

ORIGINAL ARTICLE

Correlation Between Placental Thickness And Estimated Fetal Weight In Nigerian Women

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Abstract

The aim of this study was to investigate the relationship between placental thickness and estimated fetal weight in normal pregnant Nigerian women. Six hundred and forty-five Nigerian women with singleton pregnancies in the second and third trimesters were studied by transabdominal ultrasound. Fetal weight was estimated by measurement of biparietal diameter (BPD) and abdominal circumference (AC). Gestational age was estimated by measuring the BPD and fetal femur length (FL). Placental thickness was measured in a longitudinal section at the point of insertion of the umbilical cord. Results showed that both placental thickness and estimated fetal weight increased in fairly linear manner with gestational age. There were significant positive correlations between placental thickness and estimated fetal weight in the second and third trimesters ($p < 0.05$). Regression analysis yielded linear mathematical relationships between estimated fetal weight and placental thickness in the second and third trimesters, but the marked variations in fetal weights corresponding to particular

placental thickness limit the usefulness of this relationship.

Keywords: Placental thickness, Estimated fetal weight, Ultrasound, Nigerian women.

Introduction

The placenta is a highly vascular organ. Its major function is to provide the essential connection between the mother and the developing fetus[1]. The placenta develops from the villi at the site of implantation at about five weeks gestation and by 9-10 weeks gestation, the diffuse granular echo texture of the placenta is clearly apparent at ultrasound [1]. At term the placenta is approximately 3cm thick and measures 15 to 25cm in diameter[2]. Placental thickness is closely related to fetal wellbeing and may be a key factor in perinatal outcome. Large placentas are associated with hemolytic disease of newborn, maternal diabetes mellitus, severe anemia and intrauterine fetal infections[1,3]. Small placentas are associated with preeclampsia, chromosomal abnormalities, severe maternal diabetes mellitus, chronic

fetal infections and intrauterine growth restriction[1,2,4]. Second trimester placental volumes measured by three-dimensional ultrasound have been used to identify fetuses at risk of growth restriction[5] while another study reported that ultrasonographic measurement of placental diameter and thickness is of prognostic value in identifying the subsequent occurrence of fetal growth restriction[6]. This prediction of growth restricted pregnancies from placental size is based on the fact that diminished placental size precedes fetal growth restriction[7]. Fetal weight estimation is an important aspect of obstetric management and is variously carried out by tactile assessment of fetal size[8], maternal self-estimation[9, 10], birth-weight prediction equations[8] and using algorithm derived from maternal and pregnancy-specific characteristics[11]. Medical imaging modalities used for fetal weight estimation include magnetic resonance imaging (MRI) and ultrasonography, the latter being the more popular modality. Fetal weight estimates are very important because a large proportion of perinatal mortality is related to birth-weight. Thus, birth-weight is the single most important parameter that determines neonatal survival[12,13, 14,15].

Obstetric ultrasonography offers the tools to estimate fetal weight and assess placental size. The aim of this study was to investigate the relationship between placental thickness and estimated fetal weight in normal Nigerian women.

Material and Methods

This cross sectional prospective study was carried out from February, 2007 to January, 2008 in the Department of Obstetrics and Gynaecology, and Department of Radiology, Federal Medical Centre, Makurdi, Benue State, Nigeria. Ethical approval was obtained from Human Research Ethics Committee of the Hospital. Informed consent was obtained from all the subjects before enlistment into the study.

A total of 645 pregnant women with normal singleton pregnancies in the second and third trimesters were recruited. All the subjects were apparently healthy at the time of the study. Their records indicated none of them was anemic. Patients with pregnancy induced hypertension, diabetes mellitus, previous history of intrauterine growth restriction, congenital malformations and multiple gestation were excluded from the study. Patients who consume alcoholic beverages or smoke tobacco were also excluded. Obstetric ultrasonography was carried on the patients using **Toshiba SSA 250 Sonolayer** ultrasound machine with 3.75MHz curvilinear transducer in the presence of a chaperon. Gestational age was estimated using biparietal

diameter (BPD), fetal femur length (FL) and abdominal circumference in the second and third trimesters. Fetal weight was estimated using BPD and AC in combination according to the method described by Shepard et al.[16]. The BPD was obtained at the level of parietal eminences marked by the presence of the septum cavum pellucidum while FL was measured as the length of the metaphysis of the bone[17]. The AC was measured just below the lower fetal ribs marked by the presence of a short length of the umbilical vein running through the fetal liver and the stomach bubble[17]. The placenta was localized in a longitudinal section and its thickness measured at the point of the umbilical cord insertion[18].

