

Placental-birth weight ratio at term at the Benue state university teaching hospital, Makurdi, North-Central Nigeria.

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Abstract

Background: The birth weight of a neonate depends mainly on optimal placental growth and function *in utero*. Measurement of the placental weight, the neonatal birth weight and the placenta-birth weight ratio is an indirect way of assessing this vital relationship.

Objective: To determine the placental weight, birth weight and placental- birth weight ratio in a cross-section of subjects attending our antenatal clinic.

Methodology: This was a clinic-based cross-sectional study from July 31, 2015 to June 30, 2017. Four hundred and forty-four (444) subjects attending our antenatal clinic were recruited through systematic random sampling. The placental weight and birth weight were measured within one hour of delivery using a table-top beam weighing scale. Statistical analysis was performed with SPSS version 20 and significance set at a *P-value* of <0.05.

Results: Four hundred and forty-four subjects, whose mean age was 28.75 years, mean parity was 1.5 and mean gestational age at delivery was 38.70 weeks, participated in the study. The mean placental weight was 670 g, the mean birth weight was 3300 g and the mean placental-birth weight ratio (PBWR) was 20.3%. Two hundred and eighteen (49.1%) of the neonates were male and 226(50.9%) were female. There was a positive correlation between the placental weight and the placental-birth weight ratio($X^2=108.57$; $p\text{-value}=0.001$). There was a progressive decline in the PBWR with gestational age at term.

Conclusion: The placental weight increased with the birth weight and the gestational age. The placenta-birth weight ratio declined progressively with gestational age.

Keywords: Placental weight, Birth weight, Placental-birth weight ratio, Makurdi

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Introduction

Placental weight and its relationship to infant size at birth have been studied for more than a century [1]. Fetal growth is a result of multiple factors including genetic potential for growth, maternal nutrition, maternal metabolism, endocrine factors and placental perfusion and function [2].

A study from the United States of America (USA) explored the relationships between maternal characteristics, placental growth measures and birth weight. Placental growth alone accounted for 36.5% of birth weight variation, whereas only 13.9% of birth weight variation could be explained by maternal characteristics like age, parity, height and weight, cigarette use, ethnicity and socio-economic status [3]. This underscores the significance of placental weight as a major determinant of neonatal weight. Most other factors may indirectly affect fetal growth and final birth weight through modification of placental function. The likelihood of interleukin-6 (IL-6) and interleukin-1 Receptor antagonist (IL-1Ra) playing a mediating role in placental function and final birth weight has been studied. For instance interleukin-1-receptor antagonist (IL-1Ra), one of the factors released from adipose tissue, is a determinant of neonatal birth weight [4,5].

Placental weight is a crude marker of placental size, but correlate closely with birth weight in normal pregnancies, and it is widely used as a parameter of placental functional capacity [3].

The placenta cannot be measured directly until birth. However, measurement varies widely and differs in different countries with different placental preparations [6,7].

Leary et al. suggested that fetal weight and placental weight correlations remain unchanged whether placentas are weighed trimmed or untrimmed [8].

To my knowledge no study in Makurdi has looked at the relationship between placental weight and birth weight at term. This study is borne out of a genuine desire to bridge the gap in knowledge and to pave the way for further research (in our setting) in this important indicator of intrauterine growth and perinatal outcome.

Aim of Study

To determine placental weight and its relationship with neonatal birth weight at term.

Materials and Methods

This was a clinic-based prospective study at the Benue State

University Teaching Hospital, Makurdi, north-central Nigeria between July 1, 2015 and June 30, 2017. Four hundred and forty-four (444) women who had antenatal care and delivered at our facility were recruited into the study. Using systematic random sampling, the first subject, who met the inclusion criteria, was selected through balloting. Subsequently, every fifth (5th) subject, who met the inclusion criteria, was included in the study and a sample size of 444 subjects was obtained during the study period. The inclusion criteria comprised the following: singleton delivery at term (37-42 weeks gestation), written informed consent, having booked for and had antenatal care at our facility.

Exclusion criteria included multiple pregnancy, fetal congenital anomalies, retained placenta, placenta previa, placental abruption, morbidly adherent placenta, maternal co-morbidities and maternal refusal to take part in the study.

Using a pre-designed and pretested proforma, the following information was obtained from each participant: maternal age, parity, gestational age at delivery, mode of delivery, birth weight, placental weight, and fetal gender, Apgar score at 1 and 5 minutes respectively and Neonatal Intensive Care Unit (NICU) admission.

The untrimmed weight of the placenta and neonatal birth weight were measured within one hour of delivery, using a table-top beam weighing scale.

Statistical analysis was performed using SPSS (Version 20) and statistical significance set at a *p-value* of <0.05. Written informed consent was obtained from each participant or subject and the study was conducted according to the revised Helsinki Declaration guidelines of 2008 in South Korea.

