

RESEARCH ARTICLE

Validating the Potential Predictive Value of Placental Anthropometry and Neonatal Birth Weight (NBW) Among Babies Born at General Hospital Dutse, Jigawa State

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Abstract

Background: Birth weight is the most important and reliable indicator for neonatal and infant survival as well as their physical growth and mental development. Several attempts in investigating the use of placenta in our environment have been constrained by scarcity of data on placenta during delivery. This has led to the present study to investigate the relationship between placental anthropometry and neonatal birth weight (NBW) among newborns at General Hospital Dutse. **Aim:** The study aims to examine how placental weight influences neonatal outcomes, specifically birth weight. **Methodology:** A Systematic random sampling technique was adopted to collect the sample of neonates from the population. A tape rule was used to measure birth length, a weighing scale was used to measure placental weight and neonatal birth weight, and recorded ultrasound scanning data were used to determine gestational age. The hospital's age registration certificate was also used to determine the mother's age. The data was processed using SPSS windows version 26 and the p value of < 0.001 was considered. **Results:** The result of this study revealed a moderate and statistically significant positive correlation ($r=0.662$) between placental weight and birth weight with a p value of < 0.001 . This showed that as placental weight increased birth weight increased as well suggesting a strong link between placental growth and fetal development. **Conclusion:** The findings highlighted the importance of monitoring placental health as part of prenatal care and suggested that placental weight can serve as a valuable predictor of neonatal birth weight.

Keywords: Placenta, Neonates, weight, anthropometry, fetal

INTRODUCTION

Birth weight is the most important and reliable indicator for neonatal and infant survival as well as their physical growth and mental development. It is the weight of an infant at birth and also refers to the first weight of a baby taken within a few hours after delivery (Acharya et al., 2011; Aerts et al., 2021). Several attempts in investigating the use of placenta in our environment have been constrained by scarcity of data on placenta

during delivery. This circumstance is additionally compounded by the predominant socio-cultural practice which routinely hands the placenta over to the relatives following delivery to be discarded (Berg et al., 2019).

Placental weight is important as a pointer to how well the placenta is supplying the vital nutrients and promoting fetal growth (Berg, 2005; Berg et al., 2019). The placenta facilitates the flow of nutrients and

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oxygen between the mother and the child; and its weight can reveal how well it is carrying out this function. Aberrant placental weight has been linked to problems like preeclampsia and gestational diabetes, and can be equally implicated if the fetal supply of oxygen and nutrients are impaired with consequent impact on the health of both the mother and the newborn (Kumar *et al.*, 2021; Tuntiseranee *et al.*, 2013). Potential issues like placental insufficiency that can impair fetal growth, may be responsible for abnormal placental weight. Furthermore, there is a consistent correlation between the neonatal birth weight and the placenta's ability to establish and keep an appropriate food supply (Kumar *et al.*, 2021; Tuntiseranee *et al.*, 2013).

Apparent Inconsistencies in the weight of the placenta and fetal or placental weight ratios are directly associated with microsomal low birth weight, chromosomal disorders, preterm delivery, intrauterine growth retardation, stillbirths, neonatal morbidity and mortality (Godfrey & Barker, 2000). Placental weight and its relationship with neonatal birth weight have been studied for over a century. Data on morphometric measurements of the placenta have been collected in some part of Nigeria but remain poorly addressed in Jigawa state, Dutse to be precise. Therefore, accurate reference value of placental weight and its relationship with neonatal birth weight and maternal BMI are important in the investigation of neonatal mortality as well as in still births.

Low or high birth weight, which are linked to a higher risk of newborn problems and long-term health, are examples of suboptimal birth outcomes that can result from abnormal placental development (ACOG, 2018). Although it is known that placental traits like weight and blood flow have an impact on newborns, only a few studies have been done to quantify these relationships and their precise mechanisms (Aerts *et al.*, 2021). However, the current study was prompted by the fact that at General Hospital Dutse in Jigawa State, investigation on the association between placental weight and neonatal weight at birth has not been explored.

