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Original Work

Placental thickness: A sonographic indicator of gestational age in normal singleton pregnancies in Nigerian women

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ABSTRACT: The study is aimed to investigate placental thickness as a parameter for estimating gestational age in normal singleton pregnancies in Nigerian women. 730 Nigerian women with normal singleton pregnancies who were attending antenatal clinic at Federal Medical Centre, Makurdi, Nigeria were studied by transabdominal ultrasound between February, 2007 and January, 2008. Sonography was carried out using Sonoscape SSI 600 ultrasound machine with 3.5MHz transducer. Gestational age was estimated by crown-rump length (CRL), biparietal diameter (BPD), femur length (FL) and abdominal circumference (AC) and the composite average recorded while placental thickness was measured at the point of insertion of the umbilical cord. Mean placental thickness with standard deviation was calculated for each gestational age. Correlation analysis was used to determine the relationship between placental thickness and gestational age while regression analysis yielded mathematical relationships between placental thickness and gestation age. The maximum mean placental thickness of 45.1 ± 6.4mm was recorded at 39 weeks gestation. There was a fairly linear increase in mean placental thickness with gestation age. There was significant and strong positive correlation between placental thickness and gestational age. Placental thickness appears promising as an accurate indicator of gestational age in singleton pregnancies in Nigerian women.

KEYWORDS: Placental thickness; Gestational age; Ultrasound; Singleton pregnancy; Nigerian women

INTRODUCTION

The placenta is a fetal organ which provides the physiological link between a pregnant woman and the fetus. The placenta is a highly vascularized organ and its main functions are exchange of metabolic and gaseous products between maternal and fetal bloodstreams, and production of hormones[1]. The placenta develops from the chorionic villi at the implantation site at about the fifth week of gestation and by the ninth

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or tenth week the diffuse granular echotexture of the placenta is clearly apparent at sonography[2].
Placental thickness appears to be a promising parameter for estimation of gestational age of fetus. This is because of increase in placental thickness with gestational age. Several studies have reported an increase in placental thickness with gestational age[3-5]. Studies by **Mital et al**[6] and **Anupama et al**[7] have reported the use of placental thickness as an indicator of gestational age of fetus.
The aim of this paper is to investigate placental thickness as a parameter for estimating gestational age of fetus in normal singleton pregnancies in Nigerian women. To the best of our knowledge, there has not been any documentation in this aspect of obstetric ultrasound in Nigeria.

MATERIALS AND METHODS

This cross sectional prospective study was conducted in the department of Radiology and department of Obstetrics and Gynaecology, Federal Medical Centre, Makurdi, Benue State, Nigeria between February 2007 and January 2008. A total of 912 pregnant women who were referred for ultrasound investigation during the period of the study were selected. Out of the 912 subjects 730 met the inclusion criteria and were therefore included in the study. The inclusion criteria were:

- Known last menstrual period (LMP)
- Viable singleton cyesis
- Nil history of diabetes mellitus or other metabolic diseases
- Nil history of previous adverse fetal outcome
- Nil history of intrauterine growth retardation
- Nil co-existing uterine or adenexal mass
- Nil placental mass or anomaly
- Nil fetal mass or anomaly
- Placenta can be distinguished from the myometrium
- Nil history of immune or non-immune hydrops
- Nil hydroamnios
- Nil pregnancy induced hypertension (PIH)

Sonography was carried out on each subject included in the study using Sonoscape SSI 600 ultrasound equipment with 3.5MHz curvilinear transducer. The foetus was observed for gross anatomical defects and the gestational age estimated using crown – rump length (CRL) and biparietal diameter (BPD) in the first trimester, (BPD) and femur length (FL) in the second trimester and BPD, FL and abdominal circumference (AC) in the third trimester. The composite average of the gestational age estimated by the various growth parameters was taken for each fetus and recorded. The placenta was localized in longitudinal section and its anteroposterior thickness measured at the level of insertion of the umbilical cord.

Statistical Analysis

Data was analyzed on computer using Microsoft™ statistical software package for social sciences (SPSS) version 14.0. Descriptive statistic was used to establish the nomogram for placental thickness. Values were expressed as mean + standard deviation. Correlation and regression analysis was used to establish the relationship between placental thickness and gestational age. $P < 0.01$ indicated statistical significance.

