DOI: 10.21088/ija.2320.0022.14125.1

Indian Journal of Anatomy
Volume 14 Number 1 January - April 2025

ORIGINAL ARTICLE

Ultrasonographic Correlation of Foetal Biparietal Diameter and Gestational age at A Health Care Centre in Uttar Pradesh

Babli Jaya Murmu[1], Midhat Muttaqui[2], Nema Usman[3], Fazal Ur Rehman[4], Uzma Eram[5]

HOW TO CITE THIS ARTICLE:
Babli Jaya Murmu, Midhat Muttaqui, *et al.* Ultrasonographic Correlation of Foetal Biparietal Diameter and Gestational age at A Health Care Centre in Uttar Pradesh. Indian J Anat. 2025; 14(1): 07-11.

ABSTRACT

Background: Good Antenatal Care requires monitoring of pregnancy through meticulous history, examination and investigation. Ultasound is a non-invasive, safe, economical and easlily accessible test, routinely used to monitor Maternal and Foetal well-being. Vigilant obstetric care depends on accurate dating of pregnancy and timely interventions which are gestational age dependent. Gestational age is calculated from first day of last menstrual period to the current date (Naegle's formula). Early pregnancy ultrasound using Gestational Sac Diameter (GSD) and CRL is accurate in dating pregnancy where a pregnant woman is not sure of menstrual cycles or the cycles are irregular.[1] Sonographic Monitoring utilizes foetal biometry to study fetal anatomy through different parameters like Crown-rump length (CRL), fetal bi-parietal diameters (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL) to determine gestational age (GA), fetal weight, and growth in different trimesters of pregnancy and to rule out the presence of congenital anomalies.[2,3]

There have been studies on BPD and assessment of gestational age, that have shown anthropological variations. Socioeconomic, demographic and environmental factors also play an important role in taking timely decisions which are dependent on correct gestational age

Aims and Objectives: This study aimed to ascertain correlation between BPD and gestational age in pregnant females visiting ANC OPD of Rural Health and Training Centre at Jawan, Aligarh.

AUTHOR'S AFFILIATION:

[1] Junior Resident, Department of Anatomy, Jawaharlal Nehru Medical College, AMU, Aligarh, Uttar Pradesh, India.
[2] Senior Resident, Department of anatomy, Jawaharlal Nehru Medical College, AMU, Aligarh, Uttar Pradesh, India.
[3] Assistant Professor, Department of Anatomy, Jawaharlal Nehru Medical College, AMU, Aligarh, Uttar Pradesh, India.
[4] Professor, Department of Anatomy, Jawaharlal Nehru Medical College, AMU, Aligarh, Uttar Pradesh, India.
[5] Professor, Community Medicine, Jawaharlal Nehru Medical College, AMU, Aligarh, Uttar Pradesh, India.

CORRESPONDING AUTHOR:

Midhat Muttaqui, Senior Resident, Department of anatomy, Jawaharlal Nehru Medical College, AMU, Aligarh, Uttar Pradesh, India.
E-mail: drmidhatfatima@yahoo.co.in

➢ **Received:** 01.03.2025 ➢ **Accepted:** 04.04.2025

Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution NonCommercial 4.0 License (http://www.creativecommons.org/licenses/by-nc/4.0/) which permits non-Commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the Red Flower Publication and Open Access pages (https://rfppl.co.in)

Methodology: The study enrolled 100 consecuetive pregnant females attending ANC OPD of RHTC, Jawan, Aligarh. They had their routine antenatal ultrasound, which were assessed for the BPD data.

Inclusion Criteria: Study included pregnant females without any medical conditions that can complicate the pregnancy.

Exclusion Criteria: Refusal of consent, twins, medical disorders of pregnancy, congenital anomalies

Conclusion: This study was done in North India rural population with the mean age of pregnant females of 26 years. It showed a linear correlation between BPD and gestational age. BPD was found to have a positive correlation with gestational age especially in second trimester. The accuracy in predicting gestational age declines with the advancing gestation. Thus, ultrasonographic measurement of biparietal diameter can be used to used to predict gestational age in Indian foetuses.

KEYWORDS

• Biparietal diameter • Gestational age • Ultrasound • Foetuses • Rural • Congenital anomalies

INTRODUCTION

Gestational period is the interval between first date of last menstrual period to the present date (Naegles's formula). A normal gestational period of 40 weeks is divided into three trimesters. Each trimester focusing on different aspect of foetal growth and development, with the first trimester focusing on embryogenesis, second trimester on growth by hypertrophy and hyperplasia and the third trimester on maturation and hyperplasia as a preparation for the postnatal period. Sonographic determination of gestational age depends on the known associations between gestational and size. The radiological prediction of gestational age and expected date of delivery (EDD) depends on set reference charts in the ultrasound machines.

