e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2026; 17(7); 66-69

Original Research Article

A Study on Ultrasonographic Assessment of Gestational Age by Fetal Parameters in Second Trimester of Pregnancy

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Received: 25-05-2026 / Revised: 19-06-2026 / Accepted: 02-07-2026

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Conflict of interest: Nil

Abstract:

Introduction: Fetal biometry is a methodology devoted to measuring several parts of fetal anatomy and their growth. The present study was carried out to assess gestational age in the second and third trimesters with the help of ultrasonographic measurements of four fetal biometric parameters (i.e., biparietal diameter [BPD], head circumference [HC], abdominal circumference [AC], and femur length [FL]) in the local population Hyderabad, and also to evaluate efficacy and significance of these four fetal biometric parameters in the prediction of gestational age by ultrasound.

Materials and Methods: The present study was carried out in 100 normal pregnant women with singleton uncomplicated pregnancy, with the known last menstrual period (LMP).

Results: FL was found to be more reliable parameter as compared to HL in both second trimester of pregnancy.

Conclusions: Variation in predicted gestational age by ultrasonography (USG) is attributed to the anthropometric difference between the two populations due to racial, genetic, nutritional, and socioeconomic factors. Therefore, population-specific measurements should be made to generate tables and regression equations for more precise reporting of gestational age and EDD by USG.

Keywords: Gestational Age (GA); LMP; Femur Length (FL); Humerus Length (HL).

DOI: 10.25258/ijpqa.17.7.9

Introduction

Gestational age is the age of an unborn baby.[1] The accurate knowledge of gestational age is the key for successful antepartum care and critical interpretation of antenatal tests and successful planning of appropriate intervention or treatment. In past, gestational age has been established by a combination of the historical information and physical examination. Predictions were based on menstrual history maternal sensations of fetal movements, assessment of uterine size by bimanual examination in the first trimester, initial detection of fetal heart tones by Doppler, and uterine fundal height measurement. [2–7] However, it has been reported that even in the best-known cases, the menstrual history index and fundal height measurement techniques were also fraught with error. [8] Timed ovulation and in vitro fertilization with known date of conception are expected to estimate the gestational age accurately. Unfortunately, the last menstrual period (LMP) cannot be used for all patients because 10–40% of all patients seen in the antenatal clinics have no knowledge of their LMPs or a history of irregular menstrual cycles or have been on oral contraceptives within 2 months of their LMPs. [7,9] Determining gestational age from the palpated dimensions of the uterus may be affected by uterine fibroids and maternal body habitus. Therefore, in most pregnancies the date of ovulation or conception cannot be accurately predicted as outlined by other methods and hence gestational age must be estimated by other methods Sonographic measurements of the fetus provide information about fetal age and growth. They are used to assign gestational age, EDD, estimated fetal weight, and diagnose growth disturbances. Fetal biometry is a method devoted to the measurement of several parts of fetal anatomy and their growth.[10] The real-time ultrasound scanners have given a number of ultrasonic biometric parameters to determine gestational age. The most commonly used fetal biometric parameters are crown-rump length, fetal biparietal diameters (BPD), head circumference (HC), abdominal circumference (AC), femur length (FL)

to determine gestational age, fetal weight, and growth in different trimesters. In the absence of known date of LMP or where fundal height does not agree with dates, these parameters are valuable in estimating the gestational age of the fetus. The study also aimed to find out the predictive accuracy of gestational age determined by ultrasonography (USG) with menstrual age determined by the LMP method in local population.

Materials & Methods

The study "Ultrasonographic evaluation of fetal gestational age in different trimesters from various anatomical biometric parameters." was carried out in 100 pregnant women. The subjects were females attending ANC clinic for ultrasonographic screening. Subjects of the study mainly include urban as well as rural areas in the vicinity.

Inclusion Criteria

i. Women with known LMP.
ii. Women with regular menstrual cycle.
iii. Women with singleton pregnancy.
iv. Women with uncomplicated pregnancy

Exclusion Criteria

i. Women with multiple pregnancies.
ii. Women with irregular menstrual cycles.
iii. Women with diseases like hypertension, chronic renal disease, heart diseases and diabetes mellitus.
iv. Women having Foetus with congenital anomalies.

