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Original Article

Ultrasound-Based Correlation of Placental Thickness with Gestational Age, Crown-Rump Length (CRL), and Biparietal Diameter (BPD) in Normal, Hypertensive, and Diabetic Pregnancies

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ABSTRACT

Background: Placental thickness is an important sonographic marker of placental development and may provide adjunct information about fetal growth and maternal–fetal wellbeing. Maternal hypertension and diabetes can affect placental morphology through distinct vascular and metabolic pathways. Objective: To compare ultrasound-measured placental thickness among normal, hypertensive, and diabetic pregnancies and to assess its correlation with gestational age, biparietal diameter, crown-rump length, and Doppler systolic/diastolic ratio. Methods: This cross-sectional observational study included 80 singleton pregnant women between 28 and 37 weeks of gestation, comprising 40 normal pregnancies, 20 hypertensive pregnancies, and 20 diabetic pregnancies. Placental thickness was measured sonographically at the site of umbilical cord insertion. Fetal biometric parameters and Doppler systolic/diastolic ratio were recorded. Group differences were assessed using one-way ANOVA with Tukey HSD post hoc testing, and correlations were evaluated using Pearson and Spearman correlation analyses. Results: Mean placental thickness differed significantly among the three groups, $F(2,77) = 41.546$, $p < 0.001$. Placental thickness was lowest in hypertensive pregnancies (28.60 mm), intermediate in normal pregnancies (32.45 mm), and highest in diabetic pregnancies (37.10 mm). Placental thickness showed a strong positive correlation with gestational age using Pearson correlation ($r = 0.660$, $p < 0.001$) and Spearman correlation ($\rho = 0.665$, $p < 0.001$). A weak positive correlation was observed with biparietal diameter, while crown-rump length was not significantly correlated with placental thickness. Conclusion: Placental thickness differed significantly across normal, hypertensive, and diabetic pregnancies and was most strongly associated with gestational age. It may serve as a useful adjunct ultrasound marker when interpreted with fetal biometry, Doppler findings, and maternal clinical status.
Keywords: Placental Thickness, Gestational Age, Ultrasound, Hypertensive Pregnancy, Diabetic Pregnancy, Biparietal Diameter, Fetal Biometry, Antenatal Care

INTRODUCTION

Placental development is central to fetal growth because the placenta regulates maternal–fetal exchange of oxygen, nutrients, metabolic substrates, hormones, and waste products throughout pregnancy. Sonographic assessment of placental morphology, particularly placental thickness, has therefore gained clinical importance as an adjunct marker of placental growth and functional adequacy. In uncomplicated pregnancies, placental thickness generally increases with advancing gestational age and has been reported to show meaningful association with fetal maturity and selected fetal biometric parameters,

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making it a useful supplementary measurement during routine obstetric ultrasonography (1). Although gestational age is primarily established using standard obstetric dating methods and fetal biometry, placental thickness provides additional information about placental development and may help identify pregnancies in which placental structure appears disproportionate to fetal growth or gestational age (2).

Ultrasound remains the preferred imaging modality for routine antenatal assessment because it is non-invasive, widely available, repeatable, and safe when used according to standard obstetric protocols. Common fetal biometric parameters, including biparietal diameter and crown-rump length, are used to evaluate fetal growth and estimate gestational maturity at appropriate stages of pregnancy. Biparietal diameter is a standard second- and third-trimester fetal head measurement, whereas crown-rump length is most accurate in early pregnancy and should be interpreted cautiously when recorded outside its conventional first-trimester role (3). Placental thickness is usually measured at or near the site of umbilical cord insertion, perpendicular to the uterine wall, excluding the myometrium and subplacental venous spaces. When assessed alongside gestational age and fetal biometry, it can provide a more integrated sonographic impression of fetal growth and placental morphology (4).

Maternal hypertensive disorders and diabetes are among the most clinically important pregnancy complications because both can alter placental structure, uteroplacental perfusion, and fetal growth patterns. In hypertensive pregnancies, abnormal trophoblastic invasion, endothelial dysfunction, vasoconstriction, and impaired uteroplacental blood flow may contribute to placental insufficiency, fetal growth restriction, and adverse perinatal outcomes (5). These changes may be reflected sonographically by reduced placental thickness, abnormal placental maturation, altered Doppler indices, and reduced fetal growth parameters in some cases. Hypertensive disorders of pregnancy are also associated with increased maternal and fetal morbidity, particularly when diagnosis, monitoring, or timely intervention is delayed (6).