A good pregnancy outcome requires meticulous history, examination and tests to assess maternal and Foetal wellbeing. Accurate dating of pregnancy relies on menstrual dates and first trimester ultrasound (GSD and CRL). Study of foetal biometry requires follow up ultrasound using different parametrs like BPD, FL etc in different trimesters to assess foetal growth with reference to the gestaional age.

Early pregnancy ultrasound using Gestational Sac Diameter (GSD) and CRL is accurate in dating pregnancy where a pregnant woman is not sure of menstrual cycles[1,2].Estimation of gestational age is important to prevent complications like prematurity, postmaturity, unncecessary operative interventions.[3] It also helps in medical interruption at the right time to prevent complications like administration of steroids to accelerate foetal maturity where gestational age is less than 34 weeks and delivery is imminent.[4]

Studies on foetal head have shown that BPD is a useful parameter that is routinely measured to assess gestational age From very early times there have been reference graphs to assess foetal growth with gestational period and EDD prediction.[5]

This present study was conducted in Jawan, Aligarh to study correlation between BPD and gestational age in pregnant females visiting ANC OPD Rural Health and Training Centre in Aligarh, Uttar Pradesh.

METHODOLOGY

The present study is an Observational, Cohort, Cross-Sectional Study. After taking informed consent, the Study enrolled 100 consecuetive pregnant women visiting ANC OPD of Rural Health and Training Centre, Jawan District, Aligarh. The mean age of the participant pregnant women was 26 years. Enrolled patients had their routine ANC scan and USG reports were assessed for the maternal and foetal well-being. Ultrasonographic assessment was done by a certified radiologist using the obstetric protocol by ultrasound machine (3.5 MHz probe). Fetal

biparietal diameter measurements were made from the outer edge of the closest parietal bone to the inner edge of the opposite parietal bone in the axial plane of fetal head with the skull being oval shape at the level of two thalami. Measurements weremade from the outer to inner margins of the fetal skull and the findings were recorded.

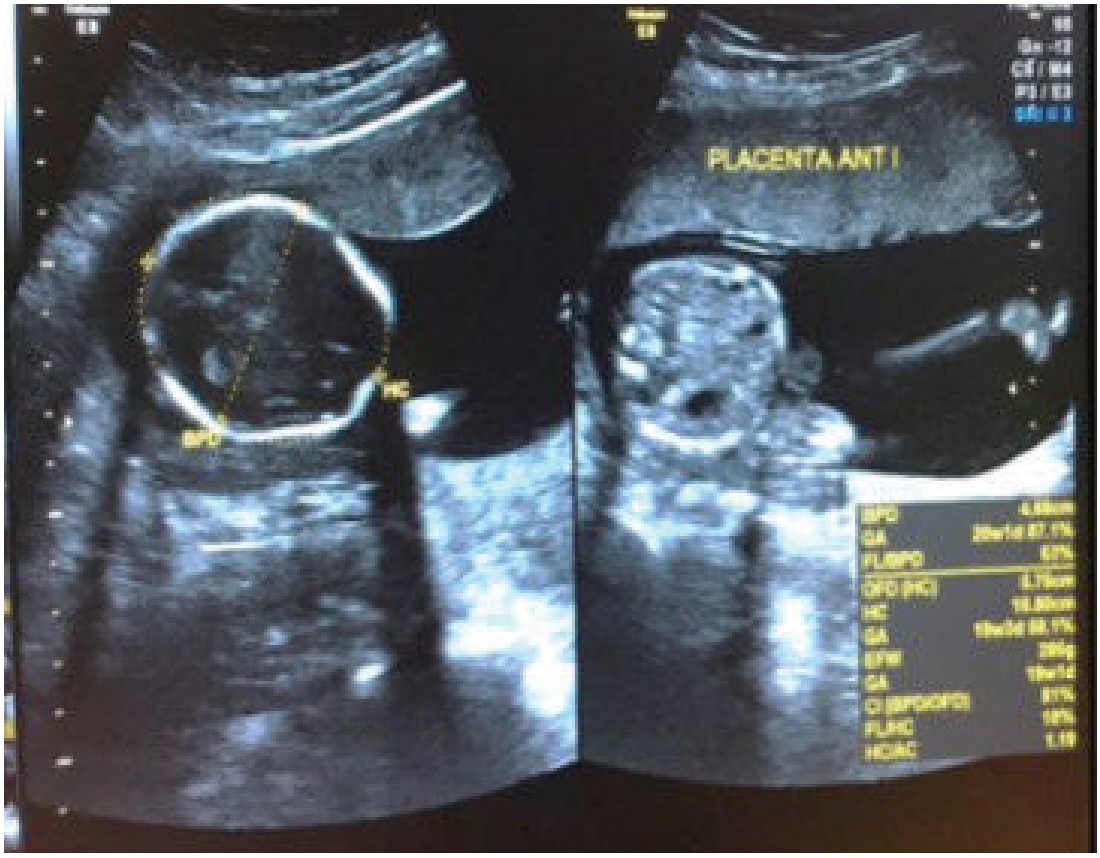


Figure 1: Showing measurement of BPD

These pregnant women were divided into 4 groups according to gestational age, comprising 25 pregnant females in each group and the mean BPD values for each group were determined.