MATERIALS AND METHODS

The study was carried out at General Hospital Dutse. General hospital Dutse was initially established in 1972 as Dutse Comprehensive Health Care (CHC) that was later transformed and upgraded to be a General Hospital. This was crucial part of the healthcare systems due increasing demand for health care services in Jigawa State. The hospital had just 50 beds at inception which has grown into 250 beds over the years. The hospital provides wide range of services

including obstetrics and gynecology, pediatrics, surgery and other specialties. It is funded by the Jigawa State Government and the Federal Ministry of Health. It is a crucial part of the healthcare systems in Jigawa State.

Study Location

The study was conducted in Dutse metropolis, Jigawa State, Nigeria which lies between the distance of 142 kilometers from Kano State by road. It is located in the northwestern region of Nigeria, Kano and Katsina border Jigawa to the west, to the north Jigawa shares an international border with Zinder region of the republic of Niger.

Study Population

The study population involved over 200 women admitted in the labor room of the department of Obstetrics and Gynecology (O&G) ward in the General hospital Dutse, Jigawa State.

Sample Size Estimation: Using the formula $n = Z^2PQ/d^2$, the sample size was calculated to be 132 (Naing *et al.*, 2006). However, a sample size of 107 was gathered due to time constraints and the number of deliveries during the study period.

Sampling Technique

A Systematic random sampling technique was adopted to collect the sample of neonates from the population, ensuring that each individual had an equal chance of been included. This method helped in obtaining a representative sample and reduced bias.

Inclusion Criteria: All neonates were eligible to participate in the study.

Exclusion Criteria: Neonates with serious health related issue that require emergency attention and intensive care were excluded from the study.

Anthropometry and Demographic Data Collection

A face mask, hand gloves, soap, a water weighing scale, and a tape rule were employed during this investigation. A tape rule was used to measure birth length, a weighing scale was used to measure placental weight and neonatal birth weight, and recorded ultrasound scanning data were used to determine gestational age. The hospital's age registration certificate was also used to determine the mother's age. To prevent contamination, hands were cleaned with soap and water. All processes were performed using disposable hand gloves.

Ethical clearance

Ethical approval for the study was obtained from the *Department of Human Anatomy Research Ethical Committee*, Federal University Dutse.

DATA ANALYSIS

The data was processed using SPSS windows version 26. Both descriptive and analytical methods were employed. The descriptive statistics were analyzed by examining the distribution of variables and the p value of < 0.001 was considered.

RESULTS

Table: 1 Shows the descriptive analysis of maternal and neonatal Characteristics

Variable	Minimum	Maximum	Mean± SD
Mother's Age	14	49	26.08±8.89
Birth length	50	55	51.33±1.42
Neonatal birth weight	1.5	4	2.93±0.64
Placental weight	0.3	0.7	0.48±0.09
Gestational age	37	42	38.71±1.54
N= 107			

The results from table 1 presents maternal age, birth length of neonates, neonatal birth weight, placental weight and the gestational age. The maternal age ranged from 14 to 49 years, with a mean age of 26.08 ± 8.89 years. The birth length of neonates was between 50 cm and 55 cm, with a mean of 51.33 ± 1.42 cm showing a narrow range and a low standard deviation. The neonatal birth weight varied from 1.5 kg to 4 kg, with an average of 2.93 ± 0.64 kg. Placental weights ranged from 0.3 kg to 0.7 kg, with a mean of 0.48 ± 0.09 kg. Gestational age also ranged from 37 weeks to 42 weeks, with an average of 38.71 ± 1.54 weeks.

Table 2: The correlation between Placental Weight and Neonatal Birth Weight

Variables	Correlation	
	Coefficient	p-value
Placental weight	0.662	p<0.001
Neonatal birth weight		

The results in table 2 shows that there is a strong positive correlation ($r = 0.662$) between placental weight and neonatal birth weight, which is statistically significant ($P < 0.001$).

