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Ultrasonographic Correlation of Placental Thickness with some Foetal Biometry in seemingly normal singleton pregnancies in Taraba State, Nigeria

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Abstract

An accurate assessment of the gestational age (G.A) and evaluation of foetal growth is essential to antenatal care. GA prediction based on the sonographic foetal parameters may be the cornerstone in modern obstetrics and continues to remain an important component of the management of pregnancies. Placental thickness appears to be a promising parameter for the estimation of GA, for it tends to have a positive correlation with it. Ultrasonography helps in the assessment of the placenta and the detection of placental abnormalities using different parameters like placental thickness and volume. This study was conducted to sonographically measure the placental thickness and correlate it with some foetal biometry in apparently normal singleton pregnancies. A prospective cross-sectional design was employed for the study from March to July 2021 in Jalingo, Taraba State. A convenient sampling method was employed and included a total of 314 healthy pregnant women referred for obstetrics ultrasound scans in their 2nd and 3rd trimesters. Ultrasound scans were performed using an ultrasound system equipped with a 3.5 MHz curvilinear transducer. Findings from this study revealed an increasing trend in the values of the mean placental thickness with an increase in G.A, and the placental thickness in mm coincide almost exactly with the GA weeks, indicating there was a positive correlation between placental thickness and G.A from 14-35 weeks of gestation. However, placental thickness gradually declined from 36-40 weeks G. A, thereby, lagging behind the G.A marginally by 1-2 mm. Placental thickness cord insertion site can be used as an accurate sonographic parameter to determine the GA, especially from 14-35 weeks of gestation in apparently normal singleton pregnant women due to its statistically strong positive correlation with G.A.

Keywords: Ultrasonography, Placental thickness, Foetal Biometry, Singleton pregnancy, Taraba

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INTRODUCTION

Placenta is a vascular materno-foetal organ that forms a little later than the foetus (Karthikeyan *et al.* 2012) and main function is to exchange nutrients, metabolic products, and gases between the maternal and fetal bloodstreams (Ohagwu *et al.* 2009). It grows throughout pregnancy, with initial growth being more rapid than that of the foetus (Pruthvi., 2013). It is thought that abnormities of placental growth may precede abnormities of foetal growth (Lee *et al.* 2012). Nyberg and Finberg (2015) reported in their study that as a rule of thumb placental thickness in millimeter (mm) equals to gestational age (GA) in weeks (Vinodha, 2016). Placental thickness remains a useful tool parameter for the estimation of the GA of the fetus (Mathai *et al.* (2013) as it tends to have a positive relation with GA linearly (Jones *et al.* 2019). This sonographically can be seen to be approximately 1 mm per week (Jones *et al.* 2019). The maximum thickness of a normal placenta at any point during pregnancy is often considered to be 4 cm (Jones *et al.* 2019). An abnormally increased placental thickness falls under the spectrum of placentomegaly (Jones *et al.* 2019). Thick placentas are noted in hydrops fetallis of varied causes and thin placentas may be seen in cases of Intra-uterine growth restriction (IUGR) (Pruthvi, 2013). GA assessment plays a vital role in the management of pregnancy and its outcome, both normal and complicated (Zaidi *et al.* 2009). The definitive placenta is visible on ultrasound from roughly 9–10 weeks of gestation when it demonstrates a uniformly granular echogenic pattern (Afrakhteh *et al.* 2013). Ultrasonography (US) enables the evaluation of the placenta and the detection of placental abnormalities using different parameters similar as placental thickness and volume or special techniques like three dimensional (3D) power doppler (Afrakhteh *et al.* 2013). Recent studies concentrated on 3D measurement of the placenta to prognosticate the adverse gestation outcome; still, this technique is relatively new, needs a complex clinical setting, and gives conflicting results regarding its reproducibility in assessing placenta, ultrasound dimension of placental thickness is a fairly simple, reproducible and clinically useful way, which had been used for further than two decades (Afrakhteh *et al.* 2013).

