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# Correlation Between Placental Thickness and Estimated Fetal Weight in the Third Trimester

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**Abstract:**

**Introduction:** The placenta is the primary factor of fetal birth weight, and abnormalities in placental growth tend to precede problems in fetal growth. Estimating the weight of a fetus is important in daily obstetric practice. It assists obstetricians in determining the timing and method of delivery. The sufficiency of the placenta is an essential indicator of birth weight.

**Aim of the study:** The goal of the research was to detect the association between sonographically measured thickness of the placenta at the site of insertion of the umbilical cord and the estimated fetal weight in the third trimester.

**Subjects and Methods:** This was cross-sectional, prospective observational research performed at Fayoum University Hospital, in the department of Obstetrics and Gynecology. 100 pregnant women in the third trimester who attended the antenatal clinic have been recruited, following fulfilment of the exclusion and inclusion criteria. In along to fetal biometry to estimate fetal weight using Hadlock's formula, the thickness of the placenta was assessed at the umbilical cord site of insertion, with the transducer positioned to scan perpendicularly to both the chorionic and basal plates of the placenta.

**Results:** The research demonstrates a statistically significant positive association has been observed between mean placental thickness and gestational age (weeks). A highly significant positive association has been observed between the mean thickness of the placenta and estimated fetal weight.

**Conclusions:** The Thickness of the placenta serves as a dependable indicator of fetal weight and gestational age during the 3rd trimester.

**Keywords:** Fetal weight; fetal biometry; Placental thickness; gestational age.

## 1. Introduction

The placenta performs numerous activities, involving respiration, feeding, and excretion for the fetus, while also playing a crucial role in regulating endocrinological,

metabolic, and immunological processes throughout gestation [1].

The placenta is the primary determinant of fetal birth weight, and it is believed that placental growth irregularities may precede fetal growth problems. The placenta is often the initial organ that demonstrates alterations indicating gestational problems, making its features significant in diagnosing pregnancy abnormalities [2].

A healthy term fetus results from three critical influences: a healthy mother, appropriate genetics, and optimal placental implantation and development. The placenta is the most critical organ; however, it is frequently ignored. A primary role of the placenta is essential for optimal fetal growth and development. Previously, it was noted that the weight of the placenta in a normal term gestation is approximately one-fifth of the weight of the fetus. The fetus and the placenta have identical stress and strain during in utero life. Any pathology impacting a pregnant female will influence both the placenta and fetus. Consequently, placental measurements, including placental thickness, should indicate the nutritional condition of the fetus and its prognosis [3].

Assessing fetal weight is crucial in routine obstetric practice, particularly during the third trimester. It advises obstetricians to evaluate the timing and method of delivery to mitigate risks associated with low birth weight throughout labor and the puerperium [4].

Estimations of fetal weight are crucial, as a significant percentage of perinatal death is associated with birth weight. Consequently, birth weight is the primary factor influencing newborn survival. Decisions concerning preterm delivery are entirely or partially based on the assessment of the anticipated birth weight, which provides perinatal counselling concerning survival probabilities, measures for delaying delivery, the preferred delivery method, and the appropriate healthcare facility for the delivery [5].

Various sonographically derived fetal metrics utilized in gestational dating and fetal weight assessment encompass biparietal diameter (BPD), fetal crown-rump length (CRL), femur length (FL), head circumference (HC), and abdominal circumference (AC). Placental thickness at the umbilical cord attachment point can serve as a unique metric for estimating fetal gestational age [6].

Ultrasound is the primary imaging technique for the placenta due to its safety, simplicity, and cost-effectiveness. The assessment of the thickness of the placenta is simple, clinically beneficial, and regarded as the simplest placental dimension to assess [7].

## *2.* Methods

### *2.1. Subjects*

***Inclusion criteria***

- Single viable pregnancy.
- Age range of eighteen to forty years.
- Gestational age is above twenty-eight weeks.
- Precise pregnancy dates utilizing a dependable first day of the previous menstrual cycle or an ultrasound examination conducted before the twenty-fourth week of gestation.

***Exclusion criteria***

- Hypertensive disorders with pregnancy.
- Diabetes mellitus.
- Heart disorders.
- Endocrinological disorders.
- Uterine masses.
- Fetal growth restriction.
- Intrauterine fetal death.
- Hydrops fetalis.
- Congenital malformations.
- Multi-fetal gestation.
- Amniotic fluid disorders.
- Abnormal Placentation (placenta previa and placenta accreta spectrum).
- Poor visualization of the placenta.