Results

The data collected was formulated according to the menstrual weeks from 13 to 42 weeks. All the observations of the fetal growth parameters were taken in centimeters. Standard deviation of each parameter for each week was calculated. Similarly the statistical mean of each parameter for each week was calculated. The weeks of gestation were defined as completed week. For e.g. 13th week refers to 13.00 to 13.86 weeks of menstrual age. 7 days = 1 week, hence 1day = 0.14 weeks. Like this subsequently for each day. The mean, SD of femur length was 5.76 and 1.2 and range is 3.04–8.8 and mean & SD of humerus length was 4.92 and 1.0 and the range is 3.0–7.6. (Table 1). Frequency distribution of gestational age were, gestational age of 29 subjects was between 15 to 20 weeks, GA of 21 subjects was between 21–25 weeks, GA of 19 subjects was between 26 to30 weeks, GA of 20 subjects was between 31-35 weeks, whereas GA of 11 subjects was between 36-40 weeks.

Simple Linear Regression: Simple linear regression analysis of the observations was done for estimating gestational Simple linear regression for the observations from the Femur Length. Regression equation for total cases (15-40 weeks) G.A = 8.02+ 3.56 x FL From the above equation it is clear that, for every 1cm increase in FL, the gestational age (G.A) increases by 3.56 weeks. Coefficient Of determination (R) = 0.9516 The value of R is highly significant $p<0.0001$ showing that there is statistically highly positive association between Gestational age and Femur Length.

Simple linear regression for the observations from the Humerus Length: Regression equation for total cases (15-40 weeks) G.A = 7.89+ 3.02 x HL From the above equation it is clear that, for every 1cm increase in HL, the gestational age (G.A) increases by 3.02 weeks. Coefficient Of determination (R) = 0.9285. The value of R is highly significant $p<0.0001$ showing that there is statistically highly positive association between Gestational age and Humerus Length.

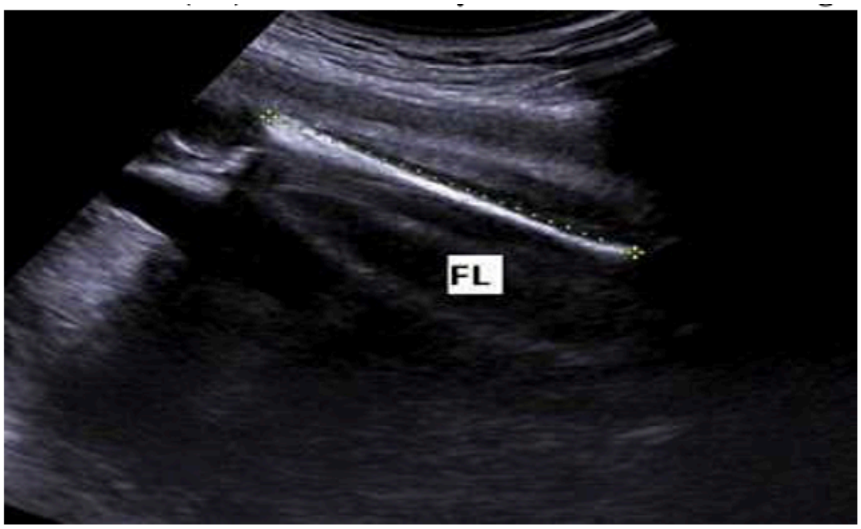

Figure 1: Diphyseal length of Femur (FL) can be reliably used after 14 weeks of gestational age. The long axis of the femoral shaft is most accurately measured with the beam of insonation being perpendicular to the shaft, excluding the distal femoral epiphysis

