

# A Comparative Study to Determine the Gestational Age in Third Trimester Using Fetal Femur Length Versus Biparietal Diameter

Alka Patil<sup>1</sup>, Shruti Singh<sup>2</sup>, Nilay Patel<sup>3</sup>

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## Author's Affiliation:

<sup>1</sup>Professor & HOD <sup>2</sup>Senior Resident  
<sup>3</sup>Junior Resident, Department of  
Obstetrics and Gynaecology,  
ACPM Medical College, Dhule  
424001 Maharashtra, India.

## Corresponding Author: Alka Patil,

Professor & HOD, Department of  
Obstetrics and Gynaecology,  
ACPM Medical College, Dhule  
424001 Maharashtra, India.  
E-mail: [alkapatil@rediffmail.com](mailto:alkapatil@rediffmail.com)

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## Abstract

*Introduction:* The accurate dating of pregnancy is critically important for pregnancy management from the first trimester to delivery, and is particularly necessary for determining viability in premature labour and in post-dated deliveries. Prior to the widespread use of ultrasound, caregivers relied on a combination of history and physical examination to clinically determine gestational age. *Objective:* To compare the Gestational Age in Third Trimester determined by Using Fetal Femur Length Versus Biparietal Diameter. *Materials and Method:* In the present study total 100 pregnant female attending antenatal clinic of the study institute in third trimester were enrolled. Detailed demographic profile including age, address etc was obtained. Detailed history regarding the exact knowledge of her LMP, cycle regularity and duration of cycle was taken. All patients then underwent detailed examination i.e. general and systematic examination. The gestational age at time of scanning was confirmed by LMP, and abdominal examination. All the women in the study underwent ultrasonography. The ultrasound was done by a single operator to avoid bias in observations. All the fetal parameters were assessed and special attention was given to the femur length and biparietal diameter. The collected data was entered in Microsoft excel. Primary analysis was conducted by using Epi Info statistical software. *Results:* The mean gestational age calculated from LMP was  $33.53 \pm 3.37$  weeks. The mean gestational age was calculated by using BPD and femur length on ultrasonography was  $35.87 \pm 2.96$  weeks and  $34.15 \pm 3.40$  weeks respectively. When the gestational age calculated from LMP and BPD was compared it was observed there was statistically significant difference in the two methods. While the gestational age calculated by LMP and FL showed no statistically significant difference. Thus the gestational age calculated from femur length was more accurate as compared to BPD. Similarity of GA in LMP with BDP was observed in 13 patients while similarity with FL observed in 74 patients. The Correlation coefficient between GA by LMP and GA by BDP was 0.9268 and correlation coefficient between GA by LMP and GA by FL is 0.9603. The coefficient between GA by BPD and GA by FL was 0.9099. *Conclusion:* The gestational age estimated from Biparietal diameter and fetal femur length were statistically significantly correlated with the gestational age calculated from the LMP. But the gestational age calculated from femur length was more accurate as compared to BPD.

**Keywords:** Ultrasonography; Gestational Age; BPD; Femur Length.

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## Introduction

The accurate dating of pregnancy is critically important for pregnancy management from the first

trimester to delivery, and is particularly necessary for determining viability in premature labour and in post-dates deliveries. Prior to the widespread use of ultrasound, caregivers relied on a combination of

history and physical examination to clinically determine gestational age.

Importance of accurate assessment of gestational age is very important in obstetrics. Fetal growth assessment, either clinically or by ultrasound evaluation, also relies on accurate assessment of gestational age. Fetal growth retardation or macrosomia may be missed or incorrectly diagnosed owing to errors in gestational age assignment. Interpretation of antenatal biophysical testing (non-stress tests and biophysical profiles) may be subject to variation with gestational age as well. Fetal heart rate reactivity and fetal breathing develop with advancing gestational age; therefore, the absence of these biophysical parameters may be interpreted as abnormal for fetuses in whom the gestational age has been overestimated. Obstetric management is also dependent on gestational age. Proper decisions regarding presumed preterm labor or postdate pregnancies are only possible when gestational age is accurately estimated. Likewise, timing of repeat cesarean section requires accurate assessment of dates [1,2]. Ultrasound is a reliable method for establishing the length of pregnancy and in this way can improve obstetric care.