### *2.2. Study design*

The study was a prospective cross-sectional observational research performed at the ultrasound unit of the Obstetrics and Gynaecology Department at Fayoum University Hospital following permission of the local Institutional Ethical Committee in the period from April 2023 to October 2023. The study included 100 pregnant women in the third trimester. Detailed history has been taken, clinical examination and sonographic evaluation for of thickness of the placenta at the site of cord insertion and to calculate fetal weight were done.

### *2.3. Statistical Methods*

Data has been gathered, organized, and statistically examined utilizing an IBM-compatible personal computer with Statistical Package for Social Sciences (SPSS) version 22. Statistics have been categorized into descriptive statistics

(quantitative data have been given as standard deviation (SD), mean, median, and range, while qualitative data have been represented by percentages (%) and numbers (N)) and analytic statistics. The significance tests which have been utilized were Fisher's Exact test or the Chi-square test ($\chi 2$), which has been utilized to examine the correlation between two categorical variables. The student's t-test (t) has been utilized to compare quantitative variables among two groups of normally distributed data. Spearman correlation to test the association between two quantitative datasets with a cut-off value for significance, *P*-value <0.05

## 3. Results

A total of one hundred healthy participants in the third trimester of pregnancy have been recruited after fulfilling the inclusion criteria. **Table 1** exhibits baseline characteristics of pregnant women. The table illustrated that the mean age among the study group was (26.7 ±5.1) years, with a mean BMI of (29.9 ±5.4) $kg/m^2$. 45% of the study group were younger than 25 years old, and 46% were overweight, versus 40% who were obese.

**Table 1:** Description of demographic characteristics among the study group.

| Variables | | Mean ±SD | Range |
|---|---|---|---|
| | Age (years) | 26.7 ±5.1 | 17-40 |
| | BMI ($kg/m^2$) | 29.9 ±5.4 | 20.9-46.5 |
| Age groups | ≤25 years | 45 | 45% |
| | >25years | 55 | 55% |
| BMI | Normal (18.5-25 $kg/m^2$) | 14 | 14% |
| | Overweight (25-30 $kg/m^2$) | 46 | 46% |
| | Obese (>30 $kg/m^2$) | 40 | 40% |

**Table 2** demonstrates that a statistically insignificant distinction has been observed in placental thickness as regards age group and BMI levels.

**Table 2:** Comparison of Placental thickness in different demographic characteristics.

| Variables | | Placental thickness (mm) | | *P*-value |
|---|---|---|---|---|
| | | Mean | SD | |
| Age groups | ≤25 years | 34.77 | 3.7 | 0.10 |
| | >25years | 33.53 | 3.8 | |
| BMI | Normal (18.5-25kg/$m^2$) | 32.93 | 1.8 | 0.46 |
| | Overweight (25-30 kg/$m^2$) | 34.33 | 4.4 | |
| | Obese (>30 kg/$m^2$) | 34.23 | 3.5 | |

**Table 3** demonstrates that a statistically insignificant variation has been observed in placental thickness in different placental locations.

**Table 3:** Comparison of Placental thickness in different placental locations.

| Variables | Placental thickness (mm) | | *P*-value |
|---|---|---|---|
| | Mean | SD | |
| Fundal | 36 | 3.6 | 0.32 |
| Fundal anterior | 34.1 | 4.4 | |
| Fundal posterior | 34.3 | 3.4 | |
| Anterior | 31.9 | 1.9 | |
| Posterior | 35 | 5.4 | |

**Table 4** demonstrates that, as regards mothers' history of parity, gravidity, abortion, and rhesus blood grouping a statistically insignificant difference in placental thickness.

**Table 4:** Comparison of placental thickness in different obstetric characteristics.

| Variables | | Placental thickness (mm) | *P*-value |
|---|---|---|---|
| Parity | Primi para | 35.1 ±4.1 | 0.10 |
| | Multi para | 33.7 ±3.7 | |
| Gravidity | ≤ 2 times | 34.5 ±3.7 | 0.68 |
| | 3-5 times | 33.8 ±4.1 | |
| | >5 times | 33.6 ±2.4 | |
| Abortion | No | 34.3 ±3.8 | 0.46 |
| | Yes | 33.7 ±3.7 | |
| RH grouping | Negative | 32.7 ±3.1 | 0.51 |
| | Positive | 34.1 ±3.8 | |

**Table 5** demonstrates that a statistically insignificant variation has been observed in estimated fetal weight in different placental locations.

