Correlation of placental morphometry with the birth weight of newborn in Kerala population

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Abstract

Background: Morphology and morphometric measurements of the placenta will provide an insight into the aetiology of newborn and maternal complications. Objective: This study aimed to observe the gross morphometric assessment of placenta and to correlate the placental indices with birth weight of the baby in hypertensive and normal pregnancies. Methods: The present study was a comparative descriptive study with analytical components. A total of 86 pregnant women comprising 40 normotensive subjects and 46 hypertensive women within the age group of 18-40 years, parity between 1-4, gestational age between 37 weeks-40 weeks, who attended antenatal clinic of the hospital and delivered by either vaginal route or caesarean section were included in this study. After collecting their placenta, the weight, diameter, surface area, thickness, shape of the placentae was recorded. Weight and sex of baby was also recorded. For statistical analysis, Pearson correlation coefficient test was employed. Results: Positive correlation was observed between the placental surface area \( (p<0.05; p<0.001) \), diameter \( (p<0.05; p<0.001) \) weight \( (p<0.001; p<0.05) \) and the corresponding birth weight of the baby among both the normotensive and the hypertensive mothers. All these relationships were statistically significant. Conclusion: From this study, it can be concluded that placental morphometry has a
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**Introduction**

Women and children are most vulnerable from the point of health care in terms of disease and death. In most of the developing countries, they are the underprivileged group in terms of nutrition, education, financial status and health care. It was reported that the genetic, socioeconomic racial and environmental factors influence the birth weight of the baby. Other factors include hypertensive disorders and gestational diabetes mellitus. Diseases of pregnancy and pathologic condition of placenta are important contributors to the morbidity and mortality for both maternal and fetal health. Some life threatening disease like hypertension during pregnancy is closely associated with the placental dysfunction due to the poor vascularization of the placenta. Hypertensive disorders of pregnancy and their complications rank as one of the major causes of maternal mortality and morbidity in the world. As placenta plays a key role in the survival of fetus and is the major communication between the mother and fetus, the effect of maternal disorders on the neonatal outcome can be assessed by studying placenta.

The placenta at term is almost a circular disk with a diameter of 15-20 cm and thickness of about 3 cm at its center. It feels spongy and weighs about 500 gm, the proportion to the weight of the baby being roughly 1:6 at term. Both fetal or maternal diseases such as severe anemia, hypertension, and fetal hydrops usually influence fetal and placental weight. The surface area is roughly parallels that of the expanding uterus, the increasing thickness of the placenta results from the arborization of existing villi. Villous area and fetal metabolism are related to the placental weight, so it is significant functionally. Morphology and morphometric measurements of the placenta will provide an insight into the aetiology of newborn and maternal complications. Cumulative development of the fetus from conception to delivery can be obtained from the dimensions of placenta. Size of the newborn is also influenced by the hormonal factors in utero and the pathologic adaptation of placenta to racial factors. As far as our knowledge no such reports on newborn birth weight relationship with placental indices in population of Kerala, a southern state of India has been published. Therefore, this study has been designed to observe the gross morphometric features of placenta and to correlate the placental indices with birth weight of the baby in hypertensive and normotensive pregnancies in Kerala population.

**Methods**

The present analytical study observed some morphometric measurement of the placenta from normotensive and hypertensive pregnant after delivery. The study was conducted at the Department of Anatomy and the placentae were collected from the Department of Obstetrics and Gynaecology of P. K. Das Institute of Medical Sciences Vaniamkulam, Ottapalam, Palakkad, Kerala between 2016-2018. A total of 86 pregnant women aged between 18-40, parity 1-4, gestational age between 37-40 weeks, who attended antenatal clinic of the hospital and delivered by either vaginal route or caesarean section were included in this study by purposive sampling. Among 86 pregnant women 46 were normotensive and 40 were hypertensive and placentae from them were collected immediately.
after delivery. Informed written consent was taken from participant mothers. Medical, social and obstetric history was taken and clinical investigations of the mother were noted. The following inclusion and exclusion criteria were followed for recruiting the participants.

**Inclusion criteria**
Normotensive - All subjects had no history of raised blood pressure at any stage of their life and had no evidence of proteinuria or any other complications prior to the pregnancy.

Hypertensive - Hypertensive woman who had history of hypertension before pregnancy or during the first 20 weeks of gestation, had consistently recorded systolic blood pressure (SBP) and diastolic blood pressure (DBP) of 140 and 90 mmHg, respectively and with or without proteinuria.

**Exclusion criteria**
Pregnant women who had experience of any complications during pregnancy like diabetes mellitus, hypothyroidism, anemia, abruptioplacentae, multiple pregnancies, jaundice were excluded from study.