RESULTS

Our study showed that there was a fairly linear increased in placental thickness with gestational age as shown in **Table 1**. The maximum placental thickness of 45.1 ± 6.4mm was recorded at 39 weeks gestation as shown in **Table 1**.
Pearson's correlation analysis revealed that there was a significant positive relationship between placental thickness and gestational age in the three trimesters and combined trimester as shown in the **Table 2**.
Regression analysis yielded the following linear equations of relationship between gestational age (y) in weeks and placental thickness (PT) in mm:

In the first trimester
$y = 0.374 (PT) + 5.568$ $(r = 0.729)$

In the second trimester
$y = 0.4323 (PT) + 9.2742$ $(r = 0.671)$

In the third trimester
$y = 0.3106 (PT) + 21.832$ $(r = 0.557)$

In the combined trimester
$y = 0.7347 (PT) + 3.8881$ $(r = 0.872)$

The best-fit mathematical models for first, second, third, and combined trimesters as shown in **figures 1, 2, 3** and **4** were derived by regression analysis.

Table 1: Distribution of placental thickness according to gestational age

First Trimester		
Gestational age (weeks)	**Number of cases**	**Placental thickness (mm)**
7	7	9.6 ± 1.9
8	3	9.0 ± 1.0
9	17	10.9 ± 1.7
10	9	10.0 ± 1.2
11	6	11.0 ± 0.9
12	13	15.3 ± 3.1
13	9	18.0 ± 3.0
Mean placental thickness = 12.5 ± 3.7		
Second Trimester		
14	3	18.3 ± 1.2
15	23	18.7 ± 3.7
16	27	22.0 ± 2.9
17	15	21.2 ± 3.4
18	15	23.7 ± 2.6
19	23	23.7 ± 4.3
20	17	25.4 ± 4.3
21	24	27.2 ± 4.9
22	16	28.6 ± 4.5
23	20	27.3 ± 3.3
24	12	28.9 ± 5.1
25	17	27.4 ± 5.2
26	25	32.5 ± 4.9
Mean placental thickness = 25.2 ± 5.6		
Second Trimester		
27	24	31.4 ± 4.5
28	28	32.0 ± 4.4
29	28	33.8 ± 4.4
30	21	36.0 ± 5.4
31	31	36.8 ± 4.7
32	48	36.0 ± 5.6
33	27	37.0 ± 7.0
34	28	37.3 ± 4.0
35	37	41.1 ± 7.6
36	33	39.3 ± 7.1
37	31	43.5 ± 5.6
38	33	42.5 ± 5.8
39	31	45.1 ± 6.4
40	14	43.0 ± 5.3
41	15	43.4 ± 8.3
Mean placental thickness = 38.4 ± 7.1		

Table 2: Pearson's correlation values between placental thickness and gestational age

	Trimesters			
	First	**Second**	**Third**	**Combined**
Pearson's correlation coefficient (r)	r = 0.729	r = 0.671	r = 0.557	r = 0.872
P - values	$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$
Number of measurement (n)	n = 64	n = 237	n = 429	n = 730

