ORIGINAL ARTICLE

Assessment of Placental Thickness during the Second and Third Trimesters and Its Correlation with Fetal Weight

Karim El Etriby *, Menna Alla Mohamed, Hossam Abdou

Department of Obstetrics and Gynecology, Faculty of Medicine, Helwan University, Cairo, Egypt

Abstract

Background: ***The placenta functions as a vital organ that supports both the fetus and the mother, providing essential nourishment and protection throughout pregnancy. Given that birth weight has been shown to be the main factor influencing newborn survival outcomes, estimating the fetal weight is necessary.***

Objectives: ***To evaluate placental thickness in the second and third trimesters and its relationship to fetal weight.***

Patients and methods: ***This prospective study involved 115 patients, who were between 18-40 weeks of gestational age, had a history of regular menstrual cycles, knew their last menstrual period, and were carrying a single fetus. Ultrasound measurements of placental thickness are commonly performed on pregnant women throughout the second trimester spans from 18 to 20 weeks, while the third trimester extends from 30 to 34 weeks.***

Results: ***The findings indicated a notable increase in gestational age, placental thickness, and fetal weight during the third trimester compared to the second trimester (P<0.001). The mean value of placental weights was 450.2 ± 90.41 grams.***

Regarding ***APGAR scores, at one minute, the mean value of scores was 5.52±2.27. While at five minutes was 7.57±1.75. In the second trimester, no significant correlations were found. Nevertheless, an obvious inverse correlation between placental thickness and placental weight emerged during the third trimester (r = -0.236, p = 0.011). Other correlations in both trimesters were not statistically significant.***

Conclusions: ***The only significant relationship identified was an inverse association between 3rd-trimester placental thickness and placental delivery weight.***

Keywords: Placental Thickness; 2nd Trimester; 3rd Trimester; Fetal Weight

1. Introduction

The primary function of the human placenta is to provide the fetus with oxygen and essential nutrients. Normal fetal development and a healthy birth weight depend on the uteroplacental unit's ability to transmit these vital nutrients from the mother to the fetus. Proper placental development is crucial for nourishing a healthy fetus during pregnancy.[1]

Proper placental development is crucial for nourishing a healthy fetus during pregnancy, as it enables the uteroplacental unit to transmit essential nutrients and oxygen from the mother to the fetus. Normal fetal development and a healthy birth weight depend on this vital function.[2] Research has focused on measuring the placenta in 3D to predict unfavorable pregnancy outcomes. However, this technology requires a complex clinical environment and has yielded contradictory findings regarding its reliability in assessing the placenta.[3]

Ultrasound assessment of placental thickness has been utilized for more than two decades and is relatively straightforward, repeatable, and clinically useful. Some researchers have demonstrated in two separate studies that placental size in mid-pregnancy independently correlates with birth characteristics, despite the fact that the majority of placental development occurs in the third trimester.[4]

Accepted 15 June 2025.
Available online 31 July 2025

* Corresponding author at: Obstetrics and Gynecology, Faculty of Medicine, Helwan University, Cairo, Egypt.
E-mail address: karim.eletriby@med.helwan.edu.eg (K. El Etriby).

https://doi.org/10.21608/aimj.2025.446667

Other studies have reported that fetal ultrasound readings were only able to predict birth size during the third trimester. Many investigations were retrospective or cross-sectional, and therefore could not establish a true association between placental measures and fetal outcomes. Regular measurements of placental thickness during the second and third trimesters could potentially help determine whether the placenta is functioning normally and whether fetal development is progressing as expected. This approach may also serve as a reliable indicator of fetal growth and birth weight.[5, 6]

Assessing placental thickness in the second and third trimesters of pregnancy and its relationship to foetal weight were the goals of this study.

2. Patients and methods

This prospective study was carried out with the approval of The Helwan University Hospitals' Ethical Committee in Cairo, Egypt. The patients gave their signed, informed permission.