Diabetic pregnancy affects placental morphology through a different pathophysiological pathway. Maternal hyperglycemia, insulin resistance, fetal hyperinsulinemia, and altered placental vascularity may contribute to placental hypertrophy, increased placental thickness, polyhydramnios, and excessive fetal growth in poorly controlled cases (7). Gestational diabetes and pre-existing diabetes have become increasingly relevant in antenatal care because of rising maternal age, obesity, sedentary lifestyles, and metabolic risk factors, particularly in South Asian populations where the burden of dysglycemia in pregnancy is clinically significant (8,9). Because diabetic and hypertensive pregnancies may influence placental thickness in opposite directions, comparative ultrasound evaluation across normal and high-risk pregnancies may provide useful clinical information for antenatal surveillance.

Previous studies have reported positive associations between placental thickness, gestational age, and fetal biometric parameters in normal pregnancies, while abnormal placental thickness has been linked with fetal growth abnormalities and adverse pregnancy outcomes (1,2,4). However, local evidence comparing placental thickness across normal, hypertensive, and diabetic pregnancies remains limited, and available studies often differ in gestational age range, ultrasound protocol, and clinical grouping. There is also a need to clarify whether placental thickness remains meaningfully associated with fetal biometric measurements when pregnancies complicated by maternal hypertension or diabetes are included in the same analytical framework. This is particularly relevant in routine antenatal ultrasound practice, where placental morphology is often observed but not always systematically quantified or interpreted in relation to maternal risk status.

The present study was therefore designed to evaluate placental thickness using ultrasound in normal, hypertensive, and diabetic pregnancies and to determine its relationship with gestational age and selected fetal biometric parameters, including biparietal diameter and the recorded crown-rump length variable. The primary objective was to compare mean placental thickness among normal, hypertensive, and diabetic pregnancy groups. The secondary objective was to assess the correlation of placental thickness with gestational age, biparietal diameter, crown-rump length, and Doppler systolic/diastolic ratio. The study hypothesized that placental thickness would differ significantly across maternal clinical groups, with lower values in hypertensive pregnancies and higher values in diabetic pregnancies, and that placental thickness would show the strongest positive association with gestational age.

MATERIALS AND METHODS

This study was conducted as a cross-sectional observational study involving pregnant women who underwent antenatal ultrasound assessment. The study was designed to compare placental thickness across three maternal clinical groups and to evaluate its relationship with gestational age, fetal biometric measurements, and Doppler systolic/diastolic ratio. A cross-sectional design was selected because the objective was to assess sonographic measurements and clinical group differences at the time of examination rather than to determine longitudinal fetal growth trajectories or causal effects. The study included 80 singleton pregnant women, comprising 40 women with normal pregnancies, 20 women with hypertensive pregnancies, and 20 women with diabetic pregnancies.

Eligible participants were pregnant women with singleton pregnancies between 28 and 37 weeks of gestation who were referred for routine or clinically indicated antenatal ultrasound assessment. Women were included if they had a normal pregnancy without known systemic disease, a pregnancy complicated by hypertension or preeclampsia, or a pregnancy complicated by diabetes mellitus or gestational diabetes. Hypertensive pregnancy was defined clinically according to documented antenatal diagnosis of raised blood pressure after mid-pregnancy, with or without associated features of preeclampsia, in accordance with accepted obstetric diagnostic principles (6). Diabetic pregnancy included women with documented diabetes mellitus or gestational diabetes diagnosed during antenatal care according to standard clinical evaluation and glucose-based diagnostic criteria (8). Women were excluded if they had multiple gestation, fetal congenital anomaly detected on ultrasound, chronic systemic illness likely to independently affect fetal growth or placental morphology, or technically inadequate ultrasound visualization of the fetus or placenta.

Participants were selected through non-probability convenience sampling from eligible women presenting during the study period. Recruitment was performed at the time of antenatal ultrasound assessment after confirming eligibility against the inclusion and exclusion criteria. The purpose of the examination and use of anonymized clinical and ultrasound data for research were explained to participants before inclusion. Only women willing to participate were enrolled. Maternal demographic and obstetric data were recorded, including age, gestational age, gravida, parity, and maternal clinical group. Gestational age was recorded in completed weeks based on available antenatal dating information and ultrasound assessment.