When ultrasound is performed with quality and precision, there is evidence to suggest that dating a pregnancy using ultrasound measurements is clinically superior to using menstrual dating with or without ultrasound, and this has been advocated and adopted in other jurisdictions [3,4]. Ultrasound is a safe, non-invasive, non-ionizing, and relatively inexpensive technique for the assessment of obstetric patients [5,6]. Biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL) are considered reliable predictors and are used as routine parameters. These parameters are helpful in the estimation of fetal age in patients whose fundal height on abdominal examination does not correspond to the last menstrual period (LMP) [7,8].

### *Objective*

To compare the Gestational Age in Third Trimester determined by Using Fetal Femur Length Versus Biparietal Diameter.

### **Materials and Method**

The present study was conducted in the department of obstetrics and gynecology of ACPM Medical College, Dhule with the aim to evaluate the

usefulness of foetal femur length in assessment of gestational age in third trimester. The study was conducted from August 2014 to September 2016. Following inclusion and exclusion criteria was used to select the study population.

#### *Inclusion Criteria*

1. Pregnant woman in third trimester with Singleton live pregnancy attending OPD of study institute.
2. Woman with known last menstrual period and regular cycles.
3. Woman not on any oral contraceptive pills for last three months before last menstrual period.

#### *Exclusion Criteria*

1. Woman with unknown last menstrual period and irregular cycles.
2. Intrauterine growth restriction, polyhydramnios and oligohydramnios, Multiple Pregnancies.
3. Congenital anomalies of baby.
4. Medical disorders of pregnancy like DM, PIH, heart diseases.

Thus by using the above mentioned inclusion and exclusion criteria total 100 Pregnant females attending antenatal clinic of the study institute in third trimester were enrolled in the present study. Detailed demographic profile i.e. age, address etc was obtained from each patient, as per pre designed proforma. Detailed history regarding the exact knowledge of her LMP, cycle regularity and duration of cycle was taken.

All patients then underwent detailed examination i.e. general and systematic examination. The gestational age at time of scanning was confirmed by LMP, and abdominal examination.

The women were asked to take plenty of oral fluids and attended the USG clinic with full bladder. They were made to lie down in supine position exposing their abdomen from xiphisternum up to pubic symphysis.

Then the abdomen was scanned with help of probe to obtain different fetal parameters. The ultrasound was done by a single operator to avoid bias in observations. All the fetal parameters were assessed and special attention was given to the femur length (FL) and Biparietal diameter (BPD). And comparison was done between the gestational age estimated by FL and BPD.

The collected data was entered in Microsoft excel. Primary analysis was conducted by using Epi Info statistical software.

## Results

It was seen that out of total 100 women, maximum (38%) women belong to age group of 20-25 years followed by 25-30 years of age (36%). Majority of the women were primigravida (58%) and 42% multi gravida (Table 1).

The gestational age was evaluated by LMP and it was seen that maximum women were of 35 weeks gestation and minimum were of 40 weeks gestation. The mean gestational age calculated from LMP was  $33.53 \pm 3.37$  weeks. The gestational age was calculated

by using BPD on ultrasonography and it was seen that majority of the women were of 38 weeks of gestational age (16%) followed by 33 weeks of gestation (13%) with mean gestational age of  $35.87 \pm 2.96$  weeks. The gestational age was also calculated by using Femur length on ultrasonography and it was seen that majority of the women were of 38 weeks of gestational age (16%) followed by 32 weeks of gestation with mean gestational age of  $34.15 \pm 3.40$  weeks (Table 2).

When the gestational age calculated from LMP and BPD was compared it was observed there was statically significant difference in the two methods.