Inclusion criteria: One hundred and fifteen patients, with gestational ages ranging from 18 to 40 weeks, who had a history of regular menstrual cycles, were aware of their last menstrual period, and were pregnant with a single fetus.

Exclusion criteria: Systemic diseases or genetic abnormalities, polyhydramnios, sickle cell disease, morbid obesity, insufficient medical records, and intrauterine growth restriction were among the exclusion criteria.

A thorough medical history and comprehensive clinical examination were conducted for every patient.

General examination:

"Key indicators include blood pressure, temperature, heart rate, and respiratory rate, along with physical signs such as pallor, cyanosis, jaundice, and swollen lymph nodes. At the antenatal clinic, our team evaluated all female participants during the 1st-trimester screening, gathering essential baseline information such as age, parity, body mass index (BMI), and any previous medical conditions. We also assessed smoking, alcohol, and drug use. In the second and third trimesters, specifically at 18-20 and 30-34 weeks of gestation, we documented maternal weight, weight gain, BMI, and BMI changes, along with ultrasound findings. Following the assessment of maternal weight, we also recorded birth weight, fetal sex, and the delivery method at the time of delivery. Following delivery, we measure the placenta's weight in grams, as outlined in a prior study by Azpurua et al. 7. Additionally, we evaluate the health and prevalence of fetal and neonatal conditions, including infant APGAR scores, fetal distress or death, and neonatal intensive care unit (NICU) hospitalization. Two senior resident physicians performed the exams and recorded the data. During the second trimester (18–20 weeks of gestation) and third trimester (30–34 weeks of gestation), pregnant women typically undergo an ultrasound examination to measure placental thickness. All sonographic evaluations were performed transabdominally using a Colour Doppler ultrasound scanner with a convex-array probe set to 3.5 MHz. As described by Hoddick et al., the ultrasound probe was positioned at a right angle to the placenta, near the site where the umbilical cord inserts, specifically in the mid-placental area, to assess placental thickness.[8]

The outcomes were placental thickness, gestational weight, and GA.

Sample Size Calculation:

The PASS 2021 Power Analysis and Sample Size Software (2021) has been employed to determine the necessary sample size. The software is available at ncss.com/software/pass and is published by NCSS, LLC in Kaysville, Utah, USA. A previous investigation found a significant positive relationship between PT and EFW with a correlation coefficient of 0.98.[9] Based on these assumptions, a sample size of 115 pregnant women is adequate to estimate the expected correlation coefficient (Pearson r) of 0.98 with a 95% confidence interval of 0.015. This calculation used a two-sided Pearson correlation test with a type 1 error of 0.05.

Statistical analysis

SPSS v26 (IBM Inc., Chicago, IL, USA) was employed to conduct statistical analysis. The quantitative variables of the two groups, presented as mean and standard deviation (SD), were analyzed through an unpaired Student's t-test. When needed, chi-square analysis or Fisher's exact test was utilized, and the frequency and percentage of the qualitative variables were presented. To explore the connection among various variables, the Pearson product-moment correlation formula was employed. A P value of less than 0.05 in a two-tailed test was defined as statistically significant.

3. Results

Demographic data, different parameters, and vital and symptomatic signs were enumerated in Table 1.

Table 1. Distribution of the patients according to demographic data, different parameters, vital and symptomatic signs

		N=115
AGE (YEARS)		30.92±6.76
SEX OF FETUS	Male	73(63.5%)
	Female	42(36.5%)
PARITY		1.46±0.64
NULLIPARA (0)		4(3.5%)
PRIMIPARA (1)		59(51.3%)
2		47(40.9%)
3		5(4.3%)
MATERNAL WEIGHT		72.78±7.39