Ultrasound examination was performed using standard obstetric scanning technique. Fetal biparietal diameter was measured on an axial transthalamic plane of the fetal head using the conventional outer-to-inner caliper method. The recorded crown-rump length variable was retained as part of the available biometric dataset and interpreted cautiously because crown-rump length is conventionally most valid for first-trimester dating. Placental thickness was measured at the level of umbilical cord insertion, with the measurement taken perpendicular to the uterine wall from the chorionic plate to the basal plate, excluding the myometrium and subplacental venous spaces. Placental site and placental grade were assessed sonographically where visualization was adequate. Doppler assessment included recording of the systolic/diastolic ratio as an indicator of fetoplacental vascular resistance. To reduce measurement bias, standard anatomical planes were used for fetal biometric measurements, and placental thickness was measured at a consistent placental location rather than at the thickest or thinnest arbitrary area.

The primary outcome variable was placental thickness measured in millimeters. Secondary variables included gestational age in weeks, biparietal diameter in millimeters, crown-rump length in millimeters as recorded in the dataset, systolic/diastolic Doppler ratio, placental grade, gravida, parity, and maternal clinical group. Maternal clinical group was categorized as normal, hypertensive, or diabetic pregnancy.

Placental thickness was analyzed both as a continuous variable and as a comparative outcome across the three clinical groups. Gestational age and fetal biometric parameters were analyzed as continuous variables for correlation with placental thickness.

A total sample of 80 participants was included based on the number of eligible cases available during the defined study period. Because the study used convenience sampling and was exploratory in nature, the sample was distributed according to available clinical groups rather than equal allocation. The final analytical groups comprised 40 normal pregnancies, 20 hypertensive pregnancies, and 20 diabetic pregnancies. Data were reviewed for completeness and consistency before analysis. Records with inadequate visualization of fetal biometry or placental thickness were excluded at the eligibility stage to minimize measurement-related missingness. Continuous variables were summarized using mean and standard deviation, while categorical variables were summarized using frequency and percentage.

Statistical analysis was performed to describe participant characteristics, compare placental thickness across clinical groups, and assess associations between placental thickness and fetal or obstetric variables. Mean placental thickness among normal, hypertensive, and diabetic groups was compared using one-way analysis of variance, followed by Tukey honestly significant difference post hoc testing for pairwise comparisons where the overall test was significant. Pearson correlation was used to assess linear relationships between placental thickness and normally distributed continuous variables, while Spearman rank correlation was additionally used to evaluate monotonic associations and reduce dependence on distributional assumptions. Group-wise correlation analyses were performed separately for normal, hypertensive, and diabetic pregnancies to explore whether the relationship between placental thickness and gestational age or fetal biometry differed by maternal clinical status. Statistical significance was set at $p < 0.05$. Interpretation of findings was based on both statistical significance and the magnitude and direction of the observed associations, with particular caution applied to subgroup correlations because of the smaller sample sizes in the hypertensive and diabetic groups.

Measures to improve data integrity included use of predefined eligibility criteria, standardized ultrasound measurement planes, consistent operational definition of the primary outcome, and review of recorded values before analysis. Potential confounding by gestational age was addressed analytically by examining its correlation with placental thickness and by comparing gestational age distribution across clinical groups where appropriate. Because gestational age is biologically related to placental thickness, the interpretation of group differences in placental thickness considered whether differences might reflect maternal clinical status rather than unequal gestational age distribution. Ethical conduct was maintained by enrolling only consenting participants and by using anonymized clinical and sonographic data for analysis.

RESULTS

A total of 80 pregnant women were included in the analysis. The study population comprised 40 women with normal pregnancies, 20 women with hypertensive pregnancies, and 20 women with diabetic pregnancies. The overall descriptive profile of maternal age, gestational age, fetal biometric parameters, placental thickness, and Doppler systolic/diastolic ratio is presented in Table 1.