Group A: 12-18 Weeks

Group B: 19-25 Weeks

Group C: 26-32 Weeks

Group D: 32-38 Weeks

Data was entered in the excel sheet each, SPSS Software version 23 was used for statistical analysis and $p<0.05$ was considered significant group. Mean BPD of each group was calculated and One way Anova test was used for statistical analysis.

significance of variation of BPD between groups is observed.

Exclusion Criteria Refusal of Consent, Irregular Menstrual Cycles, not sure of LMP, Maternal Complications like Anemia, Gestational Hypertension, Diabetes, etc or any condition that can affect health of foetus, oligohydramnios, polyhydramnios Congenital anomalies in foetus etc.

RESULTS

Variation of BPD with Gestational Age

Groups	Mean BPD (mm)	Percent Change
A	31.1+-0.46	
B	58.5+_3.99*	46.84
C	77.4+_1.22*	24.42
D	89.6+_0.76**	13.66

* P <0.01, ** P< 0.001.

The table shows that maximum growth in BPD was seen in the group B between 19-25 weeks and minimal in group D after 32 weeks. Thus we found a positive correlation between

BPD and Gestational age and the maximum increase in the mean of BPD was seen in the second trimester as compared to the first and the third trimester.

DISCUSSION

A good pregnancy outcome is an aggregation of good obstetrics care which depends on an accurate estimation of gestational age. Ultrasound helps in the study of foetal anatomy in the intrauterine life, identification of congenital anomalies or any complication that can alter the pregnancy outcome. It utilizes different parameters in different trimesters to assess the gestational period. Recent studies have evaluated Foetal Biometry through Ultrasound examination utilizing different parameters like Abdominal Circumference (AC), Femur Length (FL), Transcerebellar Diameter (TCD), orbital diameter etc. Different parametrs are used in different trimesters based on the available studies.[5,6] Assessment of gestational age is of utmost importance in optimizing pregnancy outcomes.[6]

Routinely CRL in first trimester, BPD in second trimester and FL in third trimester are used to assess gestational age and EDD prediction. Foetal Abdominal Circumference (AC) is used to assess foetal nutritional status and rule out any Intra uterine growth retardation (IUGR). BPD has been the earliest clinical parameter to assess gestational age. It is the transverse width of the head at its widest distance from inner to outer table to outer table of skull. The accuracy of BPD is 7±1 days at 14-20 weeks, ±1.6 weeks at 20-26weeks and 2.4 weeks at 26-30 weeks. The accuracy is ± 3-4 weeks after 30 weeks.[6,15]

Thus, BPD has been the most utilized parameter for assessing the gestational age of the fetus especially in the second trimester, but its relevance has been found to be more under 30 weeks. This is similar to the findings in our study that BPD was more positively correlated to the gestational age in the second trimester as the increase in mean of BPD in second trimester was more than the third trimester. The percent change in mean was maximum in pregnant females between 19-25 weeks.

Study done by Campbell *et al.* measured BPD in ultrasound of pregnant females and found that the increase in BPD was maximum from 20 to 30 weeks of gestation.[7]

Study done by Quddusa and Chowdhury on Bangladeshi pregnant females found that the BPD increase was maximum from 13 to 28 weeks, and least in the third trimester after 33 weeks.[8]

Beigi and ZarrinKoub, recorded BPD in Dutch women and found a mean weekly increase in the BPD was maximum from 12 to 29 weeks of gestation and minimum after 37 weeks.[9]

Thus, the role of BPD in assessing gestational age is more in first two trimesters than in third trimester.[10] Use of BPD for gestational age calculation before 20 weeks varies between 1 weeks 1 day to 2 weeks 2 days after 24 weeks.[11,16] Study done by Singh *et. al* in 2023 in North Indian population between 14-40 weeks of gestation found that the mean growth rate in BPD was 3.07 mm/week from 14-30 weeks of gestation while it decreased to 1.93 mm/ week from 31-40 weeks[17]. This is similar to the findings in our study which is also dine in North India where the maximum growth was seen in group B (between 19-25 weeks) and thus similar to this study maximum increase has been found in second trimester.

