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PLACENTAL WEIGHT AND ITS RELATIONSHIP TO MATERNAL AND NEONATAL HEALTH INDICATORS

[*1]Hind Abdulkareem A. Ulameer, [1]Raghad Hasan Mshattat, [3]Rana Dakhil Jasim

[1,2]Baghdad- Al-Karkh Health Directorate, Baghdad, Iraq.
[3]Babylon Health Directorate, Babylon, Iraq.

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***Corresponding Author: Hind Abdulkareem A. Ulameer**
Baghdad- Al-Karkh Health Directorate, Baghdad, Iraq.

ABSTRACT

Background: The placenta plays a crucial role in ensuring normal fetal development by facilitating the exchange of nutrients and oxygen between the mother and the fetus. Impaired placental growth or function can lead to significant fetal complications, including intrauterine growth restriction and adverse perinatal outcomes. This study was conducted to evaluate placental weight and identify the maternal and fetal factors associated with low placental weight. **Aim:** To determine the distribution of placental weight and assess the factors linked to low placental weight in term pregnancies. **Study Design and Setting:** A longitudinal cross-sectional study was carried out in the Department of Obstetrics and Gynecology in collaboration with the Department of Pediatrics at Al-Kadhymia Teaching Hospital, Baghdad, Iraq. The study spanned from March 1, 2012, to March 1, 2013. **Materials and Methods:** The study included women with singleton term pregnancies (37–42 weeks of gestation). After delivery, placentas were weighed post-trimming and drainage of blood. They were classified into three groups: high (>750 g), normal (330–750 g), and low (<330 g). Maternal and neonatal data, including maternal age, gestational age, parity, presence of preeclampsia, maternal diabetes, mode of delivery, infant's gender, birth weight, and Apgar score at 5 minutes, were recorded and analyzed. **Results:** Abnormal placental weight and placental weight ratio (PWR) were found to be significantly associated with unfavorable intrapartum and perinatal outcomes. **Conclusion:** Routine evaluation of placental growth and weight during pregnancy can help identify risks early, thereby improving fetal outcomes and promoting neonatal health.

KEYWORDS: Placental, Weight, Maternal, Neonatal, Characteristics.

INTRODUCTION

The placenta is a vital organ that plays an essential role in sustaining a healthy pregnancy. It serves as the principal interface between the mother and fetus, supporting fetal development by ensuring the exchange of oxygen, nutrients, and waste products. The ability of the fetus to grow and thrive in utero is considered largely dependent on placental function.[1] At term, the average placenta measures 185 mm in diameter and 23 mm in thickness, with an average volume of 497 ml and weight of 508 grams. The ratio of placental weight to newborn weight has commonly been reported as 1:6.[1,2] However, such values vary significantly between countries and preparation methods.[3]

The association between placental weight and infant size at birth has been studied for over a century.[4] Earlier studies highlighted a strong correlation between placental weight and pregnancy outcomes. Low placental weight has been linked to poor perinatal outcomes, including low APGAR scores, respiratory distress, and perinatal mortality, while high placental weight has been associated with maternal complications.[5] Recent studies further underscore that altered placental growth may predict adult-onset conditions like cardiovascular disease, hypertension, and diabetes.[6,7] A large placenta and low birth weight, in particular, are significant independent risk factors.

Various maternal factors, including race, socioeconomic status, health issues, and parity, have been associated with placental weight variability.[8] Additionally, placental development and function are closely tied to gestational age, maternal health (e.g., diabetes, anemia), and delivery mode.[6-8] Increase in placental size strongly correlates with maternal weight and serves as a strong

predictor of birth weight.[4] Moreover, large placentas and low birth weights are often linked to adult hypertension.[9] Morphometric studies have revealed two main stages of placental development from mid-gestation to term. The first stage, ending around 36 weeks, is characterized by progressive increases in parenchymal tissue. The second stage—extending from 36 weeks to term—is marked by rapid fetal growth with little change in placental tissue mass, suggesting increased functional efficiency. This is evidenced by a sevenfold increase in fetal weight in late pregnancy, despite only a twofold increase in villous surface area.[10] Structurally, the placenta is composed of a fetal portion (chorionic plate, villi) and a maternal portion (decidua basalis). The chorionic villi evolve through several stages—primary, secondary, and tertiary—each contributing to the formation of the vascular system essential for fetal support.[11,12] The placenta's basic units, the villi, are supported by cytotrophoblast and syncytiotrophoblast layers, both of which are critical for nutrient exchange and hormone production.[11,12] Functionally, the placenta acts like an artificial kidney, lung, and gastrointestinal system for the fetus. It facilitates the transfer of gases, nutrients, and waste between the mother and fetus while protecting the fetus from maternal immune rejection.[13] Hormones such as hCG and hPL secreted by the placenta aid in sustaining pregnancy and preparing the mother's body for lactation.[13] Ultimately, the placenta's structure and function are integral not just to fetal development but also to long-term health outcomes. Understanding its weight and its relationship with birth weight offers critical insights into maternal and fetal well-being. The aim of this study is to evaluate the placental weight, birth weight, and the placental-to-birth weight ratio in consecutive, live, singleton term deliveries. By analyzing these parameters, the study seeks to predict pregnancy outcomes through their associations with selected maternal and fetal factors.