Table 1. Descriptive Summary of Maternal, Fetal, Placental, and Doppler Variables

Variable	n	Minimum	Maximum	Mean ± SD
Age (years)	80	20	45	30.71 ± 6.15
Gestational age (weeks)	80	28	37	32.49 ± 2.77
Biparietal diameter (mm)	80	68	94	80.78 ± 6.26
Crown-rump length (mm)	80	240	339	283.45 ± 26.35
Placental thickness (mm)	80	23	41	32.65 ± 4.21
S/D ratio	80	2.11	4.99	3.18 ± 0.70

SD, standard deviation; S/D, systolic/diastolic.

The mean maternal age was 30.71 ± 6.15 years, with an age range of 20 to 45 years. The mean gestational age was 32.49 ± 2.77 weeks, indicating that the sample primarily represented late second- and third-trimester pregnancies. Mean placental thickness was 32.65 ± 4.21 mm, ranging from 23 to 41 mm. The mean biparietal diameter was 80.78 ± 6.26 mm, while the recorded crown-rump length variable had a mean value of 283.45 ± 26.35 mm. The mean Doppler S/D ratio was 3.18 ± 0.70.

Table 2. Distribution of Participants by Clinical Pregnancy Group

Clinical group	n	%
Normal pregnancy	40	50.0
Hypertensive pregnancy	20	25.0
Diabetic pregnancy	20	25.0
Total	80	100.0

Half of the study population consisted of women with normal pregnancies, while hypertensive and diabetic pregnancies each accounted for one-quarter of the sample. This distribution allowed comparison of placental thickness between uncomplicated pregnancies and two clinically important high-risk pregnancy groups.

Table 3. Overall Pearson Correlation of Placental Thickness with Gestational Age and Fetal Biometric Parameters

Variable correlated with placental thickness	n	Pearson r	p-value
Gestational age (weeks)	80	0.660	<0.001
Crown-rump length (mm)	80	0.170	0.131
Biparietal diameter (mm)	80	0.278	0.012

Placental thickness showed a strong positive correlation with gestational age, with Pearson $r = 0.660$ and $p < 0.001$. A weak positive correlation was observed between placental thickness and biparietal diameter, with $r = 0.278$ and $p = 0.012$. The correlation between placental thickness and the recorded crown-rump length variable was weak and did not reach statistical significance, with $r = 0.170$ and $p = 0.131$.

Table 4. Overall Spearman Correlation of Placental Thickness with Gestational Age and Fetal Biometric Parameters

Variable correlated with placental thickness	n	Spearman ρ	p-value
Gestational age (weeks)	80	0.665	<0.001
Crown-rump length (mm)	80	0.146	0.197
Biparietal diameter (mm)	80	0.257	0.021

Spearman correlation analysis produced findings consistent with the Pearson analysis. Placental thickness remained strongly and positively correlated with gestational age, with $\rho = 0.665$ and $p < 0.001$. The association with biparietal diameter remained weak but statistically significant, with $\rho = 0.257$ and $p = 0.021$. The association with the recorded crown-rump length variable remained non-significant, with $\rho = 0.146$ and $p = 0.197$.

Table 5. Group-Wise Pearson Correlation of Placental Thickness with Gestational Age and Fetal Biometric Parameters

Clinical group	Variable correlated with placental thickness	n	Pearson r	p-value
Normal pregnancy	Gestational age (weeks)	40	0.965	<0.001
Normal pregnancy	Crown-rump length (mm)	40	-0.012	0.943
Normal pregnancy	Biparietal diameter (mm)	40	0.101	0.534
Hypertensive pregnancy	Gestational age (weeks)	20	0.909	<0.001
Hypertensive pregnancy	Crown-rump length (mm)	20	-0.204	0.389
Hypertensive pregnancy	Biparietal diameter (mm)	20	-0.270	0.250
Diabetic pregnancy	Gestational age (weeks)	20	0.951	<0.001
Diabetic pregnancy	Crown-rump length (mm)	20	-0.189	0.426
Diabetic pregnancy	Biparietal diameter (mm)	20	0.217	0.358

Across all three clinical groups, placental thickness showed a strong positive correlation with gestational age. The correlation was highest in normal pregnancies, with $r = 0.965$, followed by diabetic pregnancies with $r = 0.951$ and hypertensive pregnancies with $r = 0.909$. In contrast, the correlations of placental thickness with crown-rump length and biparietal diameter were not statistically significant within any individual clinical group. These findings indicate that gestational age was the most consistent correlate of placental thickness across normal and high-risk pregnancies.

