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Influence of Placental Morphometric Measurements on the Body Mass Index of the Newborn

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Abstract: The placenta is a vital organ for maintaining pregnancy and fetal development. We studied the influence of placental morphometric measurements (weight and diameter) on the body mass index (BMI) of the newborn. The present study was carried out at Dr. BR Ambedkar medical college and KC General Hospital Bangalore. Hundred and eight mothers who gave birth to uncomplicated singleton pregnancy, and their newborn were examined. Placental weight, diameter, birthweight and crown to heel length were recorded immediately after delivery by electronic weighing balance, Infantometer and measuring tape. BMI was calculated in kgs/m^2. 58 Females and 50 Males new born babies were classified on the basis of body mass index (kg/m^2) into 3 groups. Group I BMI $<$ 10, Group II BMI 10-13 and Group III BMI $>$ 13. The mean placental weight (in gms) and diameter (in cms) for the male babies in the Group II and III were 466.01 ± 78.23, 524.4 ± 39.51 and 16.9 ±0.69, 18.2 ± 1.05 respectively. However there were no babies in Group I. The mean placental weight (in gms) and diameter (in cms) for the female babies in the 3 groups were 409.6± 42.74, 489.7 ± 43.57, 521.4 ± 48.7 and 15.8 ± 1.01, 17.0± 0.81 and 17.2 ± 0.76 respectively. There was a statistically significant correlation between placental weight and diameter with BMI of the newborn in Group II and III for male babies and Group I and II for female babies ($P<0.05$).

Keywords: Placental weight, Placental diameter, Body mass index of newborn, Birth weight, crown to heel length , fetomaternal perfusion.

INTRODUCTION

The placenta is a fetomaternal organ which has fetal part developed from the chorionic sac, lined by amnion. It is completely covered by chorion with attachment of the umbilical cord and maternal part of the endometrium. Placenta growth is directly related to the birth weight of the newborn, which is dependent on both nutrients and oxygen from the mother. The measurements of the delivered placenta reveal the collective development of the placenta from conception to delivery. Placental weight is one of several standard placental measures by which placental growth can be characterized. Weight is a summary of dissimilar dimensions of growth, including the laterally expanding growth of the chorionic plate (measured by chorionic plate shape, the distance from the cord insertion site to the nearest chorionic plate margin, chorionic plate diameters) and ramification of the villous and vascular nutrient exchange surface, reflected in increasing thickness of the chorionic disk. These standard placental measures have been a routine part of gross placental pathologic examinations since the large perinatal cohort studies in the 1960s [1-3]. The placental size and fetoplacental perfusion has a bearing on birth newborn [4]. The placenta is an organ to which the fetus is attached by means of an umbilical cord this is a structure to which exchange of nutrition, gases and waste products take place from the early pregnancy to its termination. The nutritional demand of the fetus draws its supply from the maternal side and grows at her expense. Thus when the mother's diet is nutritionally or calorically inadequate both the mother and fetus suffer from nutritional disorders affects the growth of the placenta contributing to growth retardation of the fetus [5]. Body mass index (BMI) of the newborn has become an indicator of body proportions and adiposity during pediatric age group, but there is a lack of data on the body mass on the newborns [6]. Thus the placental measures in terms of the weight and the diameter could act as a critical factor in determining the outcome of pregnancy. We attempted to study morphometric measurements of placenta as a factor influencing body mass index of the newborn.

MATERIALS AND METHODS

Study design

A hundred and eight healthy mothers who gave birth to uncomplicated singleton pregnancy, and their newborns were included in the study. Newborn babies delivered full-term during 37-42 weeks of gestation and mothers with twins, age above 35 years, Diabetes, Hypertension, pre-eclampsia were excluded from the study.

This was a prospective, cross sectional study carried out at Department of physiology and Obstetrics & gynecology of Dr. B.R Ambedkar Medical College Hospital, and K.C. General Hospital, Bangalore .The study protocol was approved by institutional human ethical committee. Informed written consent was obtained from all the participants prior to the data collection.

Placental measurements

Though the number of subjects participated in the study were hundred and eight, we were able to measure the parameters pertaining to the placenta in only hundred cases. The parameters namely placental weight, placental diameter and cord length were measured immediately after the delivery. Placental weight was recorded immediately after the delivery of the placenta, the cord was cut at its root, members were trimmed, blood clots were removed manually and the placenta was blotted several times with a mopping cloth and then the weight of the placenta was recorded by an electronic balance having a sensitivity nearest to ± 5 gms [6]. Placental diameter was measured by using two pins which were fixed on the placenta at its greatest diameter and the distance between the pins were measured by a flexible tape and Cord length were measured by using a flexible tape to the nearest centimeter.

Anthropometric measurements of newborn

Birth weight was recorded by using an electronic balance which has sensitivity $\pm$5gms (Electromedik Pvt. Ltd) and crown to heel length was recorded in the supine position by using an Infantometer scale in centimeters by standard technique. Body mass index was calculated by using weight in kgs /height in m^2 [7, 8].

