



The Correlation between Placental Weight and Foetal Outcome in a Tertiary Health Facility in Southern Nigeria

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Authors' contributions

This work was carried out in collaboration with all the authors. Authors CIE and EE designed the study, wrote the protocol and the first draft of the manuscript. Authors JTU and CON managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background: Placenta is a vital feto-maternal organ for promoting pregnancy, foetal growth and development. Placenta varies in weight, size, thickness, form and consistency. The weight of the placenta is functionally significant because it is related to villous surface area and foetal metabolism. Gross examination of placenta after delivery may provide a useful insight into foetal weight, newborn and maternal complications of pregnancy.

Objectives: To determine the mean placental weight in our environment and also, to determine the correlation between the placental weight and neonatal outcome in term pregnancies in Calabar.

Materials and Methods: This was a cross-sectional study of 300 women conducted at University of Calabar Teaching Hospital (UCTH). Participants in the study were women with singleton pregnancies who delivered either by vaginal delivery or caesarean section at term. Examination and weighing of placenta were done at delivery for placental weight. Foetal outcome that were recorded included birth weight, sex, length of the newborn and Apgar score at 5th minute. Maternal age, marital status and parity were also obtained. Data obtained were analyzed using the statistical

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package for Social Sciences (SPSS) version 20. Level of significance was set at p-value less than 0.05. Data were presented in tables and graph.

Results: The mean placental weight was 652 ±152g and ranged from 250g-1,200g. The mean foetal birth weight was 3.309 ±0.522kg and ranged from 2.0-5.9kg. The mean placental weight to birth weight ratio was 1: 5.08. The mean gestational age at delivery was 38.94 ±1.33weeks while the mean length of the neonate was 49.79 ±2.66cm. There was a corresponding increase in placental weight with increase in neonatal birth weight and length of the neonate.

Conclusions: Placental weight was positively correlated with birth weight and length of the neonate. Critical examination and weighting of the placenta immediately after delivery should be done to determine the well being of the newborn.

Keywords: Placental weight; birth weight; length of neonate; foetal outcome.

1. INTRODUCTION

The capacity of foetus to grow and develop during pregnancy depends on the quality and function of the developed placenta [1]. This is because normal developed placentae have several function during pregnancy such as nutritive, excretory, respiratory, endocrine and barrier action in preventing harmful substances from passing to the foetus [2]. The placental weight is about one sixth of the normal weight of the newborn [1]. Some studies have examined the relationship of placental size to the neonatal birth weight at term and concluded that placental weight was linked with pregnancy outcome [1,3]. Placentae vary in weight, size, thickness, form and consistency. The normal mature human placenta is rounded, flattened, discoid organ, 15-20cm in diameter and 2-4cm thick. It weighs 500-600grams [2]. Studies revealed that both high and low placental weights correlated with a poor perinatal outcome such as low Apgar score, medical complications of pregnancy, respiratory distress syndrome and perinatal death [1,4]. For example, they are heavier than normal in maternal conditions like syphilis, diabetes, hydrops foetalis, rhesus isoimmunisation and severe anaemia [2]. Small placental sizes may be seen in conditions like trisomies, intrauterine growth restriction and maternal hypertension. The central pathology in the development of pre-eclampsia lies in the placenta and the placental sizes is usually smaller than in normal pregnancies [5]. Barker *et al* reported that distorted growth of the placenta was a predictor of maternal medical diseases such as cardiovascular disease, hypertension and diabetes mellitus [6]. Other factors such as socioeconomic status, race, harmful habits and occupation also affect the placental weight [1].

Cautious inspection of the placenta after delivery can give insight concerning the intrauterine environment of the foetus before delivery. Recent

studies on foetal birth weights show that foetal birth weights at term have increased over time [7,8]. There is a positive correlation between foetal weight and placental weights in some studies [1,3]. The placenta can be weighed with membranes and cord attached, but the standard approach is to weigh the placenta after the extra placental membranes and the umbilical cord are trimmed from the disk [1]. This limits the measurement to the weight of the placental disk, the actual nutrient exchange part of the placenta. However, Leary *et al* suggested that trimmed and untrimmed placental weights are exchangeable, based on their high correlation [9].