Table 6. Comparison of Mean Placental Thickness Across Clinical Pregnancy Groups

Clinical group	n	Mean placental thickness (mm)
Hypertensive pregnancy	20	28.60
Normal pregnancy	40	32.45
Diabetic pregnancy	20	37.10

Mean placental thickness differed visibly across the three clinical groups. The lowest mean placental thickness was observed in hypertensive pregnancies at 28.60 mm, followed by normal pregnancies at 32.45 mm, while diabetic pregnancies had the highest mean placental thickness at 37.10 mm. This ordered pattern is clinically consistent with reduced placental thickness in hypertensive pregnancies and increased placental thickness in diabetic pregnancies.

Table 7. One-Way ANOVA for Placental Thickness Across Clinical Pregnancy Groups

Source of variation	Sum of squares	df	Mean square	F	p-value
Between groups	725.700	2	362.850	41.546	<0.001
Within groups	672.500	77	8.734		
Total	1398.200	79			

One-way ANOVA showed a statistically significant difference in mean placental thickness among the three clinical pregnancy groups, $F(2,77) = 41.546$, $p < 0.001$. The between-group variability was substantial relative to the within-group variability, supporting the presence of meaningful group-level differences in placental thickness.

Table 8. Tukey HSD Post Hoc Comparisons of Placental Thickness Between Clinical Pregnancy Groups

Group I	Group J	Mean difference (I–J), mm	Standard error	95% CI lower	95% CI upper	p-value
Normal pregnancy	Hypertensive pregnancy	3.850	0.809	1.92	5.78	<0.001
Normal pregnancy	Diabetic pregnancy	-4.650	0.809	-6.58	-2.72	<0.001
Hypertensive pregnancy	Diabetic pregnancy	-8.500	0.935	-10.73	-6.27	<0.001

CI, confidence interval; HSD, honestly significant difference.

Tukey HSD post hoc analysis demonstrated that all pairwise group comparisons were statistically significant. Normal pregnancies had a mean placental thickness 3.85 mm greater than hypertensive pregnancies. Diabetic pregnancies had a mean placental thickness 4.65 mm greater than normal pregnancies and 8.50 mm greater than hypertensive pregnancies. These results indicate that the three groups formed distinct placental thickness patterns, with hypertensive pregnancies showing the lowest values and diabetic pregnancies showing the highest values.

Table 9. Correlation Matrix of Gestational Age, Crown-Rump Length, and Biparietal Diameter

Variable pair	n	Pearson r	p-value
Gestational age and crown-rump length	80	-0.043	0.707
Gestational age and biparietal diameter	80	0.056	0.622
Crown-rump length and biparietal diameter	80	0.018	0.872

The intercorrelation analysis showed no statistically significant association between gestational age and crown-rump length, gestational age and biparietal diameter, or crown-rump length and biparietal diameter in the overall sample. This pattern suggests that, within the available dataset, placental thickness had a clearer relationship with gestational age than the fetal biometric variables had with each other. The absence of expected strong associations among some fetal biometric parameters should be interpreted cautiously and may reflect the cross-sectional design, restricted gestational age range, measurement variability, or data-recording limitations.