Statistical Analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS, Chicago, USA) version 14.0. Values of placental thickness and estimated fetal weight at various gestational ages were expressed as mean \pm standard deviation. Statistical significance was considered at $p < 0.05$. Pearson's correlation analysis was used to establish the relationship between placental thickness and estimated fetal weight.

Results

Mean placental thickness and corresponding mean estimated fetal weight at various gestational ages are shown in table 1. There was significant positive correlation between placental thickness and estimated fetal weight in the second trimester; $r = 0.616$, $p < 0.05$, and in the third trimester; $r = 0.570$, $p < 0.05$.

Figures 1 and 2 show a fairly linear relationship between placental thickness and estimated fetal weight in the second and third trimesters, though with marked variations in weights corresponding to particular placental thickness. The regression equations inserted in figures 1 and 2 can be used to estimate fetal weight during obstetric ultrasound

Discussion

The results of our study showed that the maximum placental thickness of $45.10 \pm 6.37\text{mm}$ was recorded at 39 weeks of gestation while the maximum estimated fetal weight was recorded at 41 weeks. It is possible that while the fetus continues to gain weight up to 41 weeks there is a fall in placental increase in thickness at term. Our value of mean placental thickness at term is far greater than the value quoted by Sadler [2]. The reason for this increased placental thickness at term in Nigerian women is not understood and needs to be further investigated. There was

Table 1: Relationship between gestational age, placental thickness and estimated fetal weight.
n = 645

EGA (weeks)	No. of measurements	Placental thickness (mm)	EFW (g)
14	2	18.00 \pm 1.41	145 \pm 1.41
15	21	18.24 \pm 3.66	142.33 \pm 17.52
16	21	21.86 \pm 2.86	177.29 \pm 76.50
17	14	21.36 \pm 6.39	204.71 \pm 39.65
18	14	24.00 \pm 2.35	272.57 \pm 52.08
19	23	23.61 \pm 4.36	333.13 \pm 68.31
20	17	25.41 \pm 4.26	402.29 \pm 44.35
21	17	27.35 \pm 4.30	440.29 \pm 26.95
22	16	28.56 \pm 4.52	502.44 \pm 47.80
23	17	27.06 \pm 3.29	618.76 \pm 39.98
24	12	28.92 \pm 5.09	703.33 \pm 58.68
25	17	27.41 \pm 5.21	845.41 \pm 131.63
26	25	32.52 \pm 4.94	911.40 \pm 106.78
27	24	31.42 \pm 4.47	1014.71 \pm 105.62
28	28	32.00 \pm 4.35	1086.43 \pm 207.30
29	28	33.89 \pm 4.31	1262.04 \pm 279.61
30	21	34.30 \pm 4.66	1264.76 \pm 299.02
31	31	36.26 \pm 4.43	1659.90 \pm 172.39
32	48	36.00 \pm 5.63	1866.15 \pm 238.01
33	27	37.00 \pm 7.00	2165.70 \pm 314.73
34	28	37.29 \pm 3.97	2344.61 \pm 269.04
35	37	41.08 \pm 7.64	2559.41 \pm 404.16
36	33	39.30 \pm 7.11	2761.73 \pm 192.62
37	31	43.52 \pm 5.56	3013.10 \pm 257.80
38	33	42.48 \pm 5.79	3264.03 \pm 286.04
39	31	45.10 \pm 6.37	3602.03 \pm 256.65
40	14	43.00 \pm 5.29	3718.86 \pm 138.50
41	15	43.40 \pm 8.30	3719.47 \pm 476.28