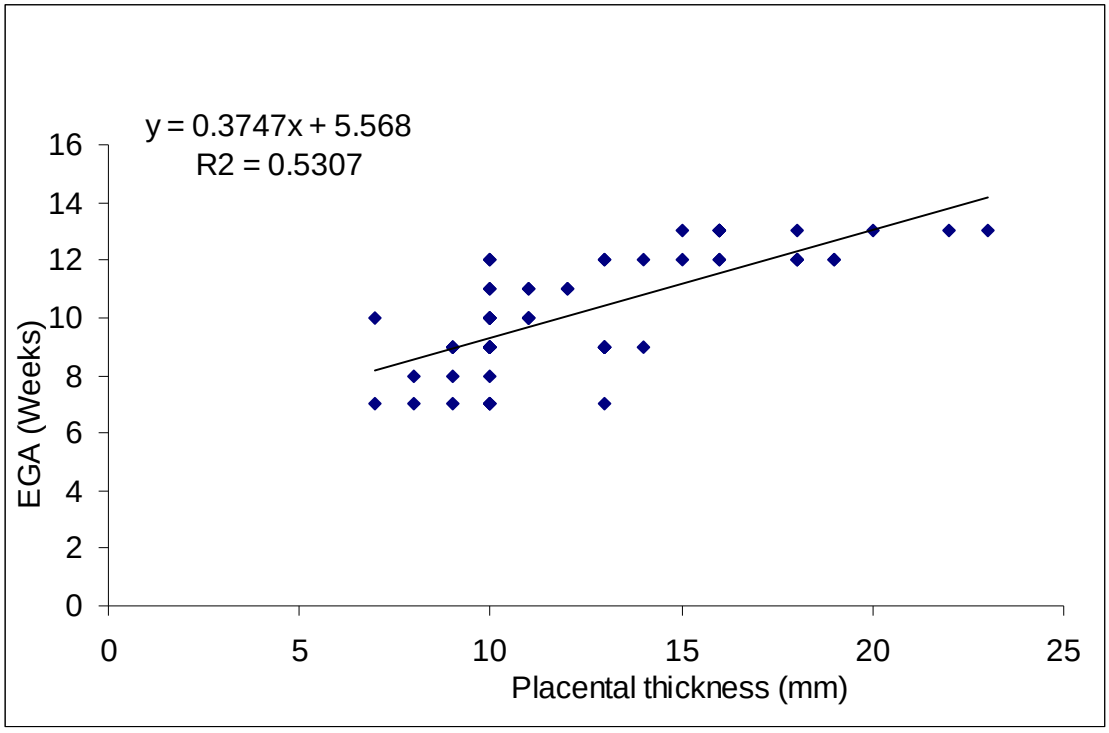

Figure 1: Graph of estimated gestational age (EGA) against placental thickness in the first trimester

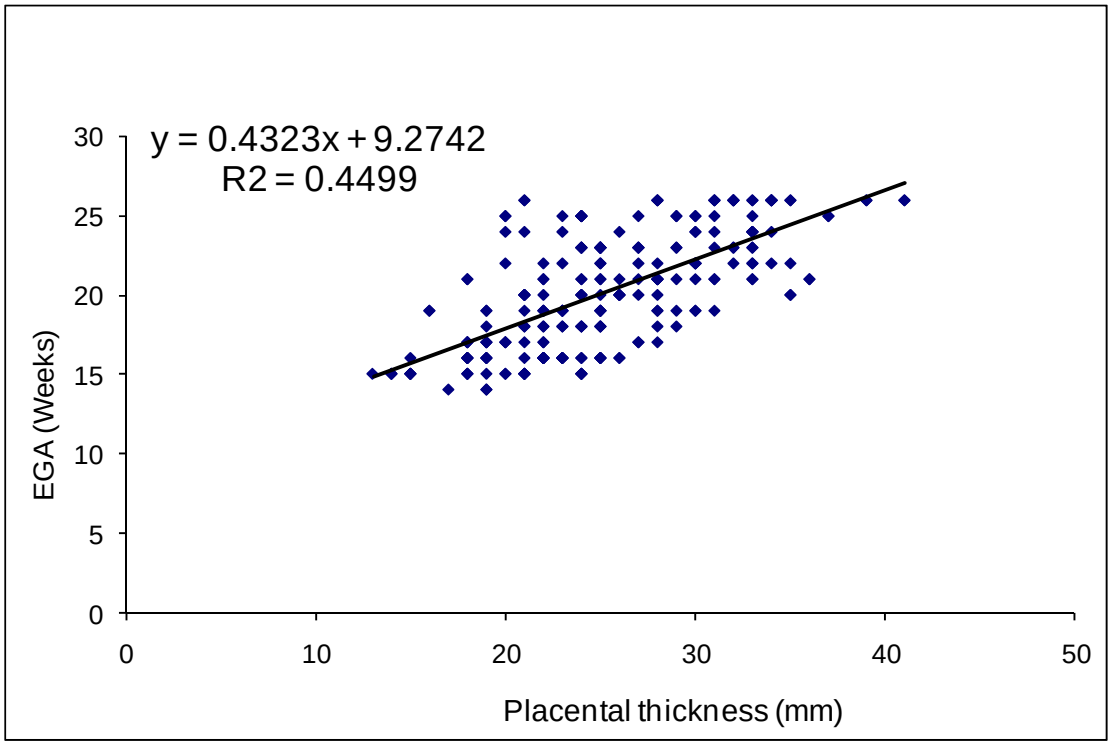

Figure 2: Graph of estimated gestational age (EGA) against placental thickness in the second trimester