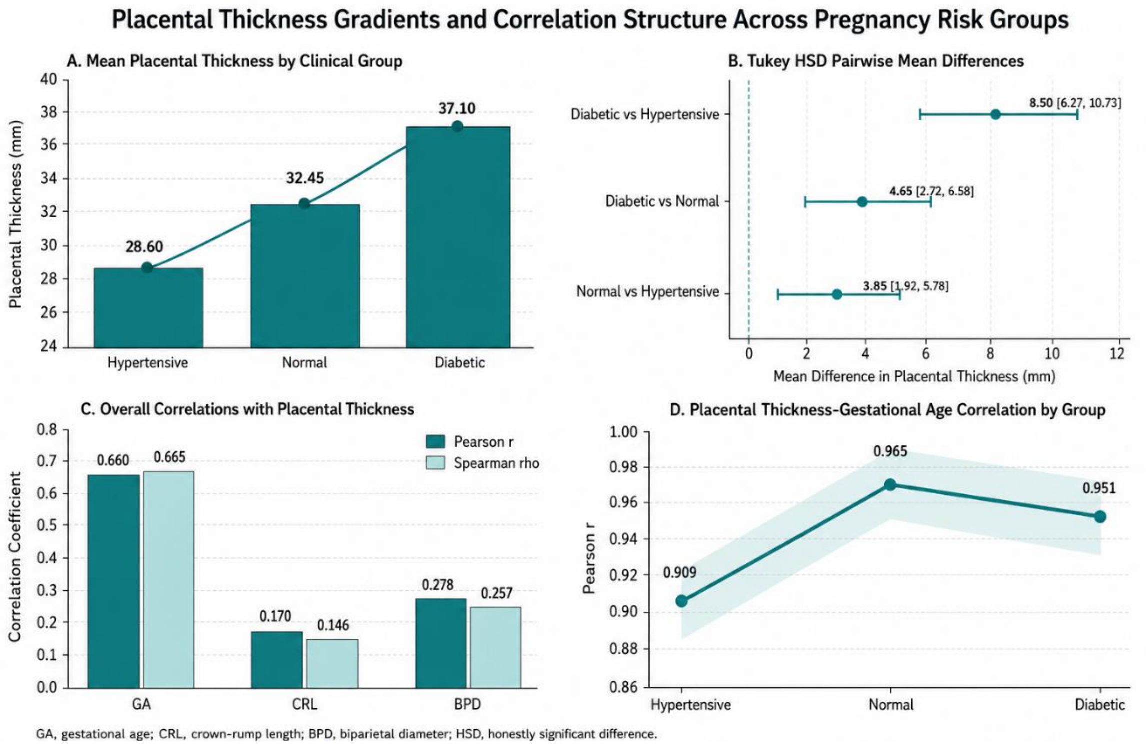

Figure 1. Placental Thickness Gradients and Correlation Structure Across Pregnancy Risk Groups. Panel A shows the ordered increase in mean placental thickness from hypertensive pregnancies to normal and diabetic pregnancies, with the lowest mean value in hypertensive pregnancies at 28.60 mm and the highest value in diabetic pregnancies at 37.10 mm. Panel B demonstrates that all Tukey HSD pairwise comparisons were statistically separated, with diabetic pregnancies exceeding hypertensive pregnancies by 8.50 mm, diabetic pregnancies exceeding normal pregnancies by 4.65 mm, and normal pregnancies exceeding hypertensive pregnancies by 3.85 mm. Panel C shows that placental thickness had its strongest overall association with gestational age using both Pearson correlation and Spearman correlation, while the association with biparietal diameter was weaker and the association with crown-rump length was limited. Panel D shows that the positive relationship between placental thickness and gestational age was preserved across all clinical groups, with Pearson correlation coefficients of 0.909 in hypertensive pregnancies, 0.965 in normal pregnancies, and 0.951 in diabetic pregnancies, indicating that gestational age remained the dominant correlate of placental thickness despite clinically distinct placental thickness patterns across risk groups.

DISCUSSION

This cross-sectional ultrasound-based study evaluated placental thickness in normal, hypertensive, and diabetic pregnancies and examined its relationship with gestational age, biparietal diameter, crown-rump length, and Doppler systolic/diastolic ratio. The principal finding was that placental thickness differed significantly across the three clinical groups, with the lowest mean value observed in hypertensive pregnancies, an intermediate value in normal pregnancies, and the highest value in diabetic pregnancies. Mean placental thickness was 28.60 mm in hypertensive pregnancies, 32.45 mm in normal pregnancies, and 37.10 mm in diabetic pregnancies, and the overall between-group difference was statistically significant on one-way ANOVA, $F(2,77) = 41.546$, $p < 0.001$. Tukey post hoc testing showed that all pairwise comparisons were statistically significant, indicating that the placental thickness pattern was not limited to a single group contrast but represented a graded difference across maternal clinical status.