Study by Agrawal *et al* in 2015 also found a similar association between BPD and Gestational age and concluded that the significance of correlaton between BPD and gestational age was maximum in second trimester.[18]

The correlation coefficient observed in our study was higher as compared to Cohen *et al.* (1991)[11], Schlesinger *et al* (1987)[12], Gloor *et al* (1997).[13] Sagi *et al.* assessed correlation of length of foetal kidney and gestational age[14]. They found a linear progression of fetal kidney length which produce a growth curve similar to that seen with BPD.

CONCLUSION

Ultrasonographic measurement of biparietal diameter in Indian fetuses showed a linear correlation exists between BPD and gestational age in the second trimester. Thus, BPD can be used as a tool for assessment of gestational age in second trimester in north Indian population and thus help in timely interventions in improving maternal and foetal outcomes.

Conflict of Interest: None

Financial Support: Nil

REFERENCES

1. Kalish RB, Chervenak F Sonographic determination of gestational age. Ultrasound Rev Obstet Gynecol 2005: 4;254–8.
2. Sadler TW ed. Langman's Medical Embryology. 11th ed (South Asian Edition). New Delhi: Wolters Kluwer (India) Pvt Ltd/Lippincott Williams & Wilkins; 2010. 95.
3. Pandey VD, Singh V, Nigam GL, Usmani Y, Yadav Y Fetal tibial length as a tool for assessment of gestational age –A comparative study in North India. IAIM 2015: 2;39–45.
4. Kramer MS, Mclean FM,Boyd ME,Usher RH. The validity of gestational age estimation by menstrual dating in term, preterm, and post-term gestation. JAMA 1988;260;3306 Effect of antenatal corticosteroid administration-to-birth interval on maternal and newborn outcomes: a systematic review. McDougall, Annie R.A. *et al.* eClinical Medicine, Volume 58, 101916.
5. Willocks J, Donald I, Duggan TC, Day N Foetal cephalometry by ultrasound. J Obstet Gynaecol Br Commonw 1964: 71;11–20. Foetal Biometry varies with variation in geographical locations, socioeconomic and nutiritional states.
6. Kramer MS, Mclean FM, Boyd ME, Usher RH. The validity of gestational age estimation by menstrual dating in term, preterm, and post-term gestation. JAMA 1988;260;3306.
7. Campbell S The prediction of fetal maturity by ultrasonic measurement of the biparietal diameter. J Obstet Gynaecol Br Commonw 1969: 76;603–9.
8. Quddusa S, Chowdhury S Estimation of gestational age by foetal biparietal diameter in Bangladesh. J Bangladesh Coll Phys Surg 2004: 22;53–6.
9. Beigi A, ZarrinKoub F Ultrasound assessment of fetal biparietal diameter and femur length during normal pregnancy in Iranian women. Int J Gynaecol Obstet 2000: 69;237–42.
10. Dr Faiza Naseem Dr Sabir Ali, Dr Umbreen Basit, Dr Naheed Fatima. Assessment of gestational age comparison between transcerebellar diameter versus femur length on ultrasound in 3rd trimesterof pregnancy. Professional Medical J. 2014; 2:412-417.
11. Cohen HL, Cooper J, Eisenberg P, Mandel FS, Gross BR, Goldman MA, *et al.* Normal length of fetal kidneys: Sonographic study in 397 Obstetrics patients. Am J Roentol. 1991;157(3):545–8.
12. Schlesinger A, Hedlund G, Pierson WP, Null DM. Normalstandards for kidney length in premature infants. Determination with US. Radiology. 1987;164:127–9.
13. Gloor JM, Breekle RJ, Gehrking WC, Rosenquist RG, Mulhelland TA, Bergstrakh EJ, *et al.* Fetal renal growth evaluated by prenatal ultrasound examination. Mayo Clin Proc. 1997; 72(2):124–9. doi:10.4065/72.2.124.
14. Sagi J, Vagman I, David MP, Dongen LGV, Gondie E, Butterworth A, *et al.* Fetal kidney size related to gestational age. Gynecol Obstet Invest. 1987;23(1):1–4.
15. Haldlock FP, Deter RL, Harrist RB, Park SK. Estimating Fetal age: Computer assisted-analysis of multiple fetal growth parameters. Radiology 1984; 152(2):497-501.
16. Haldlock FP. Determination of fetal age. In Athey P.A and Haldlock, F.P. Mosby Ultrasound in Obstetrics and Gynecology 1985.
17. Singh, Archana; Gupta, Rakesh; Singh, Arun1. Ultrasonographic Analysis of Biparietal Diameter as an Indicator of Gestational Age in North Indian Fetuses. Journal of the Anatomical Society of India 72(2):p 158-168, Apr–Jun 2023. | DOI: 10.4103/jasi.jasi_116_22.
18. Agrawal NL Correlation of gestational age by real time ultra sonographic measurement of fetal Biparietal Diameter (BPD) with existing standard normograms. Indian J Appl Res 2015: 5;79–99.