BMI (KG/M^2)		25.59±2.54
BIRTH WEIGHT		3520.4±366.2
MODE OF DELIVERY	N. D	24(20.9%)
	CS	91(79.1%)
PAST MEDICAL HISTORY		37(32.2%)
PAST SURGICAL HISTORY		27(23.5%)
ALCOHOL		3(2.6%)
SMOKING		5(4.3%)
VITAL SIGNS	SBP	124.3±8.51
	DBP	77.67±10.41
	Pulse	102.7±13.90
	Temperature	37.05±0.40
	RR	14.70±2.33
	SPO_2	96.3±42.33
SIGNS	Pallor	10(8.7%)
	Cyanosis	6(5.2%)
	Jaundice	3(2.6%)
	Lymph node enlargement	5(4.3%)

The data are displayed as frequency (%) or mean ± SD. CS stands for cesarean section, SBP for systolic blood pressure, DBP for diastolic blood pressure, RR for respiratory rate, and BMI for body mass index.

Fetal weight, placental thickness, and GA all significantly increased in the third trimester compared to the second (P<0.001). (Table 2)

Table 2. Comparison between 2nd trimesters and 3rd trimesters according to GA, placental thickness, and fetal weight

	2ND TRIMESTERS	3RD TRIMESTERS	TEST OF SIG.	P
GA	19.94 ± 9.26	31.79 ± 1.32	Z=9.022*	<0.001*
PLACENTAL THICKNESS	2.25 ± 0.47	3.20 ± 0.17	t=20.112*	<0.001*
FETAL WEIGHT	324.3 ± 56.89	2008.3 ± 261.5	t=69.509*	<0.001*

Data are presented as mean ± SD. * Significant p-value <0.05, Z: Wilcoxon signed ranks test, t: Paired t-test, GA: Gestational age.

The mean value of placental weights was 450.2 ± 90.41 grams. Regarding APGAR scores, at one minute, the mean value of scores was 5.52±2.27. While at five minutes was 7.57±1.75. (Figure 1)

In the 2nd trimester, no significant correlations were found. However, in the 3rd trimester, a notable negative correlation appeared between placental thickness and placental weight (r = -0.236, p = 0.011). Other correlations in both trimesters were not statistically significant. (Table 3)

Table 3. Correlation between placental thickness and different parameters

	PLACENTAL THICKNESS 2ND TRIMESTERS		PLACENTAL THICKNESS 3RD TRIMESTERS	
	r	P	r	P
BIRTH WEIGHT	-0.089	0.344	0.024	0.800
THE PLACENTA WEIGHS	0.019	0.836	-0.236	0.011*
ONE MIN APGAR SCORE	0.079	0.404	0.149	0.111
FIVE MIN APGAR SCORE	-0.038	0.684	0.034	0.719

r: Pearson coefficient, * Significant p-value <0.05, APGAR: Appearance, Pulse, Grimace, Activity, and Respiration.

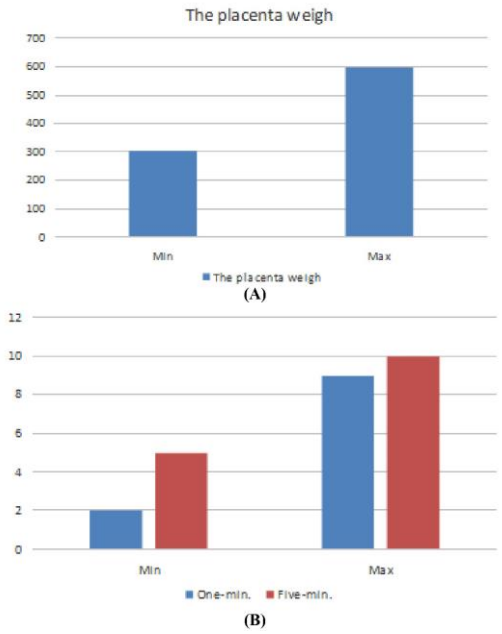

Figure 1. Descriptive analysis of the studied cases according to (A) placenta weigh and (B) Apgar score

