoped that the BPD values, centile charts, tables in this study would provide useful database and references for further studies.

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