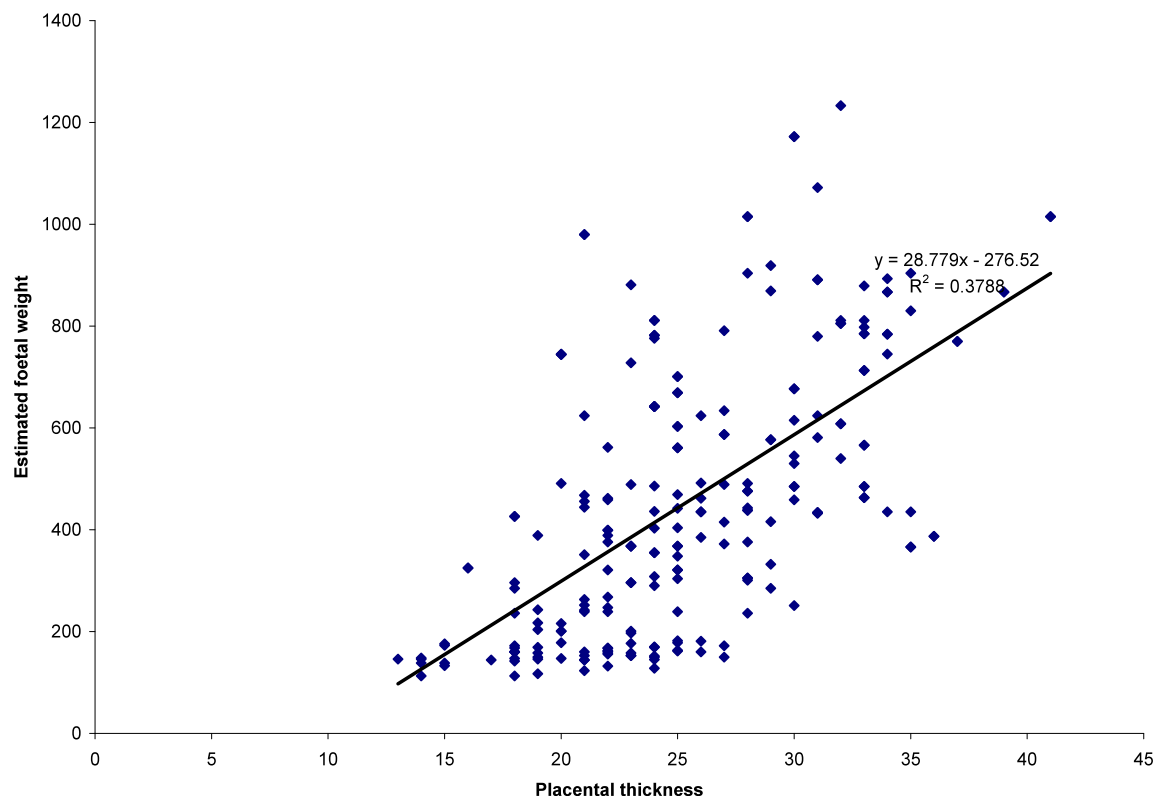


Figure 1: Graph of estimated fetal weight against placental thickness in the second trimester.

a fairly steady increase in placental thickness and estimated fetal weight with gestational age. This relationship exists in the second and third trimesters; the period during which most of the fetal weight is gained. A feature of this observed relationship was the wide variations of placental thickness corresponding to particular fetal weight. We think that it could be as a result of uncertainties involved in measuring maximum placental thickness. A slight obliquity of the scanner probe can exaggerate measurements. This makes it unsuitable to be used routinely to predict fetal weight during obstetric ultrasound.

Previous studies have suggested that low-birth weight infants can be predicted from ultrasound measurements of placental diameter and thickness[6], and that diminished placental size precedes fetal growth restriction[7]. The cause of diminished placental size is still being debated but there is a link between small placentas and preeclampsia, chromosomal abnormalities, severe maternal diabetes

mellitus, chronic fetal infection and intrauterine growth restriction. There have been suggestions that uterine artery doppler in the second trimester may in addition to measurement of placental diameter and thickness help in predicting low-birth weight infants. Several investigators have suggested that diminished fetal growth may be a consequence of hemodynamic compromise [19,20]. In our study, we did not carry out doppler investigation of the umbilical vessels to ascertain the relationship between blood flow and fetal weight estimates. This is obviously a limitation which we suggest further studies should include. This will show how blood flow disturbances relate to placental size and fetal weight.