Table: 3 Maternal Occupation and Neonatal Outcome

	Housewife, N=90	Civil servant, N=5	Self-employed, N=7	Nurse, N=5	F	P-Value
Neonatal birth weight	2.91±0.64	2.90±0.45	3.27±0.71	2.72±0.76	0.872	0.458
Placental weight	0.479±0.09	0.48±0.08	0.53±0.08	0.48±0.11	0.628	0.599
Birth length	51.32±1.46	51.60±1.14	51.43±0.98	51.00±1.73	0.159	0.924
Gestational age	38.81±1.54	38.40±2.07	38.00±1.00	38.20±1.64	0.870	0.459

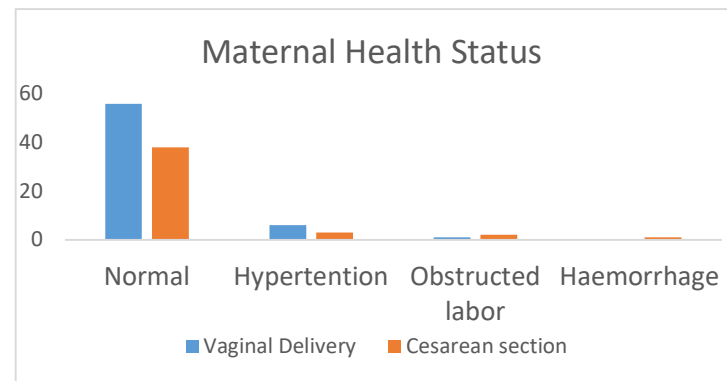


Figure 2: The maternal health status of the mothers recruited for this study and the modes of delivery

The bar chart above shows that for a normal delivery, approximately 60% had vaginal deliveries while 40% had cesarean sections. 70% of the mothers with hypertension had vaginal deliveries while 30% had cesarean sections. 33% of the mothers with obstructed labour had vaginal deliveries while 67% had cesarean sections. All the mothers that presented with antepartum hemorrhage had cesarean sections.

Table 3 results show correlation between maternal occupation and neonatal outcomes. F-statistics and p-values were used to determine if there are any statistically significant correlations in these variables. Maternal occupation showed no statistically significant correlation to the neonatal birth weight, placental weight, birth length and the gestational age of the pregnancy at delivery.

DISCUSSION

Placenta is a crucial feto-maternal organ with indispensable roles in nutrient and oxygen exchange between the fetus and the mother. Its weight has been suggested by researchers as a useful but imperfect indicator of maternal and fetal health (Sathasivam *et al.*, 2023). When combined with other parameters like placental to birth-weight ratios, histopathology and MRI-based biomarkers like T2* mapping, it is possible to capture placental functional inefficiency and placental insults (Beaumont *et al.*, 2023; Pishghadam *et al.*, 2025).

The primary trust of this study is to correlate the placental anthropometric parameters with feto-maternal demography, and also interrogate possible associations

between the growth of the placenta and the health and stature of the baby. Table 1 of the results showed a mean maternal age of 26 years which indicates a predominance of young mothers, consistent with the general pattern of reproductive age in many developing nations as reported by Bongaarts (2015) who reported 19-25 years and Liang (2015) who correlated late reproductive age to primary infertility among women (Bongaarts, 2015; Yuanhao *et al.*, 2025). There are serious health concerns associated with teenage pregnancies and anthropometric measures, which are often defined by the minimum age of 14 years. These risks include low birth weight and difficult deliveries. In contrast, mothers who are older may be at risk for conditions including gestational diabetes and hypertension, which can impact on the health of their newborns (Yuanhao *et al.*, 2025). In this study, the measured birth lengths were within the typical range, suggesting healthy fetal development. The population under study are homogeneous with possibility of good maternal health, likely responsible for the consistency in fetal lengths.

