Foetal Age Assessment From Femur Length And Biparietal Diameter In Warri, South-south Nigeria.

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ABSTRACT

Introduction: Femur length (FL) and biparietal diameter (BPD) are among the foetal biometric parameters used to estimate the gestational age (GA) of the foetus.

Aim: The aim of this study was to determine the correlation of ultrasound generated gestational age (GA) by measuring FL and BPD with the last menstrual period (LMP) in Warri, South-South Nigeria.

Materials and Methods: Two hundred and thirteen (213) pregnant women who fulfilled the inclusion criteria were recruited into the study. The ultrasound scan measurements of FL and BPD were done in accordance with standard practice. Data were analysed using SPSS 20. Pearson's correlation was used to determine the relationship of GA based on LMP with FL and BPD. T-test was used to determine the differences between the mean GA from LMP, FL and BPD. P value <0.05 was considered significant.

Results: At 12th weeks, calculated GA (from LMP) was 12.43 weeks and mean FL was 12.74mm corresponding with USS GA of 14.11weeks, while mean BPD was 27.43mm corresponding to USS GA of 14.82 weeks. In both second and third trimesters, there were significant positive correlations between, GA based on FL and LMP; GA based on FL and FL; GA based on BPD and LMP; GA based on BPD and BPD; and GA based on FL and BPD. In the second trimester, the mean GAs based on FL and BPD were significantly higher than that based on LMP, but there was no significant difference between the mean GAs based on FL and BPD. In the third trimester, there was no significant differences in the mean GAs between FL and LMP, BPD and LMP, and FL and BPD.

Conclusion: FL and BPD increase as the foetal age increases. This study will be of relevance in obstetrics and gynaecology, and in forensic medical practice.

Key words: Foetal age estimation, last menstrual period, biparietal diameter, femur length, sonography.

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Introduction

Foetal biometry is the term used to describe the measurement of foetal parts, and is a routine ante-natal practice[1]. Traditionally, the last menstrual period (LMP) given by the expectant mother is used as a guide for gestational age (GA) estimation; but this depends on the ability of the patient to accurately recollect.Hence, the need for a more reliable method of estimating gestational age.

Occasionally, in a medico-legal setting in which foetal age is necessary to provide the clue, bones, including femur and skull, may be the only parameters available for identification. Among the bone parameters that are commonly used are: femur length (FL) and Biparietal diameter (BPD) and head circumference (HC)[2]. Studies have been conducted in different populations on the relationship between gestational age based on femur length (GA.FL), biparietal diameter

(GA.BPD) and last menstrual period (GA.LMP)[3-10]. It was observed that the growth of these parameters was accelerated in the last 4 weeks of gestation [11].

Distinct significant correlation has been found between gestational age, and femur length as well as biparietal diameter[12]. These correlations have enabled ultrasound machine manufacturers to create an inbuilt program that helps to estimate the GA from the ultrasound measurements. The aim of this study, therefore was to determine the level of correlation between ultrasound scan generated gestational age (GA) by measuring femur length, biparietal diameter and last menstrual period in Warri, South-South Nigeria, thus providing location specific data on this subject matter. This will be of benefit to the obstetricians, forensic anthropologists, and researchers.

Materials and Methods

All pregnant women who visited the central Hospital Warri for obstetric scan between January and February 2016, formed the study population. Only subjects who gave informed consent, with a history of regular menstrual flow and who were sure of the date of their last menstrual period and pregnancies of 12 to 40 weeks GA, and no foetal growth retardation, participated in the study. 208 pregnant women satisfied the inclusion criteria, and hence participated in the study.

The ultrasound scan measurements of FL and BPD were done by only one radiologist (for uniformity and consistency in measurements) in accordance with the method used by Shohat et al. [13], using a 2D EDAN ultrasound machine with 3.0MHz transducer.

Data analysis was done using SPSS 20. Pearson's correlation was used to determine the relationship between gestational age based on LMP with femur length and biparietal diameter. T-test was used to determine the differences between the mean gestational age from LMP, FL and BPD. P value <0.05 was considered significant.

Result

Four (4) patients at 12th weeks had a calculated GA of 12 weeks and had an average femur length of 12.74mm which corresponded to USS GA of 14.11weeks (Table 1). The mean biparietal diameter of these four patients in the first trimester was 27.43mm corresponding to an USS GA of 14.82 weeks while the calculated GA (from LMP) was 12.43 weeks.