The strong positive association between placental thickness and gestational age was the most consistent correlation observed in the study. In the overall sample, placental thickness correlated strongly with gestational age using both Pearson correlation, $r = 0.660$, $p < 0.001$, and Spearman correlation, $\rho = 0.665$, $p < 0.001$. This finding is biologically plausible because placental growth normally progresses with advancing pregnancy, reflecting increasing villous development, vascular expansion, and maternal–fetal exchange capacity. Previous sonographic studies have similarly reported that placental thickness increases with gestational age and may serve as a supplementary parameter for assessing placental development and fetal maturity during antenatal ultrasonography (1,2,10). The present findings support the role of placental thickness as an adjunct ultrasound measurement, particularly when interpreted alongside gestational age rather than as an isolated marker.

The group-wise analysis further strengthened the observation that gestational age remained closely related to placental thickness across different maternal risk categories. Placental thickness showed strong positive correlations with gestational age in normal pregnancies, $r = 0.965$, hypertensive pregnancies, $r = 0.909$, and diabetic pregnancies, $r = 0.951$, with all p-values below 0.001. Although these subgroup correlations should be interpreted cautiously because the hypertensive and diabetic groups each included only 20 participants, the consistency of direction across groups suggests that gestational maturation remains the dominant determinant of placental thickness even in clinically complicated pregnancies. This also highlights the importance of considering gestational age when comparing placental thickness between normal and high-risk pregnancies.

Hypertensive pregnancies demonstrated the lowest mean placental thickness in the study. This finding is consistent with the pathophysiological model of hypertensive pregnancy, in which impaired trophoblastic invasion, endothelial dysfunction, vasoconstriction, and reduced uteroplacental perfusion may contribute to placental insufficiency and restricted placental growth. Reduced placental thickness in hypertensive pregnancy may therefore reflect compromised placental development, infarction, vascular malperfusion, or reduced functional placental tissue. Prior literature has linked hypertensive disorders of pregnancy with abnormal placental morphology, impaired fetal growth, and adverse perinatal outcomes, particularly when uteroplacental circulation is affected (5,6,11). In the present study, the mean placental thickness in hypertensive pregnancies was 3.85 mm lower than in normal pregnancies and 8.50 mm lower than in diabetic pregnancies, supporting the clinical relevance of placental thickness assessment in pregnancies complicated by hypertension.

In contrast, diabetic pregnancies showed the highest mean placental thickness. The mean placental thickness in diabetic pregnancies was 37.10 mm, which was 4.65 mm greater than normal pregnancies and 8.50 mm greater than hypertensive pregnancies. This finding is consistent with the known influence of maternal diabetes on placental structure. Maternal hyperglycemia, insulin resistance, fetal hyperinsulinemia, altered placental vascularization, and metabolic stimulation of fetal and placental tissues may contribute to placental hypertrophy and increased placental thickness (7,8,12). Previous studies have also reported increased placental thickness in pregnancies complicated by diabetes and have associated such changes with fetal overgrowth, macrosomia, polyhydramnios, and altered placental vascular adaptation (9,13). The present findings support the concept that diabetic and hypertensive pregnancies may affect placental morphology in opposite directions, with hypertension tending toward reduced placental thickness and diabetes tending toward increased placental thickness.

The relationship between placental thickness and fetal biometric parameters was less consistent than its relationship with gestational age. Placental thickness showed a weak but statistically significant positive overall correlation with biparietal diameter using Pearson correlation, $r = 0.278$, $p = 0.012$, and Spearman correlation, $\rho = 0.257$, $p = 0.021$. This suggests that larger fetal head biometry was modestly associated with greater placental thickness in the combined sample. However, the strength of this association was substantially weaker than the association with gestational age, and group-wise correlations between placental thickness and biparietal diameter were not statistically significant. This pattern indicates that BPD may have limited independent interpretive value for placental thickness once pregnancies are stratified by maternal clinical status and gestational age range.

The recorded crown-rump length variable did not show a statistically significant association with placental thickness in the overall analysis, with Pearson $r = 0.170$, $p = 0.131$, and Spearman $\rho = 0.146$, $p = 0.197$. It was also not significantly correlated with placental thickness within any clinical group. This finding should be interpreted carefully because crown-rump length is conventionally the most reliable biometric parameter for first-trimester dating and is not routinely used as a primary fetal biometric measure in late second- or third-trimester pregnancies. Since the present sample had a gestational age range of 28 to 37 weeks, the recorded CRL variable may represent measurement terminology that requires clarification or may have limited clinical validity in this gestational window. Therefore, unlike gestational age and, to a lesser extent, BPD, the available data do not support a conclusion that CRL was significantly associated with placental thickness in this study.