STATISTICAL ANALYSIS

The data obtained was tabulated and was analyzed by SPSS programme and Graph pad prism version 5.0. Analysis of variance (ANOVA) and student's' test were used for analysis .The level of significance of P value ($P<0.05$) between the groups was considered significant.

RESULTS

58 Females and 50 Males babies were considered for the study, they had a mean birth weight (in kgs) of 2.60 ± 0.28 and 3.01± 0.41 respectively. ($P<0.05$) (Figure 1), Male babies weighted more than female babies. Women aged below 20 years gave birth to male babies with a mean birth weight (in kgs) of 3.05 ± 0.31 or female babies with a mean birth weight (in kgs) of 2.47 ± 0.46. Women in the range of 21-29 years gave birth to male babies with a mean birth weight (in kgs) of 2.99± 0.26 or female babies with a mean birth weight (in kgs) of 2.66 ± 0.37. Women aged more than 30 years gave birth to female babies with a mean birth weight (in kgs) of 2.28 ± 0.56. However there were no male babies (Table 1) there was a no significant correlation between maternal and birth weight of male or female babies in all the 3 groups ($P> 0.05$).

New born babies were classified on the basis of body mass index (kg/m^2) into 3 groups. Group I BMI Less than 10, Group II BMI 10-13 and Group III BMI more than 13. The mean placental weight (in gms) for the male babies in the Group II and III were 466.01 ± 78.23 and 524.4 ± 39.51 respectively. However there were no babies in Group I. The Mean placental weight (in gms) for the female babies in the 3 groups were 409.6± 42.74, 489.7 ± 43.57, 521.4 ± 48.7 respectively (Table 2 Fig 2). It was observed that there was a statistically significant positive correlation between placental weight and body mass index of the newborn in Group II and III for male babies and Group I and II for female babies. The mean placental diameter (in cms) for the male babies in Group II and III were 16.9 ±0.69 and 18.2 ± 1.05 respectively. The mean placental diameter (in cms) for the female babies were 15.8 ± 1.01, 17.0± 0.81 and 17.2 ± 0.76 respectively (Table 3 , fig 3).There was a significant correlation between placental diameter with body mass index of the newborn in Group II and III for male babies and Group I and II for female babies ($P<0.05$).

DISCUSSION

Placental weight and birth weight of the neonate are commonly used variables. The ratio of these two measures is a useful indicator of fetal nutrition and utero-placental function [9]. It is observed from our study that the outcome of pregnancy is influenced by a number of maternal and fetal factors. In our study, women aged below 20 years gave birth to male babies and female babies with a mean birth weight (in kgs) of 3.05 and 2.47. Women in the range of 21-29 years gave birth to male babies with a mean birth weight (in kgs) of 2.99 and 2.66 respectively. Women aged more than 30 years gave birth to female babies with a mean birth weight (in kgs) of 2.28. However, there were no male babies there was a no significant correlation between maternal age and birth weight of male or female babies in all the 3 groups ($P> 0.05$). Our

findings were in agreement, with similar findings [18]. Mothers who give birth from age 35 years onward chances of developing low birth weight and pregnancy complications, health issues are associated with increased maternal age [18]. However the extent to which these factors influence, the birth weight of the baby appear variable.

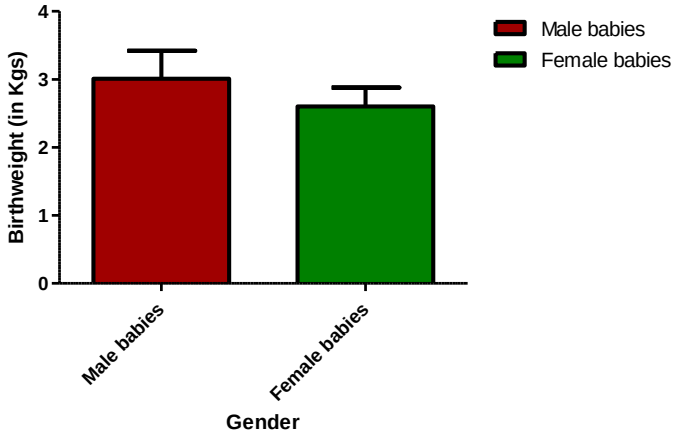

Figure 1:Gender distribution of the babies and birthweight

Table-1: Correlation of maternal age and birth weight

Group	Maternal age (in years)	Mean birth weight (in Kgs) ±SE			
		Number(n)	Male	Number(n)	Female
I	≤ 20	18	3.05±0.31	12	2.47±0.46
II	21-29	32	2.99±0.26	42	2.66±0.37
III	≥ 30	0	0	4	2.28±0.55

Group I vs. II P>0.05P>0.05
I vs. III P>0.05 P>0.05
II vs. III P>0.05 P>0.05

Table-2: Comparison of body mass index of new born and mean placental weight

Group	Body mass index of new born (Kg/m^2)	Mean Placental weight (in gms) ±SE			
		Number(n)	Male	Number(n)	Female
I	<10	-	-	13	409.61±42.74
II	10-13	28	409.61±78.23	34	489.7±43.57
III	> 13	18	524.4±39.51	7	521.4±48.7