METHOD

This study was conducted on 300 pregnant women who delivered at AL-Kadhmiya Teaching Hospital between January 1st and June 30th, 2013. All included participants delivered between 37 and 42 weeks of gestation, with fetuses classified as appropriate for gestational age (AGA). Gestational age was confirmed using first-trimester ultrasonography and antenatal records. Inclusion criteria included women with singleton pregnancies and gestational age ≥ 37 weeks. Exclusion criteria encompassed unknown gestational age, intrauterine growth restriction (IUGR), multiple gestations, maternal anemia (hematocrit <33%), vascular or congenital anomalies, placental abnormalities (e.g., adherence, previa, abruption), and post-delivery diagnosis of cord entanglement or fetal distress patterns. Women were categorized into three groups based on placental weight: low (<330 g), normal (330–750 g), and high (>750 g). Placentae were prepared using the method described by Molteni et al.(31) This involved removing membranes, severing the umbilical cord at its insertion site, draining fetal vessels, and removing clots. Placentae were weighed using a calibrated digital scale within one hour after delivery. All infants and mothers were personally monitored in the labor ward. Fetal heart rate and uterine contractions were assessed using electronic monitoring devices. Women showing persistent late decelerations or true cord knots (n=15) were excluded. Newborns were weighed to the nearest gram. Gestational age and growth were assessed using Battaglia and Lubchenco's growth curves (32). APGAR scores were recorded at 5 minutes. Additional newborn complications such as NICU admission, respiratory distress, or infection were documented within 48 hours post-delivery. Data were analyzed using SPSS version 9. Placental weight ratio (PWR) was calculated as placental weight divided by birth weight × 100. Statistical analysis included chi-square, Pearson's correlation, and Fisher's exact test. A p-value <0.05 was considered statistically significant.

RESULTS

The mean birth weight of neonates was 3235.40 ± 679.91 grams, with a corresponding mean placental weight of 565.33 ± 151.78 grams. The average placental weight ratio (PWR) was 17.36 ± 2.44%. as in table 1.

Table 1: Maternal, Fetal, and Placental Characteristics.

Variable	Mean ± SD
Birth weight (g)	3235.40 ± 679.91
Mother age (yrs)	27.58 ± 7.29
Gestational age (wks)	38.97 ± 1.40
Placental weight (g)	565.33 ± 151.78
APGAR score	7.04 ± 1.73
PWR (%)	17.36 ± 2.44
BMI (kg/m²)	22.72 ± 2.66

Low placental weight (<330g) was significantly more common in neonates with low birth weight (<2500g), seen in 25% of such cases, compared to only 4.2% in neonates with normal birth weight. This strong association ($p < 0.0001$) suggests a potential link between placental insufficiency and fetal growth restriction. Mothers with no previous births (parity 0) showed a higher frequency of low placental weight (11.1%) compared to those with higher parity (2.9%). This difference was statistically significant ($p < 0.001$), indicating that placental growth and development may be influenced by maternal reproductive history. Low

maternal age, particularly under 19 years, was associated with a significantly higher occurrence (20%) of low placental weight. In contrast, only 3.5% of women older than 35 had low placental weights. The correlation was statistically significant ($p < 0.001$), emphasizing the role of maternal age in placental development and pregnancy outcomes. As in table 2.

Table 2: Association of Placental Weight with Neonatal Birth Weight, Maternal Parity, and Maternal Age.

Neonates weight group	<330	330-750	>750	Total	P.value
<2500	16	47	1	64	<0.0001
2500-3500	7	154	5	166	
>3500	0	50	20	70	
Mother parity	**<330**	**330-750**	**>750**	**Total**	**P.value**
0	10	78	2	90	
1	9	48	4	61	<0.001
2	1	39	7	47	
3+	3	76	23	102	
Mother age group	**<330**	**330-750**	**>750**	**Total**	**P.value**
<19	9	32	4	45	<0.001
20-24	5	35	5	45	
25-29	4	47	5	56	
30-34	2	56	11	69	
35+	3	67	15	85	

This combined analysis demonstrates that low placental weight (<330g) is significantly associated with adverse neonatal outcomes such as low Apgar scores ($p < 0.001$) and fetal distress ($p < 0.001$). Cesarean section deliveries were notably more frequent in cases of low placental weight ($p = 0.001$). Additionally, a significant association was found between preeclampsia (PET) and low placental weight ($p < 0.001$), while mothers with diabetes mellitus (DM) had a slightly higher incidence of high placental weights ($p = 0.007$). as in table 3.