4. Discussion

Numerous factors influence fetal well-being, but a well-functioning placenta is the most significant contributor to the delivery of a healthy infant. The placenta serves as an organ responsible for supplying oxygen and nutrients to the fetus. Optimal birth weight and proper fetal growth depend on the placenta's ability to function effectively. [10]

Findings from our research indicated that placental thickness was substantially greater in the third trimester than in the second trimester, with corresponding mean measurements of 3.20mm and 2.25mm. According to Abdelhamid et al.[11], there was a progressive thickening of the placenta during gestation. The mean placental thickness measured at the first visit was 24.91 ± 1.27 mm. On the second visit, it was 29.50 ± 1.23 mm, and on the third visit, it was 34.60 ± 1.6 mm. In our study, regarding fetal weight, there was also a significant increase from the second to the third trimester, with means of 324g and 2008g, respectively. This is consistent with what Abdelhamid et al.[11] reported: the average EFBW via Hadlock during the initial visit was 700.40 ± 120.5 g, in the second visit, it was 1372.30 ± 306 g, and in the third visit, it reached 2516.40 ± 311 g. Our results show that there was no noticeable connection between placental thickness and birth weight in either the second or third trimester of pregnancy.

According to Abdelhamid et al., Hadlock's predicted fetal birth weight has been found to have a substantial link with placental thickness, which is in contradiction to several other studies

that revealed a connection between placental thickness and birth weight.[11] Unlike previous studies, Noor et al.[9] found a significant link between placental thickness and the estimated fetal birth weight. Our results contrast with those presented by Ismail et al.[12], who identified a strong positive correlation between expected fetal birth weight and placental thickness. Additionally, a study conducted by Baghel et al.[13] revealed that placental thickness was significantly correlated with both birth weight and predicted fetal birth weight, with expected fetal birth weight rising in tandem with placental thickness. Furthermore, research conducted by Gouda et al.[14] showed a statistically significant relationship between fetal weight and placental thickness during the second trimester, with a correlation coefficient of 0.354 and a p-value lower than 0.05. Moreover, an important association was found between the thickness of the placenta in the third trimester and fetal weight, indicated by a correlation coefficient of 0.319 and a p-value below 0.05. These findings contrast with those of Elchalal et al.[15], who reported a higher prevalence of thick placentas in births weighing over 4000 grams or under 2500 grams. Our study found no significant correlation between placental thickness in the second trimester and placental weight at delivery or Apgar scores at 1 and 5 minutes. However, a significant inverse relationship was observed between placental weight at birth and placental thickness during the third trimester, with a correlation value of -0.236 (p=0.011).

This suggests that a thinner placenta in late pregnancy may be associated with greater placental weight at term. This also indicates that a thinner 3rd-trimester placenta is associated with higher placental weight at term. Gouda et al.[14] found that there is a significant correlation between placental thickness in the second trimester and two factors: placental weight (with a correlation coefficient of 0.332) and Apgar score (with a correlation coefficient of 0.423).

They concur with us that placental weight (r=0.28) and placenta thickness in the third trimester have a significant relationship (p-value < 0.05), but they also discovered a considerable link (r=0.414) with the Apgar score, which runs counter to our results. This finding is contradicted by the conclusions of Nagpal et al.[16], who discovered a proportional association between placental thickness and Apgar score at 32 and 36 weeks.

A rather limited sample size was one of the study's many drawbacks. The study was conducted in a single location. Lack of 1st-trimester placental thickness measurements. Did not control for comorbidities affecting placental development. Technician-dependent ultrasound measurement of placental thickness.

4. Conclusion

There was a substantial increase in placental thickness from the second to the third trimester, along with a dramatic increase in fetal weight. However, placental thickness was not correlated with neonatal birth weight in our sample. The only significant relationship identified was an inverse association between 3rd-trimester placental thickness and placental delivery weight. Overall, these data do not indicate that placental thickness is a major determinant of fetal growth trajectory or neonatal health.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

Funding

No Funds : Yes

Conflicts of interest

There are no conflicts of interest.