Male Babies Group II VS Group III P<0.05
Female Babies Group I VS Group II P<0.05

Table-3: Comparison of body mass index of the new born and mean placental diameter

Group	Body mass index of new born (Kg/m^2)	Mean Placental diameter (in cms) ±SE			
		Number(n)	Male	n	Female
I	<10	-	-	13	15.8±1.01
II	10-13	28	16.9±0.69	34	17.0±0.81
III.	> 13	18	18.2±1.05	7	17.2±0.76

Male Babies Group II VS III P<0.05
Female babies group I VS II P<0.05

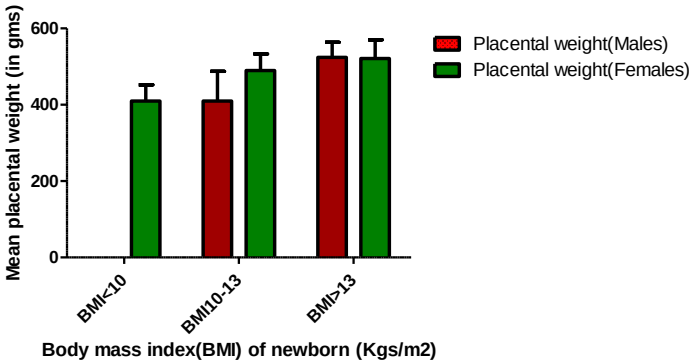

Figure 2:Comparison of bodymass index of newborn and mean placental weight

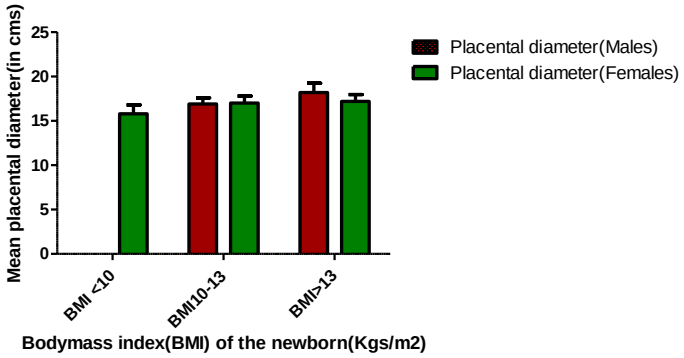

Figure 3:Comparison of Bodymass index of newborn and mean placental diameter

Placental measures as influenced by weight and diameter is a critical factor influencing the birth weight of the newborn .The larger size placenta and the heavier placenta are demonstrated to have a greater number of chorionic villi, this increased number of chorionic villi, increases the surface area and volume of the placenta resulting in better fetoplacental perfusion .Thus the adequate supply of requirements to the growing fetus will ensure a good development and a satisfactory birth weight [4]. In our study mean placental weight (in gms) for the male babies in the Group II and III were 466 and 524 grams and female babies were 3 groups were 409, 489, 521 ,as compared with the findings in Western Europe of 643 and 630 g respectively [10]. The variations in the mean weight of the placenta may be due to variations in the methodology of preparing and weighing the placenta together with cord clamping time [11]. It was reported that the weight of the placenta ranged 321‑534 g, which was almost similar to our study and we found that the weight ranged 409 to 524 grams [16].

In our study we found that the mean placental diameter (in cms) for the male babies in Group II and III were 16.9 and 18.2 and for the female babies in 3 groups were 15.8, 17.0 and 17.2 respectively. It was reported that mean placental diameter of the major axis is 21 and minor axis is 18 cms respectively [15]. It was found that the diameter of the placenta varied from 12.2 cm to 15.8 cm. [19]. It was reported that the mean diameter of the placenta to be 14.65 cm. [11], but in our study, the diameter ranged 15.8 to 18.2 cm. It was found the ratio between fetal birth weight and placental weight and fetal weight and placental circumference to be 7.2 and 64.57, respectively. These results are similar to our study and we found the values as 5.6 and 54.22. This ratio is important as in our study we found that the placental weight significantly correlates with the fetal weight [17].

The relationship was more pronounced for the female babies weighing far less than 3 kgs. It can be presumed that fetal weight of 3 kgs could be a critical factor above which these anthropometric measurements do not seem to significantly correlate with the fetal development and hence the birth weight. The female babies generally weighed around 2.5 kgs and the male babies weight around 3 kgs. It was reported that the mean birth weight of the neonate were lower than 3425, 3382, and 3400 gms reported in Ukraine, Western Europe, and eastern Nigeria respectively [12, 13].

CONCLUSION

The morphometric measurement of placenta (weight and diameter) exhibited a demonstrable influence on the birth weight of male and female babies. There was a statistically significant correlation between placental weight and diameter with BMI of the newborn in Group II and III for male babies and Group I and II for female babies ($P<0.05$).

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