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Sonographic Assessment of Placental Thickness and Its Relationships with Estimated Fetal Weight and Maternal Characteristics in a Northern Nigerian Tertiary Health Institution.

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ABSTRACT

Background. The placenta is one of the primary factors in fetal birth weight/well-being and it's though that, abnormalities of placental growth/perfusion may precede abnormalities in fetal growth/well-being, so its changes can be used to predict many feto-maternal complications. **Objectives.** To evaluate the relationship between placental thickness and estimated fetal weight (EFW) in low-risk 2nd and 3rd trimesters gestations based on gestational age and maternal characteristics. **Methods.** A cross sectional prospective study was conducted among 240 participants in ATBUTH Bauchi. An ultrasound machine "Toshiba-CC-15M71-MA" with 3.5MHz transducer was used. Maternal LMP, biparital diameter, head & abdominal circumferences and femur lengths were measured according to practical guidelines of the international society of ultrasound in obstetrics & gynecology for GA and EFW estimations. Placental thickness was measured at the level of umbilical cord insertions. Maternal characteristics were recorded prior to the study. Data obtained were analyzed using SPSS (22.0)/descriptive statistics. **Results.** The study revealed strong positive correlations between placental thickness and EFW(r=0.627; p=0.001), EGA(r=0.723; p=0.001), & maternal BMI(r=0.263, p=0.003). No correlation was found between placental thickness and maternal gravidity(r=0.055, p=0.398). **Conclusion.** The results from this study suggested that placental thickness can be used a predictive parameter of EFW and therefore, overall fetal well-being across gestational ages and corresponding maternal characteristics.

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1. INTRODUCTION

The placenta is a fetal organ which provides the physiological link between the mother and the fetus (1). It develops with the principal function of providing nutrients and oxygen to the fetus (2). As the fetus is developing, it requires certain amount of gases and nutrients to help support its growth; something provided by the placenta throughout pregnancy (3).

The placenta is one of the primary factors in fetal birth weight/well being and it is though that, abnormalities of placental growth and perfusion may also precede abnormalities

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in fetal growth and well being (4). Therefore, placenta appeared to be the first organ to manifest changes of diseases in pregnancy, so its changes can be used to predict many of feto-maternal complications (5). The primary cause of fetal growth restriction (FGR) in 60 % pregnancies for example is suggested to be due to placental insufficiency (6).

Table I. Descriptive statistics of the participants and their corresponding mean placental thickness based on age.

	Placental thickness (cm)					
	Gestational age by LMP/early scan					
	Second Trimester			**Third Trimester**		
Age (years)	N	Mean ± SD	N %	N	Mean ± SD	N %
16-20	13	2.7 ±0.4	5.4%	7	3.5 ± 0.4	2.9%
21-25	28	2.4 ± 0.5	11.7%	29	3.2± 0.5	12.1%
26-30	40	2.3± 0.5	16.7%	45	3.3± 0.4	18.8%
31-35	18	2.4± 0.5	7.5%	29	3.3± 0.5	12.1%
36-40	12	2.5± 0.5	5.0%	17	3.4± 0.3	7.1%
41-45	2	2.3± 0.5	0.8%	0	.	0.0%
Total	**113**	**2.4± 0.5**	**47.1%**	**127**	**3.3± 0.4**	**52.9%**

Of course, fetal well-being is affected by many factors, but a healthy placenta is the single most important factor in producing a healthy baby with adequate fetal growth and subsequent optimal birth weight (1). High proportions of perinatal mortalities are related to abnormal birth weights: thus, birth weight is a very important parameter that determines neonatal survival (2). Hence the aim of this study is to determine the relationship between placental thickness and fetal weight in second and third trimester gestation in the study locality.

2. MATERIALS AND METHODS

A cross sectional prospective study was carried out among low risk second and third trimesters singleton gestations in Abubakar Tafawa Balewa University Teaching Hospital (ATBUTH) Bauchi from June, 2021 to January, 2022. Ethical clearance was obtained from the ethical clearance committee and the Head of Radiology department of the Hospital, and written informed consent was obtained from all participants prior to the study. Participants were recruited from pregnant women coming for routine antenatal scans in second and third trimesters

Inclusion and Exclusion Criteria

All subjects with low risk second and third trimesters singleton gestations from Bauchi metropolis between the age of 18-50 years who give consent to participate in the study were included while all critically ill pregnant subjects, first trimester pregnant subjects, non-pregnant individuals, subjects with high risk gestations, subjects with history of previous high risk gestations, second and third trimester gestations with maternal/uterine abnormalities, pregnant subject that are actively smoking/alcoholic, and subjects with pregnancy related/non related complications will be excluded from the study.

Scanning technique

Obstetric ultrasound examination of the recruited subjects was performed using a Toshiba ultrasound machine (model CC-15M71-MA) with a curvilinear transducer of 3.5MHz frequency and Doppler capability. Measurements were done by a single observer with approximately 10 years of experience in obstetric sonography at the period of the study.

Maternal LMP and fetal growth parameters; biparital diameter (BPD), head circumference (HC), abdominal circumference (AC) & femur length (FL) were used to estimate the fetal gestational age (EGA) following the practical guidelines of the international society of ultrasound in obstetrics & gynecology (ISUOG) (7). Estimated fetal weight (EFW) was calculated using the hadlock formula {log BW = 1.56620.0108(HC) + 0.171(FL) + 0.00034(HC) 2-0.003685 (ACxFL)} (4). Placental thickness (PT) was measured following trans-abdominal longitudinal scans of the placenta with the subjects in supine position and with full bladder (8). The PT was measured from lateral chorionic plate to the umbilical insertion with an accuracy of 1 mm at the level of the umbilical cord insertion (9). Before scanning, demographic data such as age, gravidity, and parity were also taken

Data analysis

Data capture sheet was used to record all the acquired information. Data analysis was done using Statistical Package for Social Science (SPSS) version 22.0. Descriptive statistics (mean, standard deviation, frequency, and percentage) was used to describe the data acquired. The correlation between the placental thickness and EFW, EGA, maternal age, maternal BMI, parity & gravidity, was also evaluated using inferential statistics (person correlation test).