Table 3: Distribution of Placental Weight Categories (<330 g, 330–750 g, >750 g) in Relation to Apgar Score, Fetal Distress, Mode of Delivery, Preeclampsia (PET), and Diabetes Mellitus (DM).

Variable	<330	330-750	>750	Total	P.value
Apgar score 0-8	23	107	24	154	<0.001
Apgar score 8-10	0	134	12	146	<0.001
Distress - Yes	20	46	4	70	<0.001
Distress - No	3	195	32	230	<0.001
Mode of Delivery - NVD	0	92	14	106	0.001
Mode of Delivery - CS	23	149	22	194	0.001
PET - Yes	14	20	2	36	<0.001
PET - No	9	194	21	264	<0.001
DM - Yes	0	9	5	36	0.007
DM - No	23	232	32	264	0.007

The table 4 compares the placental weight ratio (PWR) among different modes of delivery and between genders. The mean PWR was significantly higher in cases delivered by normal vaginal delivery (NVD) (18.09 ± 1.24) compared to cesarean section (CS) (16.96 ± 2.82), with a p-value < 0.001, indicating statistical significance. Similarly, male neonates had a higher mean PWR (17.94 ± 2.28) than female neonates (16.81 ± 2.47), also with a statistically significant difference ($p < 0.001$). These findings suggest that both delivery method and neonatal gender are significantly associated with PWR.

Table 4: Placental Weight Ratio (PWR) by Mode of Delivery and Gender.

Variable	Character	N	Mean PWR Ratio	SD	P. value
Mode of delivery	NVD	106	18.09	1.24	<0.001
Mode of delivery	CS	194	16.96	2.82	
Gender	Male	146	17.94	2.28	<0.001
Gender	Female	154	16.81	2.47	

DISCUSSION

The placenta plays a pivotal role in fetal development and serves as a marker of intrauterine well-being. Our findings demonstrate a significant association between placental weight (PW), placental weight ratio (PWR), and various maternal and neonatal parameters. Notably,

we observed a statistically significant correlation between low placental weight and low birth weight (<2500g), where 25% of infants in this category had low placental weight. Conversely, high birth weight (>3500g) was associated with increased placental weight in 28.5% of cases, supporting the notion that placental weight increases in tandem with fetal growth. These results affirm previous observations that fetal growth capacity is strongly influenced by placental size.[14,15] Maternal age also demonstrated a significant association with PW. Mothers under 19 years exhibited a higher proportion (20%) of low PW compared to those over 35 years, where only 3.5% had low PW. This could be attributed to biological immaturity in younger mothers and physiological adaptation in older multiparous women. Similar patterns have been discussed in earlier studies.[4,14] Preeclampsia (PET) emerged as a significant determinant of low PW, with 60.8% of PET cases exhibiting low placental weight compared to 39.1% in normotensive pregnancies. While some studies report no correlation between PET and PW[8], our results align with findings by Kinare et al. and Molteni et al., suggesting a placental insufficiency pattern in hypertensive pregnancies.[14,15] Furthermore, fetal distress was more prevalent among neonates with low PW, with a reduced mean PWR of 15.38% compared to 17.96% in those without distress. Apgar scores also mirrored this trend; infants with low scores (0–8) had lower mean PWR (16.77%) compared to those with high scores (8–10), whose PWR was 17.98%. These findings highlight the importance of placental sufficiency in immediate neonatal outcomes. Mode of delivery also correlated with PWR. Cesarean section was associated with a lower mean PWR (16.96%) compared to vaginal delivery (18.09%), likely due to higher incidence of fetal compromise prompting surgical intervention. Lastly, gender-based differences in PWR were significant, with male neonates exhibiting a higher PWR (17.94%) than females (16.81%). This may reflect the higher birth weights typically seen in male fetuses.[4,16,17] Collectively, these results underscore the critical role of placental weight in predicting perinatal outcomes and support its utility in obstetric assessment and neonatal risk stratification.

CONCLUSION

Low placental weight and abnormal placental weight ratio (PWR) are associated with adverse neonatal outcomes. Early prenatal assessment of PWR could help identify at-risk fetuses even in low-risk pregnancies. Therefore, placental evaluation should be integrated into routine antenatal care for better perinatal risk prediction.

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