The mean birth weight of 2.93 kg recorded in this study is within the typical range of 2.5–4 kg as reported by Bharati, Karmakar & Choudhury; Bowers, McNally & Meyers; Sagir & Yahaya and Smith, Wong & Johnson ((Sagir & Yahaya, 2012; Bowers *et al.*, 2019; Bharati *et al.*, 2020; Smith *et al.*, 2022). However, the minimum weight of 1.5 kg observed is concerning, as low birth weight is associated with complications like respiratory distress, infections, and delayed development from compromised utero-placental blood flow and associated risks to feto-maternal health (Beaumont *et al.*, 2023; Victor *et al.*, 2024). The mean placental weight of 0.48 kg in this study is consistent with the reports from other studies like Sathasivam *et al.* (2023) whose mean placental weight was 494.45 ± 110.39 g (Sathasivam *et al.*, 2023). Though Emechebe *et al.* (2021) got a greater value of 652 ± 152 g in the southern part of Nigeria, which may be due to the prevalence of obesity in the region reflecting in the weight of their placentas (Emechebe *et al.*, 2021; Hietalati *et al.*, 2024). This was depicted by the average fetal weight of 3.309 ± 0.522 kg reported compared to this study with a mean fetal weight of 2.92 ± 0.64 kg. This disparity underscores an established fact that maternal BMI, gestational weight gain and fasting glucose have independent positive effects on the placental weight (Roland *et al.*, 2014; Zhang *et al.*, 2023). Beaumont (2023) attributed the variations to genetics variations, nutritional differences and maternal co-morbidities (Beaumont *et al.*, 2023).

This study was also able to establish a strong relationship between placental weight and neonatal birth weight as shown in Table 2. A correlation

coefficient of 0.662 was recorded, indicating a strong positive relationship similar to earlier reports from similar studies like Beaumont (2023) with $r = 0.52 - 0.6$ morbidities (Beaumont *et al.*, 2023). The implication of this is that as placental weight increases, neonatal birth weight tends to increase as well which is in keeping with the findings of earlier researchers (Simanjuntak & Simanjuntak, 2023; Inamdar *et al.*, 2025; Munaf *et al.*, 2025).

The average gestational age of approximately 39 weeks shows that most pregnancies reached full term, a positive outcome for neonatal health. Deliveries at the lower end of the range (37 weeks) could still present some developmental challenges, while those at 42 weeks may increase the risk of complications, such as macrosomia or stillbirth (Godfrey & Barker, 2000; Tuntiseranee *et al.*, 2013).

The bar chart in Fig.2 correlating the health status of the mothers with the modes of delivery showed that vaginal delivery was the most frequent mode of delivery, particularly in normal labours. However, cesarean sections were used primarily in cases with complications such as obstructed labor and hemorrhage. This trend is found in other studies too as the mode of delivery cannot affect the primary outcome of this study.

The p-value of < 0.001 , showed that the correlation between the placental weight and birth weight is highly statistically significant. The placental weight-birth weight ratio is useful and has been considered to be more relevant than placental weight alone when considering fetal and neonatal death during the perinatal period (Mehare & Kebede, 2020).

CONCLUSION

This study examined the relationship between placental weight and neonatal birth weight (NBW) among newborns at General Hospital Dutse. The analysis revealed a moderate, statistically significant positive correlation (0.662), indicating that as placental weight increases, neonatal birth weight tends to increase as well. With a p-value of < 0.001 , the results confirm that this relationship is unlikely to have occurred by chance. This finding emphasizes the importance of placental growth in supporting fetal development and its potential impact on neonatal birth outcomes.

However, the ANOVA analysis comparing neonatal birth weight, placental weight, birth length, and gestational age across different maternal occupations showed no significant differences. The p-values for all variables (0.458, 0.599, 0.924, and 0.459) were greater than 0.05, indicating that maternal occupation does not have a significant effect on these factors in the study.

RECOMMENDATIONS

1. Sonologists should pay attention to the placental health and volume during routine obstetric ultrasound as part of antenatal care of pregnant mothers
2. Doctors and midwives should be meticulous at the third stage of labour to ensure full delivery of the placenta and subsequent weighing and documentation for prognostic benefits
3. Health policy makers and maternal and child health stakeholders should incorporate placenta assessment and weighing into the routine post-delivery care.
4. Further studies should focus on the predictive value of the placenta weight-neonatal birth weight ratio to improve its sensitivity and specificity

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AUTHORS CONTRIBUTIONS

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Analysis and interpretation: **IAA, UMI, MLS, HOU, RS, MKR, IBM**

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