The placental weights examination and measurement are of great clinical relevance and is associated with a wide range of unfavourable obstetric outcome and this study was aimed to determine the correlation between placental weight and foetal outcome. There are few documented local studies of placental weight and foetal outcome [1,3]. Though the pathogenesis of variability of placental size remains largely unclear, this study would provide information about the placental weight and its association with adverse obstetrics outcome in our locality. Additionally, it will also guide further studies on the subject in our environment, enrich local content of literature and provide a basis for future best practices in maternal and prenatal care to improve neonatal outcome.

2. METHODOLOGY

This was a prospective cross-sectional study carried out at the labour ward and theatre of the Department of Obstetrics and Gynaecology, University of Calabar Teaching Hospital (UCTH), Calabar from February 15th to July 14th 2016. The target population were pregnant women delivering either vaginally or by caesarean section in this facility.

Inclusion criteria were primigravida or multigravida with singleton pregnancies who had either vaginal delivery or caesarean section between 37 and 42 completed weeks.

Exclusion criteria were pregnancies complicated by intrauterine foetal death, multiple gestations, congenital malformations of foetus, diabetes, preeclampsia, chorioamnionitis, preterm labour and intrauterine growth restriction.

Data were obtained from participants using a pre-tested questionnaire, newborn weighing scale and measuring tape calibrated in centimetres. The newborn weighing scale was a standard analogue Waymaster (England) scale corrected for zero error. This was used to measure the neonatal and placental weight after delivery.

The socio-demographic characteristics obtained include age, marital status, parity, last menstrual period and gestational age in weeks. The placentae were examined under running water to remove blood clots and the placental weight measured using a weighing scale and recorded in grams. Foetal parameters that were recorded after delivery include Apgar score at 5 min, weight of the newborn, sex and length of newborn.

Data obtained were analyzed using the Statistical Package for Social Sciences (SPSS) version 20. The test of significance was done with Pearson's correlation coefficient. Level of significance was set at p-value less than 0.05. Data were presented in tables and chart.

3. RESULTS

Placental weight varied from 250gram to 1,200gram with mean weight of 652 ±152 gram while the gestational age at delivery varies from 37-42 weeks with mean of 38.94 weeks ± 1.326 weeks. The age distribution showed the mean maternal age of 29.6 years ± 4.85years, maximum 41 years and minimum 14 years.

The male foetuses had slightly larger mean placental weight than female foetuses, though the difference was not statistically significant (663 ±141g vs 640 ±164g; P-value=0.203) as shown in Table 2. The mean placental weight increased with increase in birth weight from 600 ±141g when the birth weights were less than 2.5kg to 714 ± 128g when the birth weights were 4kg or more and the difference in mean placental weight was statistically significant (P-value=0.049).

Table 3 showed that most placentae delivered within the period weighed between 700-899 gram 129(43.0%) followed by placental weight of 500-699 gram 121 (40.3%) and the least was placental weight of 100-299 gram 1(0.3%).

The mean birth weight of the neonate increased with a corresponding increase in placental weight as shown in Fig 1. The mean birth weight increased to the maximum of 3.69kg when the placental weight was 900gram and subsequently decreased with increase in placental weight to 3.30kg when the placental weight was 1,200gram.

Table 4 showed the correlation between placental weight and foetal outcome. When the placental weight was compared with birth weight using the Pearson's correlation, there was significant positive correlation between placental weight and birth weight (r = 0.330; p value = 0.000). There was also significant positive correlation between placental weight and length of the neonate (r = 0.208; p-value = 0.000).

4. DISCUSSION

Studies pertaining to placental weight at term showed that placental weight varies from geographical location [3,4,10]. In this present study the mean placental weight was 652 ±152g and ranged from 250g to 1,200g. The mean placental weight is comparable to 657g and 643g reported in Western Nigeria and Europe

Table 1. The mean and range of the characteristics of the study group

Variables	Frequency (%)	Mean ± SD	Range
Placental Weight	300 (100)	652 ±152g	250-1200g
Gestational Age	300 (100)	38.94 ±1.326weeks	37-42weeks
Birth Weight	300 (100)	3.309 ±0.522kg	2.0-5.9kg
Maternal Age	300 (100)	29.60 ±4.845years	14-41years
Parity	300 (100)	2.21 ±1.239	0-8
Length of the Newborn	300 (100)	49.79 ±2.66cm	34-59cm

Table 2. The socio-demographic characteristics in relation to mean placental weight in the study population