Result showed that in the second trimester, Pearson's correlation coefficient (r) between, GA based on FL and LMP was 0.70 (p=0.001) (Figure 1); GA based on FL and FL was 0.93 (p=0.001) (see Figure 2); GA based on BPD and LMP was 0.68 (p=0.001) (see Figure 3); GA based on BPD and BPD was 0.995 (p=0.001) (see Figure 4); and GA based on FL and BPD was 0.91 (p=0.001) (see Figure 5).

In the third trimester, Pearson's correlation coefficient (r) between, GA based on FL and LMP was 0.758 (p=0.001) (see Figure 6); GA based on FL and FL was 0.990 (p=0.001) (see Figure 7); GA based on BPD and LMP was 0.739 (p=0.001) (see Figure 8); GA based on BPD and BPD was 0.937 (p=0.001) (see Figure 9); and GA based on FL and BPD was 0.965 (p=0.001) (see Figure 10).

Table 2 shows that in the second trimester, the mean GA based on femur length was significantly higher than that based on last menstrual period. Table 3 shows that in the second trimester, the mean GA based on biparietal diameter was significantly higher than that based on last

menstrual period. Table 4 shows that in the second trimester, there was no significant difference between the mean GAs based on femur length and biparietal diameter.

Comparison of the mean gestational ages between, femur length and last menstrual period, biparietal diameter and last menstrual period, femur length and biparietal diameter in the third trimester are shown in Tables 5, 6 and 7 respectively. It was observed that in all, the mean differences were not statistically different.

Table 1. Mean FL and BPD, and GA based on LMP, FL and BPD.

Age (weeks)	N	GA.LMP (weeks)	FL(mm)	GA.FL (weeks)	BPD (mm)	GA.BPD (weeks)
12	4	12.43	12.74	14.11	27.43	14.82
13	0	0.00	0.00	0.00	0.00	0.00
14	0	0.00	0.00	0.00	0.00	0.00
15	1	15.00	17.80	15.14	31.80	15.86
16	2	16.58	25.35	17.65	40.40	18.22
17	2	17.65	**42.40**	**24.93**	**62.80**	**25.79**
18	0	0.00	0.00	0.00	0.00	0.00
19	2	19.22	25.20	18.50	41.20	18.50
20	4	20.50	**38.50**	**22.32**	**53.90**	**22.39**
21	4	21.72	36.93	21.79	51.00	21.61
22	3	22.52	36.40	21.48	51.33	21.43
23	4	23.50	50.35	26.97	66.80	27.51
24	9	24.51	49.73	28.53	65.50	28.00
25	7	25.49	52.33	27.81	68.43	30.40
26	12	26.42	53.03	28.39	70.42	32.00
27	8	27.25	53.61	28.39	72.33	32.45
28	10	28.44	58.20	30.39	75.21	32.35
29	7	29.53	61.34	31.94	79.43	32.59
30	17	30.49	62.82	32.51	81.02	34.01
31	12	31.28	62.34	32.30	80.21	32.35
32	13	32.43	63.26	32.61	80.95	32.59
33	13	33.40	66.09	34.01	84.06	34.01
34	13	34.50	67.48	34.74	85.54	34.81
35	16	35.43	70.48	36.30	88.11	36.13
36	11	36.48	72.36	36.88	88.36	36.96
37	16	37.41	72.37	37.03	91.13	36.71
38	8	38.43	72.05	36.97	90.94	36.86
39	11	39.49	73.65	38.05	92.37	37.13
40	3	40.14	76.00	39.05	95.00	38.81

BPD= Biparietal diameter, FL= Femoral length, LMP= Last menstrual period, GA=Gestational age.

Table 2. T-test between mean GAs based on LMP and FL in the second trimester (N=50).

GA (Weeks)	Mean	SD	Mean difference	T	Df	*p*-Value
LMP	23.37	3.09	2.24	2.759	98	0.007
FL	25.61	4.84				

FL= Femoral length, LMP= Last menstrual period, GA=Gestational age.

Table 3. T-test between Mean GAs based on LMP and BPD in the second trimester (N=50).