An accurate assessment of GA and evaluation of fetal growth is fundamental to antenatal care. Prediction of GA based on sonographic foetal parameters may be the cornerstone in modern obstetrics and continues to remain a crucial component in the management of pregnancies (Ganjoo *et al.* 2018). The interventional modality used when a fetal anomaly is detected is influenced by the GA (Karthikeyan *et al.* 2012). Virtually, all the important clinical decisions, which include cesarean section, elective labour induction, etc., depend on the knowledge of the GA (Karthikeyan *et al.* 2012). The GA is roughly 280 days, which is calculated from the first day of the last menstrual period and so, the dating of the gestation starts even before fertilization (Ganjoo *et al.* 2014). GA was originally estimated using only the woman's last menstrual period (LMP) and clinical methods such as uterine size assessment, time of quickening/original perception of fetal movement, and fundal height dimension (Agwuna *et al.* 2016). These methods have numerous limitations; dating the LMP may be perhaps difficult because of poor recollection, irregular menstrual cycles of varying duration, lactational amenorrhea, bleeding in early pregnancy, or hormonal contraceptive use before conception (Agwuna *et al.* 2016). Another method of GA estimation is symphysis fundal height, but its accuracy may be diminished by multiple pregnancies, maternal size, intrauterine growth restriction, fetal position, and other maternal and fetal characteristics (Imtiaz *et al.* 2010).

Several sonographic fetal parameters used to date pregnancy include fetal crown rump length (CRL), biparietal diameter (BPD), femur length (FL), head circumference (HC), and abdominal circumference (AC) (Schwarzler *et al.* 2004). BPD corresponds well with GA but since the fetal head is quite malleable, therefore in breech presentations BPD is always lesser than normal

fetuses (Habaerkein *et al.* 2015). Also, BPD GA estimation discrepancies have been found in brachycephaly, dolichocephaly, multiple gestations, and premature rupture of membranes (Habaerkein *et al.* 2015). There is also a consistent sex related difference in prenatal BPD, HC, and AC, which are established as early as 15 weeks of gestation (Wolfson *et al.* 2010). Taking into consideration the shortcomings of these various parameters in estimating GA, a new parameter "placental thickness" (PT) measured at the level of the umbilical cord insertion is used to estimate the fetal GA (Ohagwu *et al.* 2009), added to this is the fact that the measurement of PT is relatively simple and clinically useful (Ganjoo *et al.* 2014).

Fetal biometric parameters such as BPD, HL, AC, TTD, TAD, etc. are routinely used to estimate GA in the second and third trimesters, however, contradictory values of GA are sometimes obtained when using most of these parameters (Agwuna *et al.* 2016). A study by L'ubuský *et al.* (2006) reported pitfalls in using these common fetal biometric parameters for GA estimation. Furthermore, the accuracy of these parameters decreased as pregnancy advanced in GA (Karki *et al.,* 2006). Consequently, there is a need to assess other parameters that may augment the established fetal biometric parameters in predicting GA with minimal error, specifically as pregnancy proceeds to the third trimester. Nyberg *et al.* (2015) reported that the placental thickness parallels the GA and to the best of the researcher's knowledge this has not been tested in the study location, hence, the need for the study. This current study aimed at sonographically measuring the placental thickness and correlating it with some foetal biometry in apparently normal singleton pregnancies.

METHODOLOGY

Study design and study location

A prospective cross-sectional study design was employed for the study. The study was conducted at Iware Primary health care center (PHCC), Ardo Kola Local Government Area (LGA), Cottage Hospital, Mutum Biyu, Gassol LGA, and Turaki A. PHCC, Jalingo, all in Taraba state, Nigeria.

Ethical Approval

In accordance with the Helsinki Declaration, ethical approval was sought from the Health Research Ethics Committee (HREC) of the Federal Medical Center, Jalingo. Before enrolling participants into the study, an extensive explanation of the procedure was given to the participants including the study aim and written informed consent was obtained from each participant. They were notified of their choice to withdraw from the study anytime without losing any of the benefits and healthcare services given by the facility.

Sampling Technique and Sample Size Determination

Healthy pregnant women referred for obstetric ultrasound scans in their 2nd and 3rd trimesters at the study location were recruited from March 2021- July 2021. Cochran's formula was employed to determine the minimum sample size for the study, and a minimum sample size of 314 was used for the study. A convenience sampling technique was adopted for the study. Pregnant women with maternal diseases, gestational diabetes, hypertension, anemia, gross foetal anomalies, multiple gestation, and unknown LMP were excluded from the study.