Variable	Frequency (%)	Placental weight (gram) Mean ± sd	ANOVA	p-value
Age (Years)				
14-19	11(3.7)	652 ± 108	2.035	0.061
20-24	30(10.0)	643 ± 107		
25-29	97(32.3)	663 ± 153		
30-34	114(38.0)	642 ± 144		
35 and above	48(16.0)	654 ± 198		
Marital status				
Married	293	653 ±154	0.174	0.677
Single	7	629 ± 047		
Parity				
1-2	198	648 ± 150	0.847	0.430
3-4	86	652 ± 147		
5 and above	16	700 ± 200		
Sex				
Male	161	663 ± 141	1.625	0.203
Female	139	640 ± 164		
Foetal weight				
<2.5kg	9	600 ±141	2.900	0.049
2.5-<4.0kg	269	649 ±153		
4.0kg and above	22	714 ± 128		
5-Min APGAR score				
<7	19	708± 98	0.859	0.421
7-10	281	715 ± 112		

SD—standard deviation

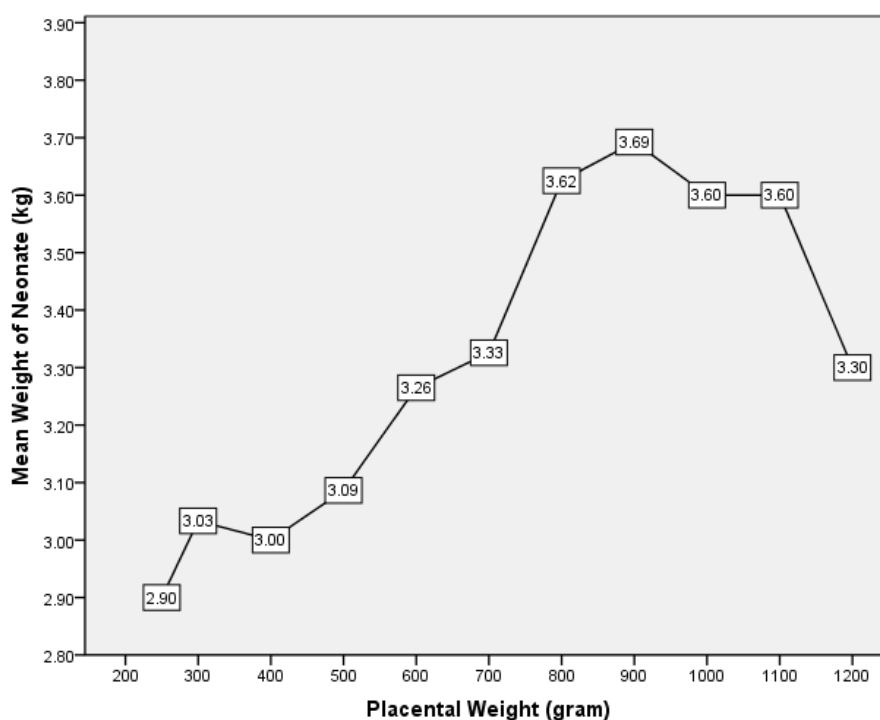


Fig. 1. The relationship between the weights of placenta and the mean birth weights of the neonates

Table 3. The frequency distribution of placental weights

Placental weight (g)	Frequency	Percent	Cumulative Percent
100-299	1	0.3	0.3
300-499	24	8.0	8.3
500-699	121	40.3	48.7
700-899	129	43.0	91.7
900-1000	22	7.3	99.0
>1000	3	1.0	100.0
Total	300	100.0	

Table 4. Correlation between placental weight and foetal outcome

Foetal Outcome	Placental Weight	P- Value
	Correlation (r)	
Gestational Age	0.116	0.045*
Birth Weight	0.330	0.000*
5 th Minutes Apgar Score	0.030	0.606
Length of the Neonate	0.208	0.000*
Foetal sex	0.103	0.098

*Correlation is significant at less than 0.05 level (2-tailed)

respectively [3,6]. However, it is higher than 580g, 587 and 470 g reported in Nigeria, Asia and Ukraine respectively [11-13]. The variations observed in the mean placental weight may be due to variation in control mechanisms for the growth of placenta such as ethnicity, genetic factors, nutrition, variations in placental weighing and the cord clamping time [1,13]. This showed that human neonates exhibit wider variations in terms of the weight of their placenta and results of these studies supported this finding.