GA (Weeks)	Mean	SD	Mean difference	T	Df	*p*-Value
LMP	23.37	3.09	1.77	2.328	98	0.022
BPD	25.14	4.41				

BPD= Biparietal diameter, LMP = Last menstrual period, GA=Gestational age.

Table 4. T-test between mean GAs based on FL and BPD in the second trimester (N=50).

GA (Weeks)	Mean	SD	Mean difference	t	Df	*p*-Value
FL	25.61	4.84	0.47	0.505	98	0.614
BPD	25.14	4.41				

BPD= Biparietal diameter, LMP= Last menstrual period, GA=Gestational age

Table 5. T-test between mean GAs based on LMP and FL in the third trimester (N=158).

GA (Weeks)	Mean	SD	Mean difference	t	Df	*p*-Value
LMP	33.77	3.61	0.55	1.372	314	0.171
FL	34.32	3.50				

FL= Femoral length, LMP= Last menstrual period, GA=Gestational age.

Table 6. T-test between Mean GAs based on LMP and BPD in the third trimester (N=158).

GA (Weeks)	Mean	SD	Mean difference	t	Df	*p*-Value
LMP	33.77	3.61	0.55	1.372	314	0.171
BPD	34.32	3.50				

BPD= Biparietal diameter, LMP = Last menstrual period, GA=Gestational age.

Table 7. T-test between mean GAs based on FL and BPD in the third trimester (N=158).

GA (Weeks)	Mean	SD	Mean difference	t	Df	*P*-Value
FL	34.32	3.50	0.13	0.337	314	0.736
BPD	34.19	3.42				

BPD= Biparietal diameter, LMP= Last menstrual period, GA=Gestational age

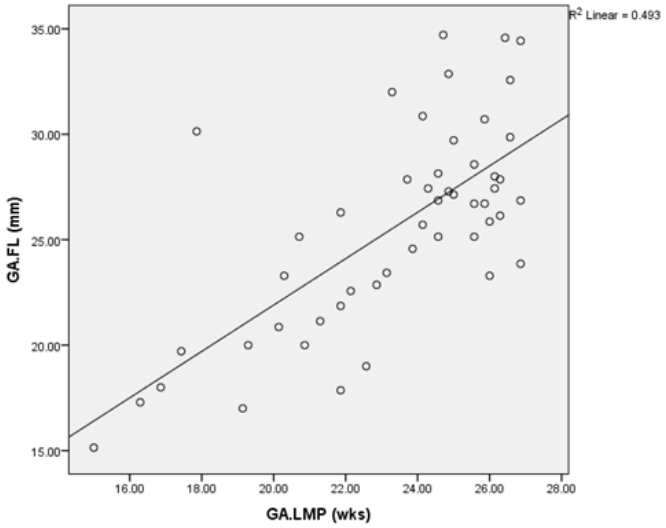

Figure 1. Scatter plot between GA.FL and GA.LMP in second trimester.

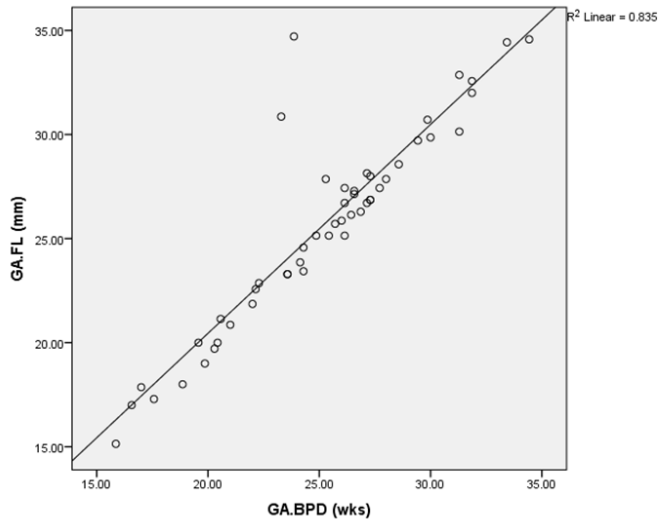

Figure 2. Scatter plot between GA.FL and GA.BPD in second trimester.