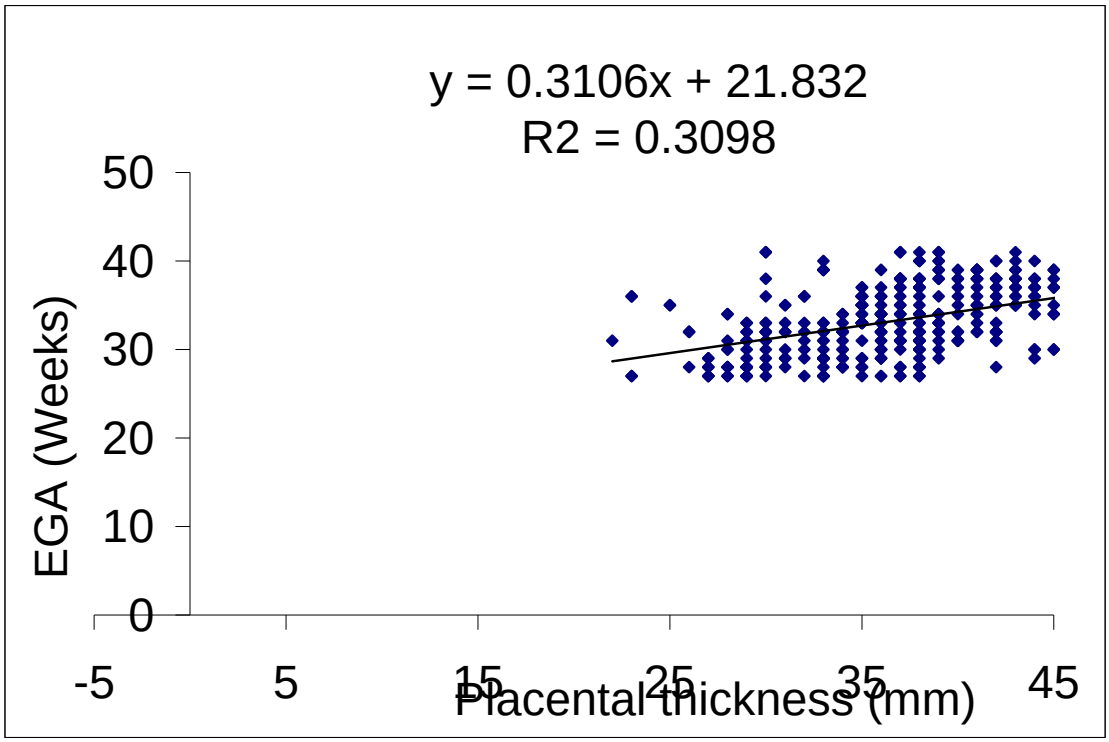

Figure 3: Graph of estimated gestational age (EGA) against placental thickness in third trimester