References

1. Turco MY, Moffett A. Development of the human placenta. Development. Nov 27 2019;146(22):12-25.
2. de Vos ES, Koning AHJ, Steegers-Theunissen RPM, et al. Assessment of first-trimester utero-placental vascular morphology by 3D power Doppler ultrasound image analysis using a skeletonization algorithm: the Rotterdam Periconception Cohort. Hum Reprod. Oct 31 2022;37(11):2532-2545.
3. Olaleye OA, Olatunji OO, Jimoh KO, Olaleye AO. Ultrasound measurement of placental thickness: A reliable estimation of gestational age in normal singleton pregnancies in nigerian women. J West Afr Coll Surg. Jan-Mar 2022;12(1):17-22.
4. Wang X, Shi H, Li L, Yuan P, Zhao Y, Wei Y. The relationship between placental characteristics and birthweight discordance in different types of selective intrauterine growth restriction in monochorionic diamniotic twins: A single-center 7 year cohort study. Prenat Diagn. Nov 2021;41(12):1518-1523.
5. Reijnders IF, Mulders A, Koster MPH, et al. First-trimester utero-placental (vascular) development and embryonic and fetal growth: The Rotterdam periconception cohort. Placenta. May 2021;108(55):81-90.
6. Sun X, Shen J, Wang L. Insights into the role of placenta thickness as a predictive marker of perinatal outcome. J Int Med Res. Feb 2021;49(2):12-25.
7. Azpurua H, Funai EF, Coraluzzi LM, et al. Determination of placental weight using two-dimensional sonography and volumetric mathematic modeling. Am J Perinatol. Feb 2010;27(2):151-5. doi:10.1055/s-0029-1234034
8. Hoddick WK, Mahony BS, Callen PW, Filly RA. Placental thickness. J Ultrasound Med. Sep 1985;40(9):479-82. doi:10.7863/jum.1985.4.9.479.

9. Noor N, Jain A, Parveen S, Ali SM. Ultrasonographic measurement of placental thickness and its correlation with estimated fetal weight. Int J Reproduct Contracept Obstet Gynecol. 2018;7(2):287-290.
10. Ortega MA, Fraile-Martinez O, García-Montero C, et al. Evidence of increased oxidative stress in the placental tissue of women who suffered an episode of psychosis during pregnancy. Antioxidants (Basel). Jan 12 2023;12(1):12-25.
11. Shahin AHE, Abdelhamid AN, Zerban MA, Sayyed TM. Correlation between second and third trimester placental thickness with ultrasonographic gestational age. MMJ. 2019;32(4):1406-1410.
12. Ismail K, Mahgoub A, Abdulilah K. Estimation of placenta thickness in third trimester to determine fetal weight in Sudanese women 2016. Res Rep Gynaecol Obstet 2017; 1 (2): 9-11 Res Rep Gynaecol Obstet 2017 Volume 1 Issue. 2017;28(5):14-25.
13. BaGhel P, Bahel V, Paramhans R, Sachdev P, Onkar S. Correlation of placental thickness estimated by ultrasonography with gestational age and fetal outcome. IJNMR. 2015;30(3):19-24.
14. Gouda A, Aboelwan YY, Saleh H, El Anwar A. Ultrasound assessment of placental thickness in the last two trimesters of normal pregnancy and its relation with fetal outcome. ZUMJ. 2021;27(4):638-644.
15. Elchalal U, Ezra Y, Levi Y, et al. Sonographically thick placenta: a marker for increased perinatal risk--a prospective cross-sectional study. Placenta. Mar-Apr 2000;21(3):268-72.
16. Nagpal K, Mittal P, Grover SB. Role of ultrasonographic placental thickness in prediction of fetal outcome: A prospective indian study. J Obstet Gynaecol India. Oct 2018;68(5):349-354.