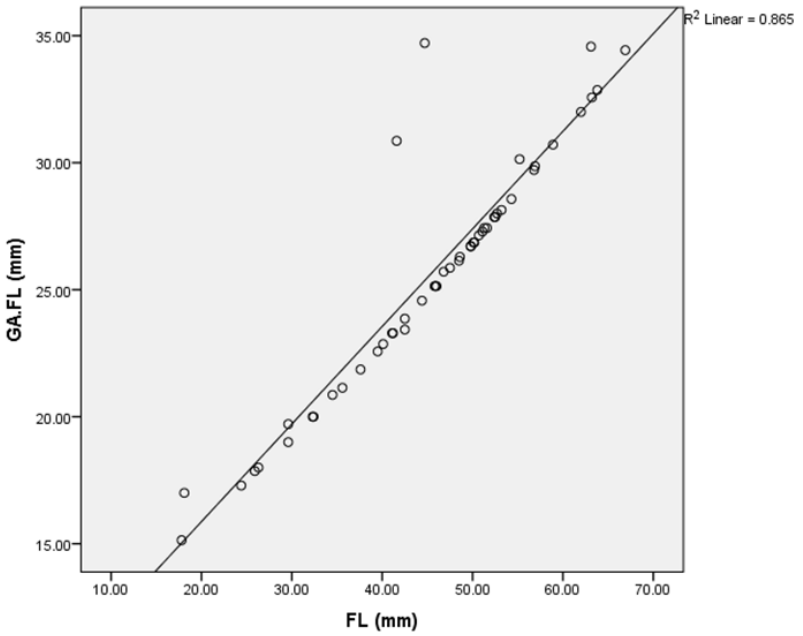

Figure 3. Scatter plot between GA.FL and FL in second trimester.

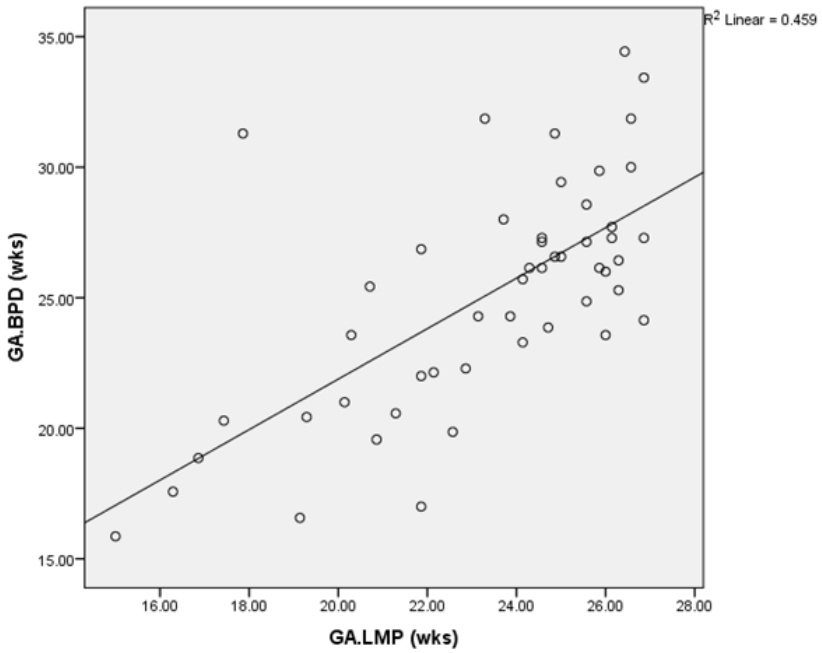

Figure 4. Scatter plot between GA.BPD and GA.LMP in second trimester.