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Table II. Mean values of placental thickness, EFW and maternal characteristics according to gestational trimesters.

PARAMETERS	MEAN VALUES ± SD 2ND TRIMESTER (N=113)	MEAN VALUES ± SD 3RD TRIMESTER (N=127)
PLACENTAL THICKNESS (cm)	2.376 ± 0.462	3.307 ± 0.431
ESTIMATED FETAL WEIGHT (Kg)	0.918 ± 0.0331	2.553 ± 0.835
MATERNAL BMI (Kg/m^2)	26.187 ± 6.189	28.251 ± 6.274
PARITY	3.36 ± 2.402	3.61 ± 2.247

3. RESULTS

Total of 240 (113 second and 127 third trimesters) subjects participated in study. Table I shows the average mean values of placental thickness with respect to maternal age and trimesters.

From the study, the maternal age group 26-30 years has the highest number of participants while the age group 16-20 years has the highest mean values of placental thickness in both second and trimesters respectively (Table I).

From table (II), the mean placental thickness was found to be higher in the third trimester (p=0.001). Mean values of the EFW and maternal characteristics were also displayed according to participant's trimesters.

Findings from this study revealed strong positive correlations between placental thickness and EFW (r=0.627; p=0.001), EGA (r=0.723; p=0.001), & maternal BMI (r=0.263, p=0.003). However, no significant correlation was found between placental thickness and maternal gravidity (r=0.055, p=0.398) (Table III).

4. DISCUSSION

A total of 240 participants were examined. Majority (85 = 35.4%) of the participants belongs to reproductive age group 26-30 years (Table 4.1). similar findings to this were reported by many local and international researches concerning placental thickness and EFW/EGA (4, 6, 9, 10, 11) whom all reported the dominance of the maternal group between 20-30 years in their studies. The dominance of this age group in our study could possibly be due to geographical and social factors.

The respective 2nd an 3rd trimesters mean placental thickness values in this study were found to be 2.376 ± 0.462cm and 3.307 ± 0.431 while mean EFW values of 0.918 Kg ± 0.033 and 2.553 Kg ± 0.835 were found. These findings corroborates with those of Agwuna et al (8) who reported placental thickness values of 2.32 ± 0.28cm (2nd trimester) and 3.61 ± 0.36cm (3rd trimester). Suseela et al (5) also reported placental thickness range of 2.5cm-3.75cm with values above 3.75 considered thick placentas.

Finding from this study reveals that there is a strong positive correlation between the placental thickness and estimated fetal weight (r=0.627; p=0.001). This is in conformity with the reports of strong positive correlation between placental thickness and EFW reported by Javaid et al (p=0.01), Eman et al (p=0.007), Aydin et al., (p=0.036), Kushal et al (p=0.000), Adhikari et al, and Afrakhteh et al (11, 9, 4. 12, 13 and 14). Placental thickness and estimated fetal birth weight have a significantly high positive correlation in both trimesters according to Abu PO et al (15) findings. The usefulness of this relationship between placental thickness and estimated festal weight is that, subnormal placental thickness for a gestational age may be the earliest indicator of fetal growth retardation.

There was also a significant strong positive correlation found in our study between placental thickness and fetal estimated gestational age (EGA) (r=0.723; p=0.001). In the study conducted by Agwuna et al (8) on the relationships of placental thickness with respect to gestational age and fetal weight found that, correlation exist between placental thickness and gestational age at 0.01 level of significance. According to Rabiah et al (10), when variability of placental thickness is accessed categorically, the mean placental thickness is 2-3mm more than the gestational age from 12 to 20 weeks and showed strong positive correlation. Similar findings are also reported in earlier studies (2, 13 and 14). Accurate determination of gestational age has become important for deciding appropriate time for termination of pregnancy as well as to monitor the fetal growth during the entire period of pregnancy (10). This linear increase in placental thickness cannot be unconnected to the increasing fetal growth and metabolic demands with advancing fetal age.

The study further revealed that there was a strong positive correlation between the placental thickness and maternal BMI (r=0.263, p=0.003). Placental weight and size has been found to be the main effect of maternal BMI (16, 17) and therefore, it's not surprising that the placental thickness increases in incidences of increasing maternal BMI. However, this contradicts the findings of Eman et al (9), who reported a non-significant correlation between placental thickness and BMI (p=0.14).

No correlation was found in our study between placental thickness and maternal gravidity (r=0.055, p=0.398).

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Table III. Correlation of placental thickness with estimated fetal weight, gestational age and maternal characteristics.

	PLACENTAL THICKNESS	
	r-value	**p-value**
Estimated fetal weight (FEW)	0.627	0.001
Estimated Gestational age(EGA)	0.723	0.001
Gravidity	0.055	0.398
Maternal BMI	0.263	0.003

5. CONCLUSION

The results from this study suggested that placental thickness can be used as a successful predictive parameter of estimated fetal weight and therefore, overall fetal well-being across different gestational ages and corresponding maternal characteristics.

ETHICAL APPROVAL

All procedures followed were by the ethical standards of the responsible committee on human experimentation of the University of Maiduguri and Abubakar Tafawa Balewa University Teaching Hospital Bauchi and with the Helsinki Declaration of 1964 and later versions.

DECLARATION D'INTERETS

The authors declare no competing interest

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