Data Collection

Ultrasound scans were performed using a portable ZONCARE i50 Ultrasound system equipped with a 3.5 MHz transducer. The participants were examined in the supine position. The placental thickness was measured in mm at the level of the cord insertion site. Placental thickness measurement was carried out from the echogenic chorionic plate to the placental

myometrial interface. The myometrium and sub-placental veins were excluded from the measurement. All placental measurements were taken during the relaxed phase of the uterus, as the contraction of the uterus can incorrectly increase the placental thickness (Figure 1).

Figure 1: Sonogram demonstrating placental thickness measurement.

Data Analysis

For data analysis, SPSS version 26.0 for windows was utilized. The participant's bio-data frequency and percentages were determined using descriptive analysis. Placental thickness and GA gestational age were correlated using Spearman's rank order correlation. Kolmogorov was used for testing the normality of the data and was found to be not normally distributed (p=0.02), hence the data was non-parametric. The level of significance for was set at P values of 0.05 or less (Ohagwu *et al.* 2009).

RESULTS

Table 1 shows the frequency distribution of the participants according to their ages, women in their 28th years were found to be 10.2%. Thirty participants (9.6%) were found to be in their 23rd year of age whereas women in their 18th, 34th and 37th years were 2 (0.6%) each and 40th were 3 (1.0%).

Table 1: Frequency and percentage distribution of the participants according to their age

Maternal age (Weeks)	Frequency (n)	Percentage (%)
18	2	0.6
19	4	1.3
20	7	2.2
21	23	7.3
22	12	3.8
23	30	9.6
24	24	7.6
25	23	7.3
26	27	8.6
27	19	6.1
28	32	10.2
29	29	9.2
30	23	7.3
31	16	5.1
32	19	6.1
33	9	2.9
34	2	0.6
35	8	2.5
37	2	0.6
40	3	1
TOTAL	100	100

Table 2 shows the frequency and percentage distribution of placental location, out of the 314 participants, those with posteriorly located placentas were found to be 149 (47.5%), anterior were 144 (45.9%), laterally locate 11 (3.5%) and fundal were 10 (3.2%). Fig. 2 shows the GA frequency distribution of the participants. Out of the 314 women that participated, 35 (11.15%) were between the GA group of 14-20 weeks, 88 (28.03%) were between 21-25 weeks of GA, 63 (20.06%) were between 26-30 weeks, 93 (29.62%) were between 31-35 weeks of GA, and lastly 35 (11.15%) were between 36-40 weeks of GA.

Table 2: Frequency and percentage distribution of the participants according to their placental location

Placental location	Frequency (n)	Percentage (%)
ANTERIOR	144	45.9
FUNDAL	10	3.2
LATERAL	11	3.5
POSTERIOR	149	47.5
TOTAL	314	100

Table 3 shows the mean placental thickness at 14th week of gestation was 15.80 mm and 38.90 mm at 40th weeks of gestation. The minimum placental thickness observed was 1 mm, and the maximum placental thickness was 38.9 mm.

Table 3: Mean placental thickness and standard deviation at each week of the gestation

Gestational age (Weeks)			Placental thickness (mm)	
GA	Frequency (n)	Percentage (%)	Mean	SD
14	4	1.27	15.800000	0.761577
15	2	0.64	16.900000	0.565685
16	1	0.32	16.700000	-
17	2	0.64	17.450000	1.060660
18	4	1.27	18.950000	0.500000
19	5	1.59	20.160000	0.598331
20	17	5.41	20.464706	0.873170
21	23	7.32	21.456522	0.664575
22	23	7.32	22.939130	1.095752
23	19	6.05	23.300000	1.410674
24	10	3.18	23.410000	1.646174
25	13	4.14	25.115385	0.952056
26	9	2.87	26.877778	1.021981
27	13	4.14	27.253846	1.380589
28	14	4.46	28.328571	0.965902
29	14	4.46	30.207143	0.748809
30	13	4.14	31.100000	1.156864
31	16	5.10	30.568750	0.982323
32	23	7.32	32.078261	0.615671
33	16	5.10	33.168750	0.736405
34	15	4.78	33.840000	0.916359
35	23	7.32	35.078261	0.824597
36	11	3.50	35.872727	0.513986
37	8	2.55	36.600000	0.587975
38	9	2.87	37.722222	0.399305
39	4	1.27	38.525000	0.309570
40	3	0.96	38.900000	0.200000