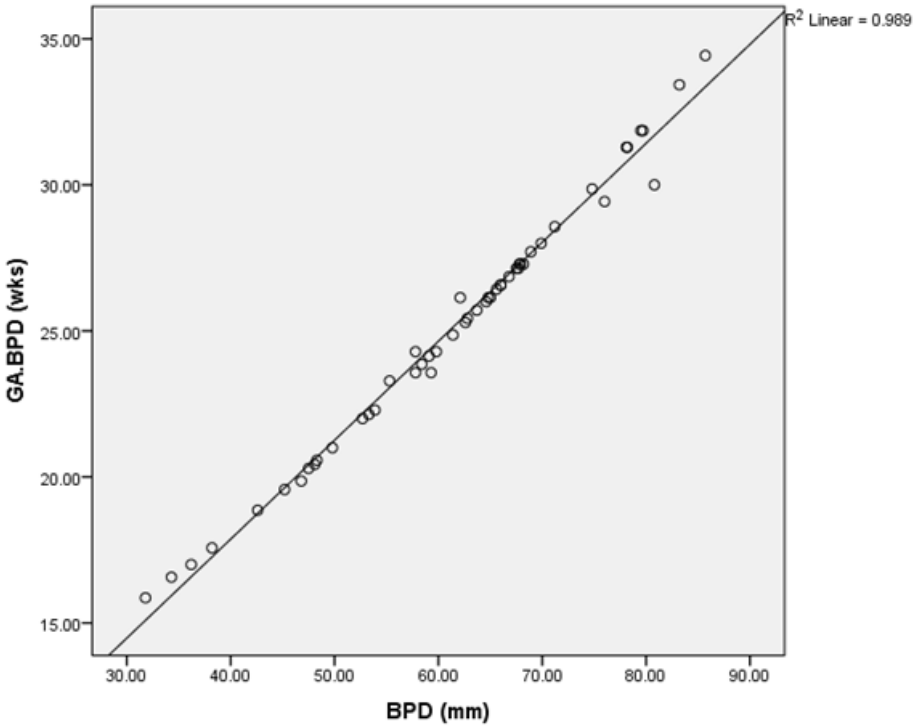

Figure 5. Scatter plot between GA.BPD and BPD in second trimester.

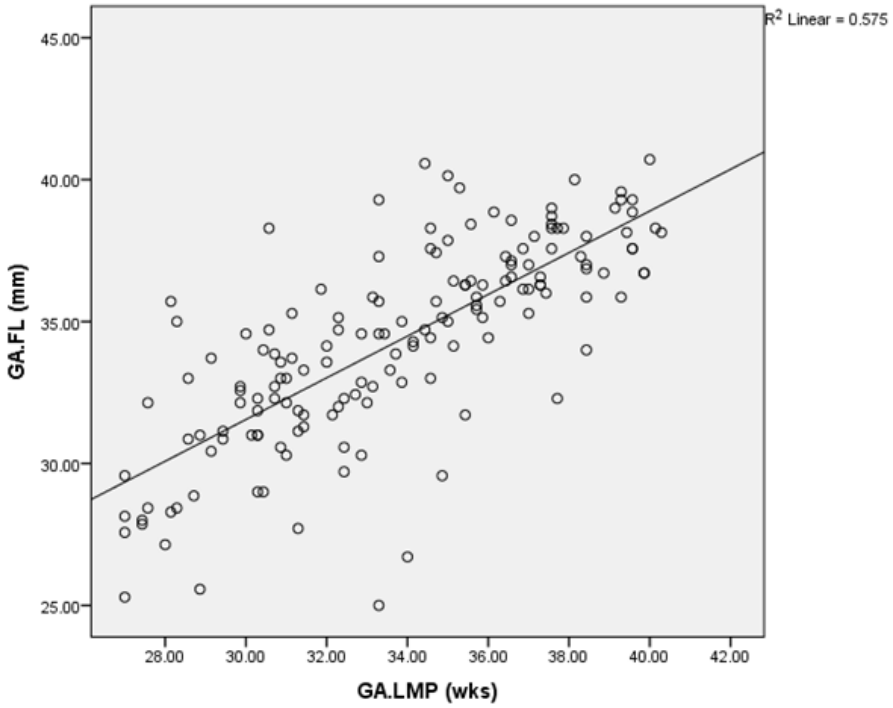

Figure 6. Scatter plot between GA.FL and GA.LMP in the third trimester.