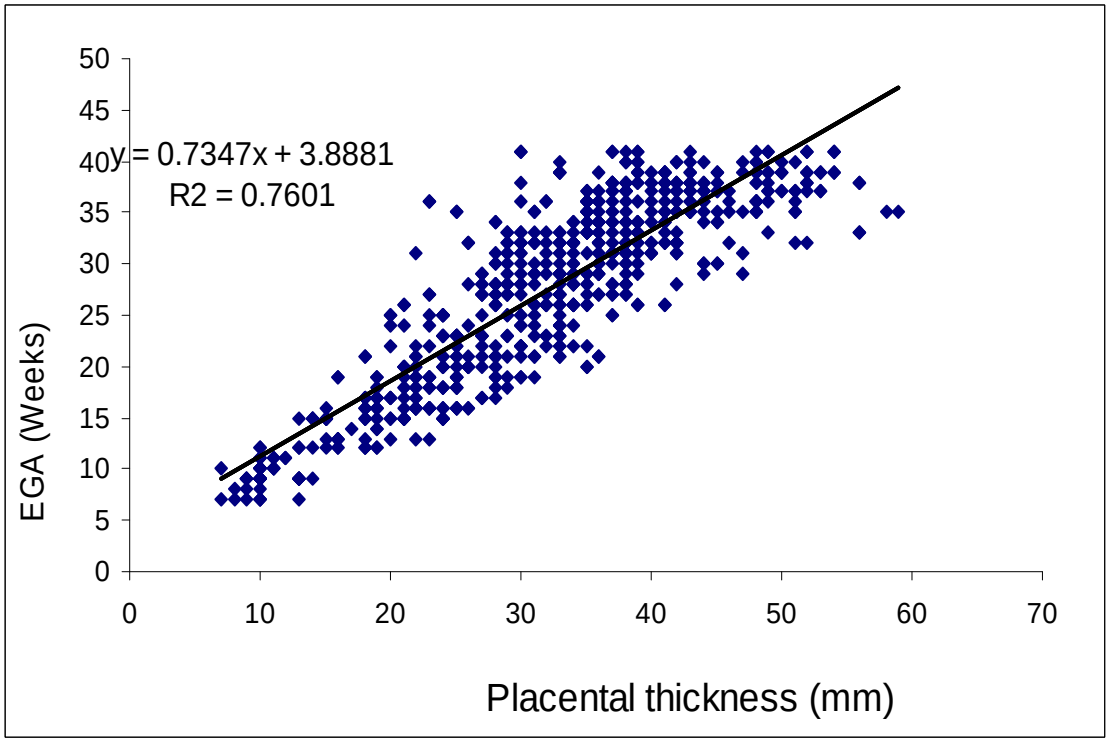

Figure 4: Graph of estimated gestational age (EGA) against placental thickness in the combined trimester

DISCUSSION

Estimation of gestational age of the fetus by ultrasound is usually carried out by measurement of various fetal growth parameters and gestational sac diameter and volume, in early pregnancy. Gestational sac volume as an indicator of gestational age is only accurate to within ± 9 days [8].

The results of our study show that the maximum mean placental thickness of 45.1±6.4mm occurred at 39 weeks of gestation. This is above report values in literature which put the mean placental thickness at term to be 37.5mm[6] and 30mm[1]. We cannot exactly explain why the placental thickness at term in our subjects is higher than the values in other races but we presume that the placenta may be normally thicker in Negroes. Thus the conclusion that placentas more than 40mm thick have an association with maternal diabetes mellitus, fetal hydrops and intrauterine infections[9] has to be regarded with caution in Negroes. It is also possible that we had consistently over-estimated the placental thickness in our measurements. In our results the placental thickness only equaled the gestational age at 10 and 11 weeks of gestation but the number of measurements at gestational age is small for us to make a categorical statement about it.

Studies by **Mital et al**[6] and **Anupama et al**[7] reported that placental thickness can be used to sonographically estimated the gestational age of the fetus. The studies were conducted among the Indians. To the best of our knowledge no such studies have been done in Nigeria. We therefore investigated the possibility of using placental thickness to estimate the gestational age of the fetus in singleton pregnancies in Nigerian women. We did this by first, constructing a nomogram of placental thickness for this category of patients and then deriving a mathematical relationship between gestational age and placental thickness using regression analysis.

We cannot at this stage conclude that placental thickness can be used sonographically to estimate gestational age because we adopted a cross sectional method in our investigation and our subjects were scanned only once during gestation. A multiple longitudinal study has to be carried out before this conclusion can be made. In this suggested study the subjects have to be scanned at constant regular intervals from the beginning of the pregnancy to term and placental thicknesses measured at each scan.

Our study showed a fairly linear relationship between placental thickness and gestational age as shown in **table 1**. There was also significant positive correlation between placental thickness and gestational age as shown in **table 2**. Based on these two findings we are of the opinion that placental thickness promises to be an accurate parameter for estimating gestational age in singleton pregnancies in Nigerian women. This will become definitive when the above suggested study has been carried out.

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