Results

Four hundred and forty-four (444) subjects participated in the study. Their mean age was 28.75 (± 4.60) years, with a range of 18 to 42 years. The parity was 1.50 (± 1.40), with a range of 0 to 9. The mean gestational age at delivery was 38.70 (± 1.60) weeks, with a range of 37 weeks to 42 weeks.

Three hundred and thirty-seven (75.9%) were delivered by spontaneous vaginal delivery, 105 (23.6%) by caesarean section and 2(0.5%) by assisted breech delivery (Table 1).

The mean placental weight was 670 (± 160) g, with a range of 300 g to 1500 g. The mean birth weight was 3300 (± 500) g, with a range of 1000 g to 4900 g. The mean placental-birth weight ratio (PBWR) was 20.3% (670/3300).

Two hundred and eighteen (49.1%) of the fetuses were male while 226 (50.9%) were female.

Majority (93.0%) of the fetuses had Apgar scores of greater than 6 within one minute of delivery and the number of babies with Apgar scores greater than 6 rose to 97.7% within five minutes of delivery. Of the total deliveries, only 2.0% of the babies required admission at the Neonatal Intensive Care Unit (NICU) (Table 2).

The placental weight increased according to birth weight and gestational age ($\chi^2=108.570$; *p-value*=0.001). However, the placental-birth weight ratio decreased gradually with increasing gestational age (Table 3).

Discussion

The subjects in this study had normal antenatal care and were free of any co-morbidity. The placental weight increased according to birth weight and gestational age. Although non linear, this correlation was statistically significant($\chi^2=108.570$; *p*=0.000). The same trend has been documented by other authors [9-13]. There was a progressive decline in the placental- birth weight ratio (PBWR) with gestational age. This may be attributed to the gradual decline in placental weight and function at term brought on by placental senescence or aging, which is a natural, physiological phenomenon. Other studies have reported a similar trend in placental-birth weight ratio [9,10]. However, Samuel Lurie et al. [14] reported that the PBWR increased with gestational age in their study. The variation in PBWR trend with

Table 1. Socio-demographic characteristics of the subjects.

Variable	Frequency (N=444)	Percentage
Age (Years)		
18-22	34	7.7
23-27	157	35.4
28-37	175	39.7
33- 37	61	13.7
38-42	17	3.8
Parity		
0	106	23.9
1-2	252	56.8
3-4	70	15.7
≥5	16	3.6
Gestational Age at delivery (weeks)		
37-38	189	42.6
39-40	199	44.8
41-42	56	12.6
Mode of Delivery		
SVD	337	75.9
CS	105	23.6
Assisted Breech Delivery	2	0.5

Table 2. Fetal characteristics.

Variable	Frequency (N=444)	Percent
Placental Weight(g)		
300-490	12	2.7
500-690	217	48.9
700-890	161	36.2
900-1090	47	10.6
1,100-1, 290	6	1.4
≥ 1,300	1	0.2
Birth Weight (g)		
< 2500	16	3.6
2500-3900	383	86.3
≥ 4000	45	10.1
Fetal Gender		
Male	218	49.1
Female	226	50.9
APGAR Score at 1 minute		
<6	31	7.0
≥ 6	413	93.0
APGAR Score at 5 minutes		
<6	10	2.3
≥ 6	434	97.7
Neonatal Intensive Care Unit Admission		
Yes	9	2.0
No	435	98.0

Table 3. Mean neonatal birth weight (g), mean placental weight (g) and mean placental-birth weight ratio (PBWR) by gestational age at birth.

Gestational Age (Weeks)	n	Birth Weight(g) Mean (SD)	Placental Weight (g) Mean (SD)	Placental-Birth Weight Ratio (%)
37-38	189	2,680(436)	570(145)	21.3
39-40	199	3,260(458)	680(172)	20.9
41-42	56	4,020(857)	760(258)	18.9
Total	444	3,300(500)	670(160)	20.3

gestational age may be due to ethnic, racial and socioeconomic differences of the study populations. Differences in the methods of placental preparation may also account for variation in PBWR pattern with increasing gestational age at term.

The mean placental weight of 670 g in this study was higher than the mean values of 590 g reported in Sokoto, 565 g in Ilesa and 587 g in Indonesia but similar to the mean placental weight of 672 g reported in Norway [9,15-17]. The mean placental-birth weight ratio of 20.3% in this study was higher than the mean values of 18.2%, 13.9% and 17.08% reported in Sokoto (North-western Nigeria), Ukraine and Thailand respectively [9,11,18]. Perry et al. reported mean placental-birth weight ratios of 20.4%, 20.0% and 19.5% among Afro-Caribbean, Asian and European women respectively [19]. These mean PBWR values were similar to the mean PBWR of 20.3% obtained in this study.

We recommended further study on the relationship between paternal age and placental-birth weight ratio in our setting.

Conclusion

The placental weight had a positive (though non-linear) correlation with the birth weight and the gestational age; the placental-birth weight ratio showed progressive decline with gestational age at term.

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