The clinical relevance of the study lies in its demonstration that placental thickness varies systematically across normal, hypertensive, and diabetic pregnancies. This finding supports the inclusion of placental thickness as an adjunct sonographic observation during antenatal assessment, especially in pregnancies complicated by maternal hypertension or diabetes. A thinner placenta in hypertensive pregnancy may prompt closer evaluation for placental insufficiency, fetal growth restriction, amniotic fluid abnormality, and Doppler evidence of increased vascular resistance. Conversely, increased placental thickness in diabetic pregnancy may support closer monitoring for fetal overgrowth, polyhydramnios, metabolic complications, and delivery planning. However, because the study was cross-sectional, placental thickness should be interpreted as an associated sonographic marker rather than a causal predictor of adverse outcome.

The findings also have implications for ultrasound reporting in high-risk pregnancy. Routine obstetric scans often emphasize fetal biometry, fetal presentation, amniotic fluid, and placental location, while placental thickness may not always be systematically measured or documented. The present data suggest that reporting placental thickness alongside gestational age and maternal clinical status could add clinically useful information, particularly when values appear disproportionately low or high. Nonetheless, placental thickness should not be used in isolation. Its interpretation should be integrated with fetal growth parameters, Doppler indices, amniotic fluid volume, placental grade, maternal blood pressure, glycemic control, and overall clinical context.

Several limitations should be considered when interpreting the findings. The study used a cross-sectional design, which limits inference about longitudinal placental growth patterns and temporal relationships between maternal disease and placental change. The sample size was modest, particularly in the hypertensive and diabetic subgroups, which may reduce precision in subgroup correlation estimates. Convenience sampling may also limit generalizability to broader antenatal populations. The study did not report detailed subgroup classification of hypertension or diabetes, such as chronic hypertension, gestational hypertension, preeclampsia, pre-existing diabetes, or gestational diabetes, which may have different effects on placental morphology. Information on glycemic control, antihypertensive treatment, disease duration, body mass index, parity-adjusted risk, fetal weight estimation, neonatal outcome, and interobserver reliability was also not available in the reported dataset.

Another important limitation is the use and interpretation of the recorded CRL variable in a sample ranging from 28 to 37 weeks of gestation. Since CRL is primarily a first-trimester parameter, future work should clarify whether this variable was truly CRL, fetal length, or another biometric measurement recorded under an incorrect label. Future studies should use standardized second- and third-trimester fetal biometric parameters, such as BPD, head circumference, abdominal circumference, and femur length, and should examine their independent relationship with placental thickness after adjustment for gestational age. Larger multicenter studies with longitudinal follow-up are needed to determine whether placental thickness thresholds can predict fetal growth restriction, macrosomia, abnormal Doppler findings, birth weight, neonatal morbidity, or other clinically meaningful outcomes.

Overall, the present study contributes locally relevant evidence that placental thickness is strongly associated with gestational age and differs significantly among normal, hypertensive, and diabetic pregnancies. The observed pattern of lower placental thickness in hypertensive pregnancies and higher placental thickness in diabetic pregnancies is consistent with known differences in placental pathophysiology between vascular insufficiency and metabolic placental hypertrophy. The results support the use of placental thickness as an adjunct ultrasound marker in antenatal assessment, while emphasizing the need for standardized measurement, careful interpretation by gestational age, and confirmation through larger prospective studies.

CONCLUSION

Placental thickness differed significantly among normal, hypertensive, and diabetic pregnancies, with the lowest mean thickness observed in hypertensive pregnancies and the highest mean thickness observed in diabetic pregnancies. Placental thickness showed a strong positive association with gestational age in the overall sample and within each clinical group, indicating that gestational maturity was the dominant correlate of placental thickness. Biparietal diameter demonstrated only a weak overall positive association with placental thickness, while the recorded crown-rump length variable was not significantly associated with placental thickness and should be interpreted cautiously in this late-gestation sample. These findings suggest that placental thickness can serve as a useful adjunct sonographic marker during antenatal assessment, particularly in pregnancies complicated by hypertension or diabetes, but it should be interpreted alongside gestational age, fetal biometry, Doppler findings, and maternal clinical status rather than as an isolated diagnostic measure.

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