**Table 1:** Distribution according to age and gravida

		Frequency	Percentage
Age Group	<20 Years	14	14
	20-25 Years	38	38
	25-30 Years	36	36
	30-35 Years	10	10
	>35Years	2	2
Gravida	Primi	58	58
	Multi	42	42
	Total	100	100

**Table 2:** Distribution According to Gestational Age by LMP, Fetal Biparital diameter and femur length

GA (Weeks)	GA (Weeks) LMP	Frequency (BPD)	Frequency (FL)
28 Week	8	0	5
29 Week	9	3	11
30 Week	12	1	6
31 Week	9	5	6
32 Week	4	10	14
33 Week	10	13	4
34 Week	7	8	5
35 Week	14	3	10
36 Week	6	9	10
37 Week	9	11	9
38 Week	6	16	16
39 Week	4	21	4
40 Week	2	0	0

**Table 3:** Comparison of estimation of Gestational Age by LMP, Fetal Biparital diameter and femur length

Gestational age	Mean $\pm$ SD	SEM	P value	Statistical significance
LMP	$33.53 \pm 3.37$	-	-	-
BPD	$35.87 \pm 2.96$	-5.2186	< .00001	Significant
FL	$34.15 \pm 3.40$	-1.28492	.200323	Not significant

**Table 4:** Difference between GA by BPD/ FL and LMP

Difference Between USG (BPD) and LMP	Frequency (BPD)	Frequency (FL)
No difference	13	74
1-2 Week	26	24
2-3 Week	29	2
3-4 Week	26	0
4-5 Week	6	0
>5 Week	0	0

While the gestational age calculated by LMP and FL showed no statistically significant difference. Thus the gestational age calculated from femur length was more accurate as compared to BPD (Table 3).

Difference between GA (BPD and LMP) was observed in 87 patients out of 100 patients. Maximum observed difference between GA by BPD and LMP was 2 to 3 weeks. The difference between GA calculated from FL and LMP was observed in 26 patients out of 100 patients. Maximum difference observed between GA by FL and GA by LMP was 1-2

week. Similarity of GA in LMP with BDP was observed in 13 patients while similarity with FL observed in 74 patients (Table 4).

From Table 5 it was evident that the Correlation coefficient between GA by LMP and GA by BDP was 0.9268 with P-Value <0.05 and correlation coefficient between GA by LMP and GA by FL is 0.9603 with P-Value <0.05. The coefficient between GA by BPD and GA by FL was 0.9099 with P-Value <0.05. Thus there was significant correlation between GA by LMP, BDP and FL.

**Table 5:** Correlation of gestational age estimated by LMP with gestational age estimated by Fetal Biparietal diameter and femur length

Correlation between	Pearson Correlation coefficient	P value	Statistical significance
GA by LMP and BPD	0.9268	0.000	Significant
GA LMP and FL	0.9603	0.000	Significant
GA by BPD and FL	0.9099	0.000	Significant

## Discussion

An observational study was conducted in 100 pregnant women, in third trimester of their pregnancy. Prediction of gestational age using Biparietal Diameter and Fetal femur length was calculated. Observations were carried out using single ultrasonography in each of the patients.

It was seen that out of total 100 women, maximum (38%) women belong to age group of 20-25 years followed by 25-30 years of age (36%). Similar findings were also observed by Sherif A. Akl et. al. [9], Kansaria and Parulekar [10] and Konje et. al. [11] in their studies. Majority of the women were Primi Gravida (58%) and 42% multi gravida. The findings of the present study were comparable with the findings reported by Sherif A. Akl et. al. [9], Manisha Bakliwal [12] and Patre et. al. [13].

The gestational age was evaluated by LMP and it was seen that maximum women were of 35 weeks gestation and minimum were of 40 weeks gestation. The mean gestational age calculated from LMP was  $33.53 \pm 3.37$  weeks. The gestational age was calculated by using BPD on ultrasonography and it was seen that majority of the women were of 38 weeks of gestational age (16%) followed by 33 weeks of gestation (13%) with mean gestational age of  $35.87 \pm 2.96$  weeks.