Table 4 shows Spearman's rank order correlation analysis between placental thickness and GA. There was a positive and significant correlation between placental thickness and GA in each GA group (P-value 0.000 for all groups). There was a significant positive correlation

between placental thickness and GA (P-value 0.000) and Spearman's correlation coefficient (r) of 0.98341.

Table 4: Relationship between placental thickness and gestational age by Spearman's rank order correlation

Weeks of Gestation		Placental thickness and gestational age: a correlation	
GA	Frequency (n)	**Correlation coefficient (r)**	**P-value**
14-20	35	0.920835	0.000**
21-25	88	0.724942	0.000**
26-30	63	0.841574	0.000**
31-35	93	0.884655	0.000**
36-40	35	0.879411	0.000**
Overall	314	0.983415	0.000**

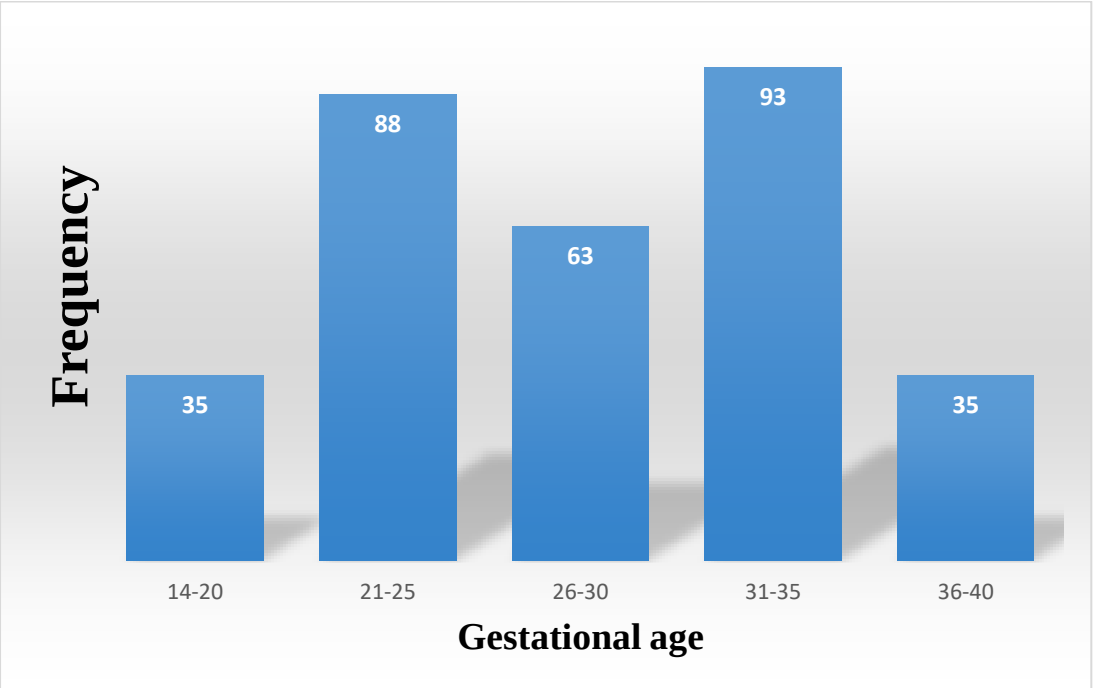

Fig. 2: Frequency distribution of the participants according to their age of gestation.