**Table 5:** Comparison of estimated fetal weight in different placental locations.

| Variables | Estimated fetal weight (g) | *P*-value |
|---|---|---|
| Fundal | 2725.25 ±560.60 | 0.45 |
| Fundal anterior | 2446.92 ±682.11 | |
| Fundal posterior | 2340 ±701.33 | |
| Anterior | 2053.9 ±476.13 | |
| Posterior | 2421.5 ±1134.19 | |

**Table 6** demonstrates a statistically significant negative association ($p$ <0.05) has been observed between estimated fetal weight and each of mother age, gravidity, and parity times, which indicates that a decrease in mother age, gravidity, and parity times will be associated with an increase in estimated fetal weight. Conversely, a statistically insignificant association has been observed between estimated fetal weight and mothers' BMI.

**Table 6:** Correlation between calculated fetal weight with maternal and fetal measurements.

| Variables | Estimated fetal weight (g) | |
|---|---|---|
| | r | *P*-value |
| Age (years) | -0.31 | 0.002* |
| BMI (kg/m$^2$) | -0.023 | 0.82 |
| Gravidity | -0.29 | 0.003* |
| Parity | -0.30 | 0.002* |

**Table 7** illustrates that there was a statistically significant positive correlation ($p$ <0.05) between estimated fetal weight and each of gestational age and placental thickness, which indicated that an increase in gestational age and placental thickness is associated with an increase in estimated fetal weight. The study of the multivariate linear regression model has been performed to investigate the explanatory capacity of various factors in predicting estimated fetal weight, demonstrating that gestational age had statistically significant predictive power ($p$ <0.001).

**Table 7:** Correlation between calculating fetal weight with the thickness of the placenta and gestational age.

| Variables | Estimated fetal weight (g) | |
|---|---|---|
| | **r** | ***P*-value** |
| Gestational age (weeks) | 0.97 | 0.001 |
| Placental thickness (mm) | 0.62 | 0.001 |

The bar chart in **Figure 1** demonstrates a statistical distinction ($p$ <0.05) between calculating the weight of the fetus and the thickness of the placenta, which indicates that a rise in placental thickness will be associated with an increase in estimated fetal weight.

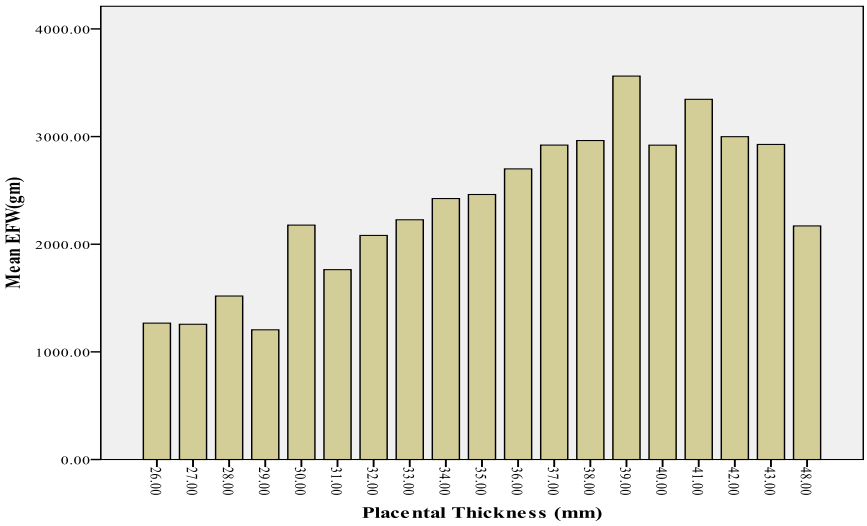


**Figure 1: A bar chart of the relationship between the weight of the fetus and the thickness of the placenta.**

## 4. Discussion

Ultrasonographic estimation of the weight of the fetus plays a pivotal role in antenatal follow-up. Placental thickness measurement, with advancing gestational age, can be used as an additional tool to calculate gestational age and the weight of the fetus. Any aberration from normal

references may indicate the presence of abnormalities [8].