The mean birth weight observed in this study was 3.309 \pm 0.522kg and ranged between 2.0kg to 5.9kg. This finding is similar to study in Northern Nigeria [10]. The mean birth weight of the neonate in this study is lower than 3.42kg and 3.40kg reported in Ukraine and Nigeria respectively; but higher than 3.275kg and 3.103kg in Northern Nigeria and Caribbean region respectively [1,12-14]. These observed differences in mean birth weights of neonates may be due to altitude; race, maternal nutrition, and maternal medical condition [3,10].

The age range of the participants in this study was 14-41years with a mean of 29.60 \pm 4.85years and was similar to subjects in previous studies [10,15]. The mean gestational age in the study (38.94 \pm 1.33weeks) is similar to a study in Northern Nigeria and Italy [1,16], but lower than 39.9weeks reported in western Europe [17]. There was an increase in placental weight with increase in parity of the participants in the study. This finding is in agreement with a study in

Nigeria which showed that placentae and babies from multiparous women at term were heavier than those from primiparous women [1].

In this present study the placental weight increased with increase in birth weight and was positively correlated with birth weight. This means that foetuses with large placenta were likely to have normal birth weight or to be macrosomic. The positive correlation between the placental weight and newborn weight noted in the study were also, observed by previous authors [3,18]. Staribratova et al reported a significant positive correlation between placental weight and foetal weight [19]. A study in Asia between placental weight and obstetric outcome also, found a statistically significant relationship between placental weight and birth weight [20].

Concerning the relationship between placental weight and length of the neonate, there was a significant positive correlation. This is comparable to the study by Yu-Fang Lo et al in Taiwan which noted a positive correlation between body length of neonate and placental weight and suggested that growth of the placenta and body length may be under similar control mechanisms some of which are likely to be genetic in origin [20].

The weight of the placenta which correlated positively with the weight of the baby and length of baby in this study showed that functional placenta is necessary for optimal growth and

development of the foetus. This strong relationship between the placenta and the foetus suggests that the well being of the foetus is highly dependent on the placenta since it serves as a link between the mother and the developing foetus for nutritional support, excretory functions as well as immunological and hormonal support. Large placental size provides a large surface area for the exchange of substances from the mother to the foetus resulting in high foetal weight. It then implies that, factors which directly affect the weight of the placenta will indirectly affect the weight and length of the foetus. Such factors may possibly include nutrition, maternal anaemia, altitude, hypertension, maternal diabetes mellitus and other chronic medical illness [21,22].

This study also observed that foetal weight declined with the placental weight above 900g. The reason for the finding may be that the function of the placenta is impaired with very large placenta. Past studies indicated that high placenta weight was associated with a poor perinatal outcome, a low Apgar score, respiratory distress syndrome and perinatal death [1,23]. Also, disproportionately large placenta could reflect an acute placental injury resulting in villous oedema or a chronic process requiring placental overgrowth, such as maternal anaemia, impaired glucose tolerance and malnutrition [1,24]. Infants with such abnormal ratios are at increased risk of perinatal death and intrauterine growth restriction [25,26].

5. CONCLUSION AND RECOMMENDATION

The present study showed that the placental weight is variable; however, most cases had normal placenta. There was a significant positive correlation between the placental weight, birth weight and length of the neonate. This implies that normal healthy placenta is necessary for optimal foetal growth and development. All efforts should be made during early antenatal care to identify factors which may adversely affect placental growth and development for early treatment to optimise placental weight. As part of routine postnatal examination, there should be appropriate examination and documentation of placental weights and abnormalities as this will provide more information on foetal well being and neonatal outcome. Since placental size correlated positively with foetal weight and foetal length, future exploration of antenatal

measurement of placental size for assessment of foetal growth and well-being should be explored.

6. LIMITATIONS OF THE STUDY

The risk factors for large and small placental weight were not studied. Only gross examinations of the placentas were carried out and were not sent to histology for identification of placental abnormalities. Further studies in future in our area are needed to examine the risk factors for large or small placental weights and the extent to which placental weight affects the growth, development and health of newborns.

CONSENT AND ETHICAL APPROVAL

Ethical approval was obtained from the ethics and research committee of the Hospital before commencement of the study. Informed consent was obtained from clients after being recruited for the study and counselling.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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