DISCUSSION

The human placenta develops with the major function of providing nutrients and oxygen to the foetus (Wolfson *et al.* 2010). Efficient delivery of nutrients from the mother to the foetus via a normally functioning utero-placental organ is an essential role to adequate foetal growth and subsequent normal birth weight. Ultrasonography enables the evaluation of the placenta and the detection of placental abnormalities using different parameters such as placental thickness and volume or a special technique like 3D power Doppler. GA is frequently over or under-estimated, as the conventional GA estimation is based on the last menstrual period and many people are unaware of their LMP and irregular mensuration, which may cause difficulties in GA estimation (Agwuna, *et al.* 2016). Since no study has been conducted in this regard in our study area and population,

This study revealed an upsurge in the values of a mean placental thickness (in mm) with an increase in gestational age (in weeks) and the placental thickness (in mm) coincides almost exactly with GA in weeks, i.e., the placental thickness increased gradually with GA in a linear

pattern from 14-35 weeks gestational age. However, placental thickness gradually declined from 36-40 weeks of gestation, thereby, lagging behind the GA marginally by 1-2 mm. This result in line with that of Ohagwu *et al.* (2009) that observed a fairly linear relationship between placental thickness and GA. The finding of this study is also in tandem with Pant S. *et al.* (2017) that found placental thickness to have increased with GA linearly from 14-35 weeks of gestation and decreased from 36-40 weeks, hence lags behind the GA marginally by 1-3 mm. Findings from this study are also in agreement with a related study by Verma *et el.* (2019) who reported that in normal cases placental thickness is almost corresponding with GA (in weeks) from 18 to 32 weeks after that placental thickness had slightly decreased and remained nearly constant with average placental thickness 31 mm till the 40th week. The finding of this study is again in agreement with the study of Kumar (2019) who showed that the placental thickness increased steadily with increasing GA (in weeks) in a linear fashion and almost matched the GA from 11-35 weeks of gestation. The author further reported that from 36-40 weeks the rate of increase of placental thickness gradually diminished and was less by 1-4 mm compared to GA in weeks. The finding from this study is also in agreement with by the studies of Mittal *et al.* (2002), and Parveen *et al.*, (2018) who reported that placental thickness at the umbilical cord insertion point can be used as an accurate sonographic parameter in the assessment of GA in singleton normal pregnancies because of its strong positive linear correlation with GA.

The finding of this study showed that in each GA, a statistically significant positive correlation between placental thickness and gestational age ($r>0.7$, $p=0.000$, for all groups. Overall, placental thickness also showed a positive and significant correlation with GA ($r=0.983415$, $p=0.000$). The finding of this study is in line with the study of Pant e*t al.* (2017) who reported that placental thickness increased with the advancing GA and placental thickness showed a statistically significant positive correlation with GA ($r=0.990$, $p=0.001$). The findings of this study are in agreement with a study conducted by Karthikeyan et al. (2012) which revealed that there was a strong positive correlation between placental thickness and GA, with coefficient correlation values for 1st, the 2nd, and 3rd trimesters being $r=0.609$, $r=0.812$ and $r=0.184$ respectively. The finding from this study agrees with that of Ismail *et al.* (2016) whose study showed that there was a linear relationship between placental thickness and average GA and there was a strong positive correlation between them ($r=0.743$) with probability ($p=0.01$). The findings of this current study are in agreement with that of Hanif *et al.* (2005);Ohagwu *et al.* (2009); Ashok e*t al.* (2019), and Tanzila *et al.* (2018) whose findings suggested that there was a strong positive correlation between placental thickness and GA, which can be an accurate means of GA estimation in singleton pregnancies.

CONCLUSION AND RECOMENDATIONS

In this study, placental thickness showed a direct relationship with GA from 14 to 35 weeks of gestation. However, between 36 to 40 weeks of gestation, placental thickness gradually declined, thereby lagging behind the GA marginally by 1-2 mm. Placental thickness at the umbilical cord insertion point can be used as an accurate sonographic parameter in the assessment of GA from 14-35 weeks gestation in singleton normal pregnancies because of the statistically strong positive direct correlation with GA recorded in this study.

Sonographers in various health facilities in Taraba state can use placental thickness at the umbilical cord insertion site as an accurate sonographic parameter in the assessment of gestational age from 14-35 weeks of gestation in singleton seemingly normal pregnancies.
Some of the limitations of this study was that the placental thickness was measured only formerly in each subject during the study by a single observer. Again, the study was cross-

sectional designed, and as such may not give a true correlation between the placental thickness and gestational age.

Further studies should consider correlating placental thickness and GA using a longitudinal study design to enhance our understanding of the correlation between placental thickness and GA over time.

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