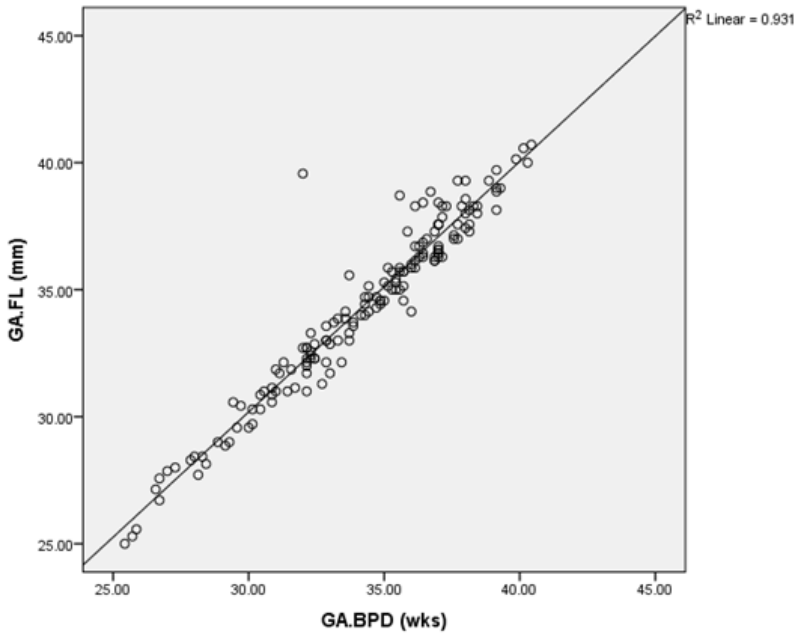

Figure 7. Scatter plot between GA.FL and GA.BPD in the third trimester.

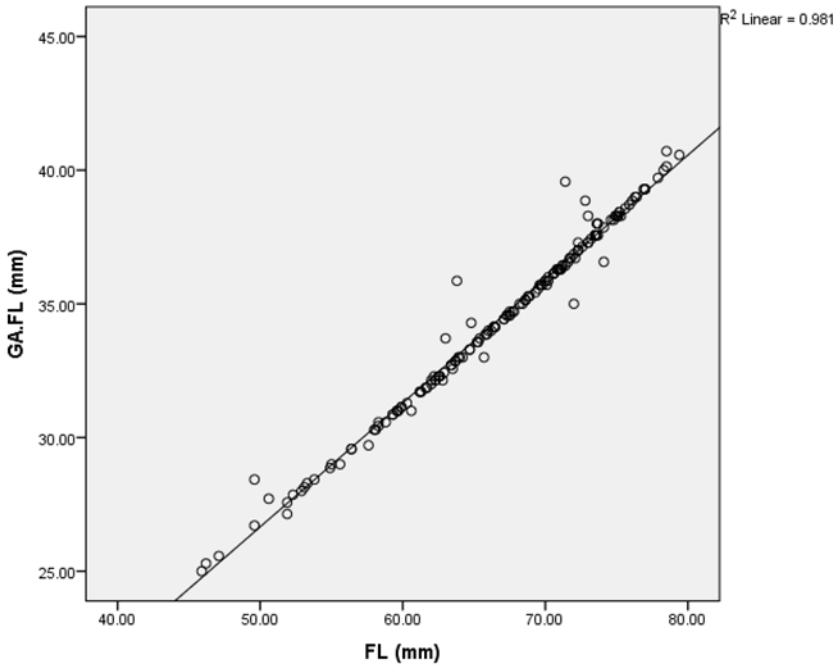

Figure 8. Scatter plot between GA.FL and FL in the third trimester.