The gestational age was also calculated by using Femur length on ultrasonography and it was seen that majority of the women were of 38 weeks of gestational age (16%) followed by 32 weeks of gestation with mean gestational age of  $34.15 \pm 3.40$  weeks.

When the gestational age calculated from LMP and BPD was compared it was observed there was statistically significant difference in the two methods. While the gestational age calculated by LMP and FL showed no statistically significant difference. Thus the gestational age calculated from femur length was more accurate as compared to BPD. The findings were comparable with findings reported by Hadlock et. al. [14], Shepard and Filly [15], Kurtz et. al. [16] and Sabbagha and Hughey [17].

Difference between GA (BPD and LMP) was observed in 87 patients out of 100 patients. Maximum observed difference between GA by BPD and LMP was 2 to 3 weeks. The difference between GA calculated from FL and LMP was observed in 26 patients out of 100 patients. Maximum difference observed between GA by FL and GA by LMP was 1-2 week. Similarity of GA in LMP with BDP was observed in 13 patients while similarity with FL observed in 74 patients. It was evident that the Correlation coefficient between GA by LMP and GA by BDP was 0.9268 with P-Value <0.05 and correlation coefficient between GA by LMP and GA by FL is 0.9603 with P-Value <0.05. The coefficient between GA by BPD and GA by FL was 0.9099 with P-Value <0.05. Thus there was significant correlation between GA by LMP, BDP and FL.

The relationship between the BPD and GA has been studied by various workers [18-20]. BPD is a fairly accurate method of estimating the GA [17].

In the present study, the correlation coefficient between GA and BPD is equal to 0.9268, indicating that BPD is highly correlated to GA.

However, the natural variations in the growth patterns of the head size in different individuals make

the prediction by BPD inaccurate in the third trimester. BPD is also less reliable in breech head, dolichocephaly, uterine anomalies, and multiple gestations. BPD is also difficult to record when the head gets engaged in the late third trimester.

Fetal FL is a relatively easy measurement to obtain. It is especially useful where it is difficult or impossible to obtain a reliable BPD for example, where position or engagement of the head makes visualization difficult or in cases of hydrocephalus, anencephaly, dolichocephaly where FL can be better relied upon. The FL has a linear relationship with the GA, similar to BPD, but the growth appears to be slow in the third trimester. Fetal FL has been widely used for prediction of GA [14,22-24].

Accurate dating of pregnancy is important to improve outcomes and is a research and surveillance, the best obstetric estimate, rather than estimates based on the LMP alone, should be used as a measurement of gestational age.

An accurately assigned EDD is among the most important results of evaluation and history taking early in prenatal care. This information is vital for:

1. Timing of appropriate obstetrics care
2. Scheduling and interpretation of certain antepartum tests
3. Determining appropriateness of fetal growth
4. Designing interventions to prevent preterm births, post-term births and related morbidities

Consistent approach to accurate dating is also a research and public health imperative because of the influence of dating on investigational protocols and vital statistics [25].

It has been observed that there is a high degree of positive correlation between GA and FL. In the present study, the correlation coefficient for FL on GA was 0.9603, which was statistically significant. Thus FL turned out to be a better indicator of GA as compared to BPD.

## Conclusion

In our parts, due to ignorance, illiteracy, poor socio-economic conditions and widely used traditional local remedies especially in villages, very few number of patients come for proper antenatal checkup. Most of them come to the hospital with advanced pregnancies or on development of some complication or only in the first stage of labor while some of them do not turn up at all. In these circumstances most of them are, as expected, vague about the date of their L.M.P. In the absence of previous antenatal records,

only clinical appreciation of the duration of pregnancy cannot be relied upon. The gestational age estimated from Biparietal diameter and fetal femur length were statistically significantly correlated with the gestational age calculated from the LMP. But the gestational age calculated from femur length was more accurate as compared to BPD.

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