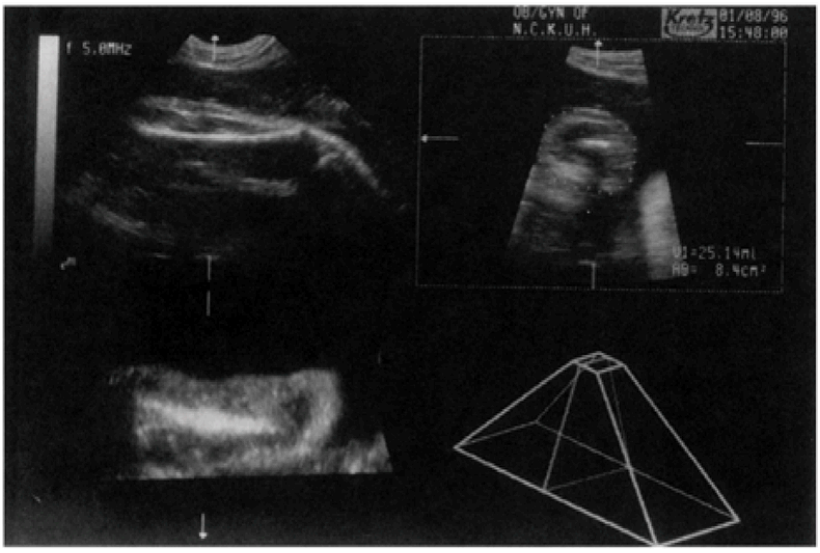

Figure 2: The fetal Arm (humerus) length technique: After visualizing the heart, the transducer is moved to image the scapular spine which is dorsal to the humerus head. The full length of the humerus was then obtained in a plane as close as possible to right angles of the ultrasound beam. A straight measurement was made from the center of one end of the diaphysis to the other, disregarding any curvature.

Table 1: Ultrasonic Biometric Parameters

Parameters	N	Minimum	Maximum	Mean	Std. deviation
Femur length (cm)	100	3.04	8.8	5.76	1.2
Humerus length (cm)	100	3	7.6	4.92	1.0

Table 2: Frequency distribution of Gestational age

GA in weeks	Frequency	Percent
15-20 weeks	29	29
21-25 weeks	21	21
26-30 weeks	19	19
31-35 weeks	20	20
36 -40 weeks	11	11

Discussion

Researchers from Anatomical background in the past worked on the correct estimation of gestational age by measuring different anatomical biometric parameters by Ultrasound. So, here also by using two anatomical biometric parameters (i.e FL & HL) to determine gestational age using ultrasonography, we found that each parameter increases as age advances from second trimester to third trimester & also found to be statistically significant. These finding were supported by Hadlock [12] et al. but were in contrast to Sumit [11] et al. Hadlock [14] et al. stated that a combination of multiple fetal parameters (HC, AC, FL) provided age estimates that were significantly better (p=0.05) than alone using single parameter. In fact, Hohler [14] found that the measurement of more than one parameter, in a sense, prevents over-reliance on any single measurement which by itself might mislead the clinician. Therefore, it proves that the estimate using the mean fetal gestation period is accurate as well as precise than single measurement. Hadlock [15] et al. stated that the regression equation developed from white middle class population appeared to be applicable to the populations of racial & socioeconomic groups. Ruvolo [16] et al. found no statistically significant difference in FL versus gestational age in racially mixed population of Blacks, Asians & Caucasians while Present study shows that FL is reliable parameter in determining the gestational age & also it is statistically significant. Yeo [17] et al. conducted a study on Chinese, Malaysian & Indian population which showed that fetal FL of Chinese and Malaysian, are apparently shorter than Indian FL. Lai [18] & Yeo demonstrated Slightly smaller FL more pronounced over the course of gestation in Asians compared with white fetuses. Patre et al. found that in the management of the patient with premature labour, to accurately predict GA, FL can be used in conjunction with HL Supported by Tahmasebpour [19] AR et al. Thus, proving the existence of similarities & differences in ultrasound measurement of FL & HL in different ethnic groups. Anatomical dimension of fetus varies according to the race, nutritional status, build & geographic location of the origin of the parents. As the growth trend of our fetuses increases, all fetal biometric parameters predict precise gestational age, more so as pregnancy advances. Sonographic measurement of the ossified

shaft humerus is possible after the 12th week of gestation. Humerus is difficult to define accurately, because of its proximity to the chest wall &its apparent continuity with the scapula & clavicle [20].

Conclusion

The present study describes the use of two fetal biometric parameter (FL and HL) to determine the accurate gestational age in the population of Telangana Present analysis reveals that fetal anthropometric parameters significantly differ among different population groups due to racial, genetic & ethnic regions. Therefore biometric curves of one population may overestimate gestational age when used for other racial or ethnic groups.

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