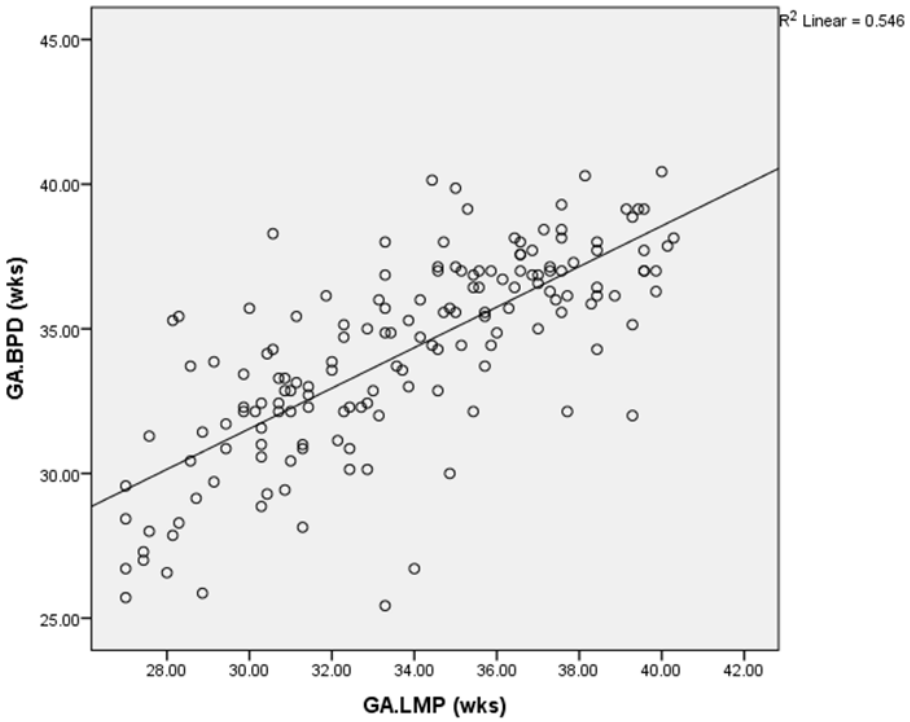

Figure 9. Scatter plot between GA.BPD and GA.LMP in the third trimester.

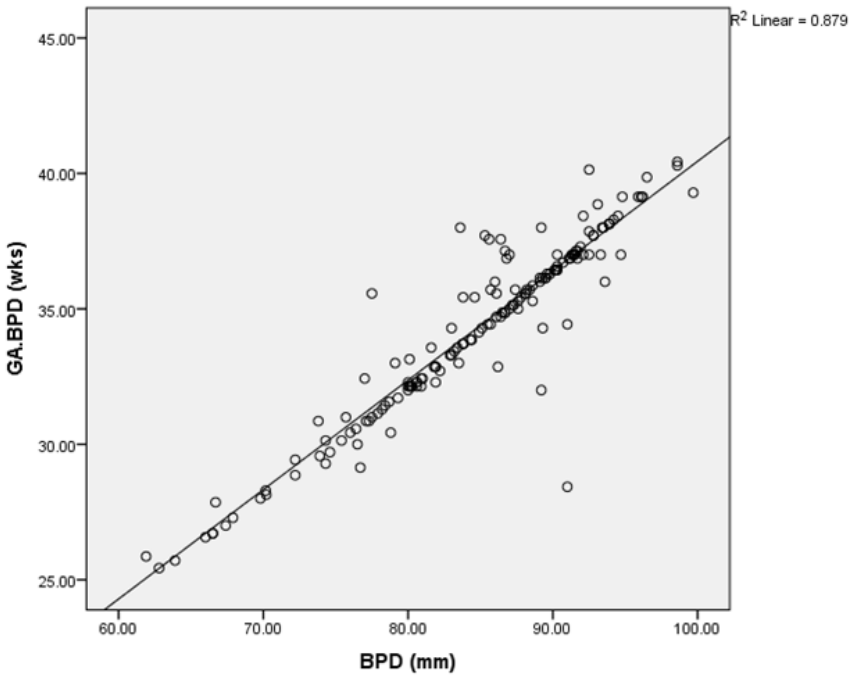

Figure 10. Scatter plot between GA.BPD and BPD in the third trimester.

Discussion

In the present study, the appropriateness of femur length and biparietal diameter as foetal biometric parameters for ultrasonic estimation of GA was assessed. As early as the calculated GA of 12 weeks, these foetal parts are visualized and measured. This is consistent with the statement that measurement of the biparietal diameter may be possible from gestational age of 12 weeks until term [2]. Some prior studies posited that visualization of the femur is possible as from the 14th week of gestation until delivery [2,14].

The two peaks due to abnormal high femur length and biparietal diameter in the second trimester could be attributed to the inability of the subjects to accurately state their LMP; hence the discrepancies between the biometric parameters and respective GA. The mean GA difference observed between femur and last menstrual period is outside the ±2 weeks acceptable with range. This indicates that in this study, femur length does not provide an acceptable gestational age. In the case of biparietal diameter, the mean difference is < 2 weeks, showing that it can be used to estimate gestational age in the second trimester. In the third trimester, the mean difference between GA.LMP and FL, and GA.LMP and BPD shows FL and BPD can be acceptably used to estimate gestational age, since the differences observed are less than one week. The observation in the present study that no significant differences between the mean GA based FL and BPD in both second and third trimester is similar to the finding in a previous study also in third trimester.