After collecting placenta, weight, diameter, surface area, thickness and the shape of the placentae was recorded. The weight of the placenta was taken using a standard weighing machine. The shape of the placentae was noted and it is categorized as oval, circular, triangular or irregular in shape. The Diameter was measured in cms using a graduated metallic scale. The maximum diameter was recorded for two times. The mean of the two maximum diameters was calculated as the diameter of placenta. Knitting needle calibrated in cms was inserted at the center of the placenta and the thickness of the placenta was measured. The maternal surface area of the placenta was calculated using the following formula: Surface area = \( \pi d_1 \times d_2 / 4 \), (where \( d_1 \) is the largest diameter and \( d_2 \) is the smallest diameter. 12) Weight and sex of baby was also recorded.

**Data analysis**
Data was analyzed using Microsoft excel. The degree of correlation between the birth weight and some relevant placental parameters viz weight, area and diameter were analyzed using Pearson’s correlation coefficient. \( p \) value less than 0.05 was considered as significant.

**Results**
There was a positive correlation between the birth weight of the baby with the placental surface area among the normotensive and the hypertensive group of pregnant and it was statistically significant. (Figure 1). There was a positive correlation between the birth weight of the baby and the placental diameter among the normotensive and the hypertensive group, the result was statistically significant (Figure 2). There was a significant positive correlation of the birth weight of the baby with the placental weight among the normotensive and the hypertensive group, (Figure 3).

![Figure 1](image-url)  
*Figure 1: Correlation between the birth weight of the baby with the placental surface area among the (A) normal and the (B) hypertensive group.*
Discussion
In the present study, placental weight, surface area and the diameter showed significant positive correlation with the birth weight of the baby. Earlier reports stated that the placental weight and birth weight showed positive correlation.\textsuperscript{9,3,15} Our results supports this earlier reports as there was a significant positive correlation between the placental weight and the neonatal weight in the present study. Udainia and Jainin 2001 also reported linear relation existed between the placenta weight and newborn weight in uncomplicated, mild and severe pregnancy induced hypertension.\textsuperscript{16} Singh and Gugapriya reported that decrease in the placental weight was associated with reduced birth weight which was related to increase in severity of hypertension in pregannts.\textsuperscript{17} The weight of the placenta is intimately related to the villous area and foetal metabolism. Placental weight and birth weight of neonate are widely variable measures and the ratio of which is a useful marker of fetal nutrition and utero-placental function.\textsuperscript{18} If fetal nutrients or oxygen supply is reduced, the placental weight will increase compared to fetal weight. Placental weights have been shown to be high in comparison to birth weight when fetal nutrient or oxygen is reduced. This is believed to be a

Figure 2: Correlation between the birth weight of the baby and the diameter among the (A) normal and the (B) hypertensive group.

Figure 3: Correlation between the birth weight of the baby and the placental weight among the (A) normal and the (B) hypertensive group.
compensatory mechanism through which placental weight have been found to be predictive of maternal disease, obstetric outcome, perinatal morbidity and mortality, childhood growth and development. Increased placental weight was reported to be associated with increased risk of hypertension in adults between 46 and 56 years of age. Reduced placental weight and surface area were also associated with hypertension in later life. Placental weight is higher in African Americans and lower in those of Asian ethnicity when compared to all other ethnic groups.

Gupta et al. compared weight, volume, diameter, thickness, and surface area of the placenta and found significant strong correlation with the fetal weight. So this means that if there is any abnormality in the placenta, it will be strongly reflected in the fetus. This was in accordance with the present study regarding the surface area, diameter and placental weight which showed significantly positive correlation but the thickness had no correlation with the birth weight in this present study. In contrast, other study reported that there was no correlation probably due to genetic environmental or ethnic factors. Birth weight has a positive relation with both second and third trimesters placental thickness; however, placental thickness changes could not predict low birth weight. Thompson et al. also reported that there was no correlation between a thick placenta and poor obstetrical outcome, apart from a mild association with severe preeclampsia.

Research evidence from previous studies suggested that the capacity of the fetal growth is determined by the placental growth. The expansion of the chorionic plate begin in the early pregnancy is the principal determinant of the ability of the placenta to translate its mass into the birth weight. As chorionic disc area and thickness increase, birth weight and placental weight also increase. Duration of disease and severity of preeclampsia are important determinants of placental abnormality. Studies have shown that diminished placental size precedes fetal growth retardation as IUGR is associated with impoverished villous development and feto-placental angiogenesis. Abnormalities of the placenta are recognized as the leading causes of stillbirths and are frequently mentioned as the primary cause of death. It was suggested that the placental indices have significant role in foetal growth. Examination of the placenta and its measurements will be helpful to the obstetricians and paediatricians in clinical practice.

**Conclusion**

From this study, it can be concluded that there exists a significant positive relationship between the birth weight of the baby and placental variables. The study results may help in understanding of the maternal-placental programming of chronic diseases.

**Limitations**

The results of our study may not be generalized to the general population. However, they do closely mirror the hospital registry because they present similar demographic, clinical and obstetrical maternal data.

**Ethical consideration**

The study protocol was approved by the institutional human ethical committee of P.K. Das Institute of Medical Sciences, Kerala, India. (CRF/CRL/P11-1/Ph.D.)

**Conflicts of interest**

Authors confirm that there was no conflict of interest to declare.

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