In measuring placental thickness, we adopted measurement at the insertion of the umbilical cord which other investigators have used[6,18,21]. We think that total placental volume would have been more appropriate but non-availability of three-dimensional ultrasound equipment

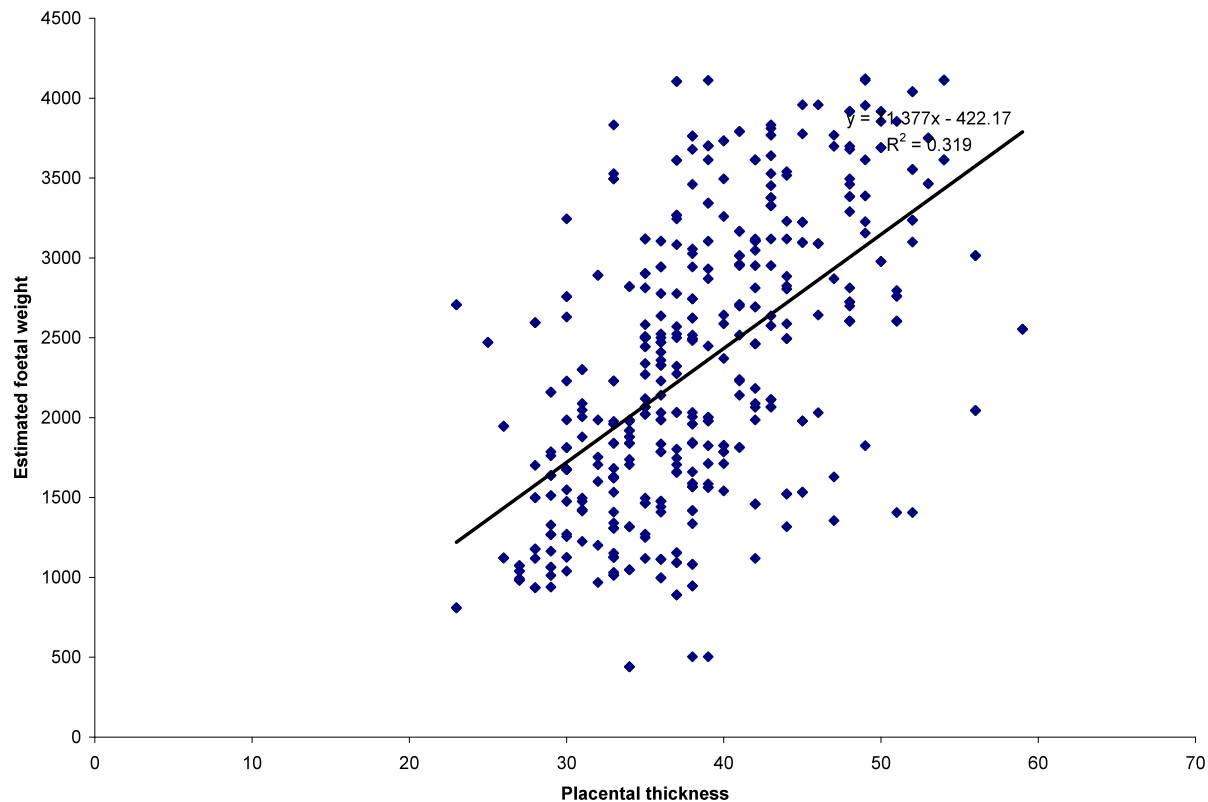


Figure 2: Graph of estimated fetal weight against placental thickness in the third trimester.

made this impossible. Using a two-dimensional ultrasound to obtain the thickness, and diameter of the placenta and calculating the volume would have introduced errors. This is because such calculations would be based on the formula for calculating the volume of a sphere which the placenta approximates to in shape.

The result of this study shows a strong positive correlation between placental thickness and estimated fetal weight. Thus, placental thickness can be used as a fairly accurate indicator of normality of fetal weight, but because of wide variations in placental thickness corresponding to particular fetal weight a more thorough search should be undertaken when a fetus is considered to be at risk.

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