The significant positive correlation of FL and BPD with their respective gestational age in both second and third trimesters shows that as gestational age is increasing, the biometric parameters are also growing. This is similar to the finding of Varol et al.[12]

In conclusion, at 12th weeks, calculated GA (from LMP) was 12.43 weeks and mean femur length was 12.74mm corresponding with USS GA of 14.11weeks, while mean BPD was 27.43mm corresponding to USS GA of 14.82 weeks. In both second and third trimesters, there were significant positive correlations between, GA based on FL and LMP; GA based on FL and FL; GA based on BPD and LMP; GA based on BPD and BPD; and GA based on FL and BPD. In the second trimester, the mean GA based on FL and BPD were significantly higher than that based on LMP, but there was no significant difference between the mean GA based on FL and BPD. In the third trimester, there were no significant differences in the mean gestational age between FL and LMP, BPD and LMP, FL and BPD. This study will be of relevance in obstetrics and gynaecology, and in forensic medical practice.

References

1. Garg A, Pathak N, Gorea RK, Mohan P. Ultrasonographical age estimation from Fetal Biparietal Diameter. J. Indian Acad. Forensic Med. 2010; 32: 308-310.
2. MacGregor, S, Sabbagha, R, Glob. libr. women's med., 2008; DOI 10.3843/GLOWM.10206: http://www.glowm.com/section_view/ heading /Assessment%20of%20Gestational%20Age%20by%20Ultrasound/item/206 Accessed on December 11th 2016.
3. Adiri CO, Anyanwu GE, Agwuna KK, Obikili EN, Ezugworie OJ, Ezeofor SN. Use of foetal biometry in the assessment of gestational age in South East Nigeria: Femur length and biparietal diameter. Niger J. Clin. Prat. 2015; 18: 477-482.
4. Jaiswal P, Masih WF, Jaiswal S, Chowdhary DS. Assessment of fetal gestational age by ultrasonic measurement of bi-parietal diameter in the southern part of Rajasthan. Med J DY Patil Univ 2015; 8: 27-30.

5. Rudrawadi MB, Melkundi M, Dey P. A single ultrasonic biparietal diameter, femur length in term pregnancy and their use in predicting gestational age International Journal of Clinical Cases and Investigations 2013. 2014; 5: 101-107.
6. Chris-Ozoko LE, Akinnuoye HO. An assessment of the use of femoral length and biparietal diameter in the estimation of gestational age in second and third trimester in Edo women in Benin City. International Journal of Pharmaceutical and Medical Research. 2014; 2: 24-26.
7. Falatah H, Awad I, Abbas H, Khafaji M, Alsafi K, Jastaniah S. Accuracy of ultrasound to determine gestational age in third trimester. Open Journal of Medical Imaging. 2014; 4: 126-132.
8. Moawia G, Baderldin A, Mead ZA. The reliabilty of biparietal diameter and femoral length in estimation the gestational age using ultrasonography. Journal of Gynecology and Obsterics. 2014; 2: 112-115.
9. Mador ES, Pam IC, Ekedigwe JE, Ogunranti JO. Ultrasound biometry of Nigerian fetuses: 2. Femur length. Asian J. Med. Sci. 2012; 4: 94-98.
10. Dare FO, Smith NC, Smith. Ultrasonic measurement of biparietal diameter and femur in foetal age determination. West Afr. J. Med. 2004; 23: 24-26.
11. Adiri CO, Anyanwu GE, Agwuna KK, Obikili EN, Ezugworie OJ, Agu AU, Nto J, Ezeofor SN. Use of fetal biometry in the assessment of gestational age in South East Nigeria: Femur length and biparietal diameter. Niger J. Clin. Pract. 2015;18:477-82
12. Varol F, Saltik A, Kaplan PB, Kilic T, Yardim T. Evaluation of Gestational Age Based on Ultrasound Fetal Growth Measurements. Yonsei Med. J. 2001; 42: 299-303.
13. Shohat T, Romano-Zelekha O. Ultrasonographic measurements of fetal femur length and biparietal diameter in an Israeli population. IMAJ, 3, 2001,166-168.
14. Jeanty P, Rodesch F, Delbeke D, Dumont JE: Estimation of gestational age from measurement of fetal long bones. J. Ultrasound Med. 1984; 3(2):75-79.

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