In this research, the thickness of the placenta was a suitable indication of the weight of the fetus and gestational age, as the p-value less than 0.05 indicates a positive association. This result is aligned with the research of Akhtar et al. (2022), which identified a positive association among the thickness of the placenta, gestational age, and calculated weight of the fetus [8].

Further research conducted by Nour Eldin et al. (2020), Badu et al. (2020), and Sharami et al. (2023) shows results consistent with ours. A linear correlation was identified among gestational age and placental thickness, as well as among the thickness of the placenta and the calculated weight of the fetus [4, 6, 9].

Our findings aligned with those of Sharami et al. (2023, who demonstrated a significant association between gestational age and thickness of placenta [9]. In contrast, our results contradicted other results performed by other studies, which indicated that the thickness of the placenta declines as the gestational age advances and the placenta matures. Grannum et al., 1982; Ghosh et al., 1994 [10, 11].

Regarding parity and gravidity, we discovered a statistically insignificant variance in the thickness of the placenta. This finding was similar to the ones concluded by other studies. Rajeshgowtham et al., 2019; Njeze et al., 2020 [12, 13]. In contrast, our results contradicted the results of the research carried out by Nour Eldin et al., 2020 regarding the association between thickness of placenta and gravidity as they discovered that there was an association with gravidity, while our study showed a statistical insignificant variance was observed in the thickness of the placenta [4].

Regarding placental location and its correlation with placental thickness, our study showed that an anteriorly placed placenta is usually thinner than a posterior one and which is consistent with the findings concluded by other studies. Sharami et al.,2023; Njeze et al., 2020 [9, 13].

As regards maternal body mass index (BMI), a statistically insignificant distinction has been observed in placental thickness. Our results contradicted the results of other studies conducted by Sharami et al. (2023), Turan and Çeliker (2019), and Kiliopa et al. (2019) showed a significant positive association between the

thickness of the placenta and BMI [9, 14, 15].

Regarding maternal age, our research demonstrates higher thickness of the placenta in the age group less than 25 years, and that is consistent with the discoveries of the research conducted by Nour Eldin et al., 2020 [4].

Our research demonstrated a statistically significant negative association between calculated parity and the weight of the fetus, with a p-value less than 0.05. This finding aligns with Hinkle et al. (2014), who established a non-linear association among parity and birthweight, noting the most significant rise among 1st and 2nd-born infants [16]. Conversely, an investigation by Gerard et al. (2022) revealed a contradiction, indicating that parity is directly and independently correlated with fetal growth, concluding that increased maternal parity is likely to result in a larger fetus [17].

As regards maternal body mass index (BMI), there was no statistical significance difference in estimated fetal weight between different BMI levels, and this result mismatches the results of the research carried out by Mohammadnuri et al., 2023, who found a significant positive correlation [18].

Moreover, the study of Miletic and Stoini (2005) discovered that maternal obesity affects fetal weight, indicating that increased maternal weight correlates with higher fetal size [19].

Regarding the relationship between the estimated fetal weight and maternal age, this study showed a statistically insignificant negative association, our results contradicted other results performed by other studies, which indicated that the estimated fetal weight increases as the maternal age advances. Wang et al., 2020; Di Gravio et al.,2019 [20, 21].

Regarding the history of abortion, we discovered that a statistically insignificant variance has been observed in estimated fetal weight. In disagreement with our finding, the research carried out by Weijin et al. (2000) found a negative association between time of abortion and the weight of the fetus [22].

Moreover, our study demonstrated that a statistically insignificant variation has been observed in the estimated weight of the fetus in different locations of the placenta. Similarly, Samuel et al. (2023) and Behzadmehr et al. (2020) proved the same conclusion [23, 24].

To the best of our knowledge, no research has established a potential association between the thickness of the placenta and both Rh typing and history of abortion. Our results indicate that a statistically insignificant variance has been observed in the thickness of the placenta. Furthermore, no study has examined the possible correlation between the estimated fetal weight and Rh typing. Our findings stated that a statistically insignificant variance has been in the estimated fetal weight.

## 5. Conclusions

To conclude, placental thickness can be used as a reliable parameter for the reflection of gestational age and fetal weight in the third trimester.

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**AI declaration statement:** None declared.

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