

Impact of Placental Morphometric Measurements on the Body Mass Index of New-borns

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Abstract

Background: Placenta is a functional unit between the mother and the fetus. It is the discoid, deciduate, hemochorial, chorioallantoic, endocrine gland which connects developing embryo by umbilical cord to the uterus. It develops from two sources. The fetal component which is the principal component develops from chorion frondosum and the maternal component from decidua basalis. If the decidual part of the placenta is healthy, the embryogenesis from germinal period up to the end of fetal period will be healthy. **Material and Methods:** This is a prospective and observational study conducted in the Department of Anatomy at Tertiary care Teaching Hospital from April 2021 to December 2021. Inclusion Criteria: Totally, 90 healthy mothers who gave birth to uncomplicated singleton pregnancy, and their new-born were included in the study. Exclusion Criteria: Subjects with diabetes mellitus, hypertension, anaemia, vascular diseases, and multiple pregnancies were excluded from this study. **Results:** In present study, newborn body mass index (BMI in kg/m²) was measured. Majority (55.55%) of the newborn were within BMI range of 11-13 kg/m² followed by 25.57% of the new-born were with BMI >14 kg/m² and the lesser proportion of 18.88% new-born with BMI <10 kg/m². The mean placental weight (in gms) for female babies with BMI <10 kg/m² was 402.23±56.81. The mean placental weight (in gms) for male and female babies with BMI 11-13 kg/m² were 421.35±58.67 and 501.28±60.84 respectively. In addition, mean placental weight (in gms) for male and female babies with BMI >14 kg/m² were 569.54±54.37 and 556.76±67.91 respectively. The mean placental diameter (in cms) for female babies with BMI <10 kg/m² was 19.23±2.68. The mean placental diameter (in cms) for male and female babies were 20.89±2.87 and 21.58±2.76 respectively with BMI of 11-13 kg/m². Moreover, mean placental diameter (in cms) for male and female babies were 22.61±2.93 and 20.97±2.99 respectively with BMI of >14 kg/m². **Conclusion:** This study confirms that morphometric observation of placenta is associated with foetal weight. So, an early examination of not only the fetus, but also the placenta by non-invasive techniques like ultrasonography will be helpful to predict and to avoid low birth weight babies with better preventive measures. This study will also help the obstetricians and researchers to focus on the impact of placenta on new-born BMI.

Keywords: Placenta, placental morphometry, placental weight, placental diameter, new-born BMI.

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Introduction

The placenta is the vital organ for promoting and maintaining pregnancy and normal fetal development.^[1] It is elaborated by both fetal and maternal tissues to serve as an instrument for essential nutrient transfer. The benefits which are associated with the anatomical

examination of the placenta, an organ that is often disposed soon after parturition, without adequate examination.^[2]

Intimate association between embryo and mother in placental mammals creates the potential problem of two genetically distinct individuals having to coexist for the duration of pregnancy. Term placenta is about 23 cm in diameter and 2.0 to 2.6 cm thick. It generally weighs approximately 470 g, with an average volume of 500 mL.^[3]

The ratio between placental weight and new-born weight has been reported as 1: 6. Measurements vary widely and considerably in different regions. It has been shown that fetal or maternal diseases (severe anemia, hypertension, and fetal hydrops) influence fetal and placental weight.^[4]

Placental weight has a significant role in fetal growth in terms of cord length, body length, and neonate abdominal circumference but it had no significant role in the presence of excessive meconium -stained tissues.^[5] While some other studies have shown less correlation between mentioned factors and placental weights, in addition absolute measures of infant size and placental weight had mutual positive correlation.^[6] In another observation presence of low hematocrit was associated with higher placental weight and lower fetal weight.^[7]

The maternal surface is finely granular, mapped into 18–25 lobes by grooves or fissures (lobes) corresponding in large measure to the major branches of distribution of the umbilical vessels.^[8] Fetal surface is covered by amnion with the umbilical cord attached to its center.^[9]

Information from gross placental description can be critical in early neonatal care, in reproductive planning for the family, and it can provide risk assessment for neurologic outcome of the infant.^[10] The results of this study would have an important implication for infant care and decision making for obstetrics. Lesions of the placenta often explain or reflect the condition in which the neonate was born, with some having histopathological implications.

Anthropometrics for a long time have emphasized the benefits which are associated with the anatomic examination of the placenta, an organ that is often disposed soon after parturition without adequate observation. Examination of the placenta in utero as well as postpartum gives valuable information about the state of the fetal well-being.^[11]

Material & Methods

This is a prospective and observational study conducted in the department of Anatomy at Tertiary care teaching Hospital from April 2021 to December 2021.

Inclusion Criteria: Totally, 90 healthy mothers who gave birth to uncomplicated singleton pregnancy, and their new-borns were included in the study.

Exclusion Criteria: Subjects with diabetes mellitus, hypertension, anaemia, vascular diseases and multiple pregnancies were excluded from this study.

After taking mothers' consent, freshly delivered placentas were examined consecutively until the sample size of 90 was achieved. The mothers were weighed prior to delivery (with 12 kg deducted to give pre-pregnancy weights) and their BMIs calculated. The nurse-midwife who delivered the placenta gave it to the researcher who cleaned off the blood using running tap water. The placenta was put in a plastic bag and weighed, using a scale which recorded to 0.01 kg, after the umbilical cord was cut 3 cm from the neonate (after the cord had been measured). Cord length was considered short when < 32 cm and long when >70 cm

Statistical Analysis

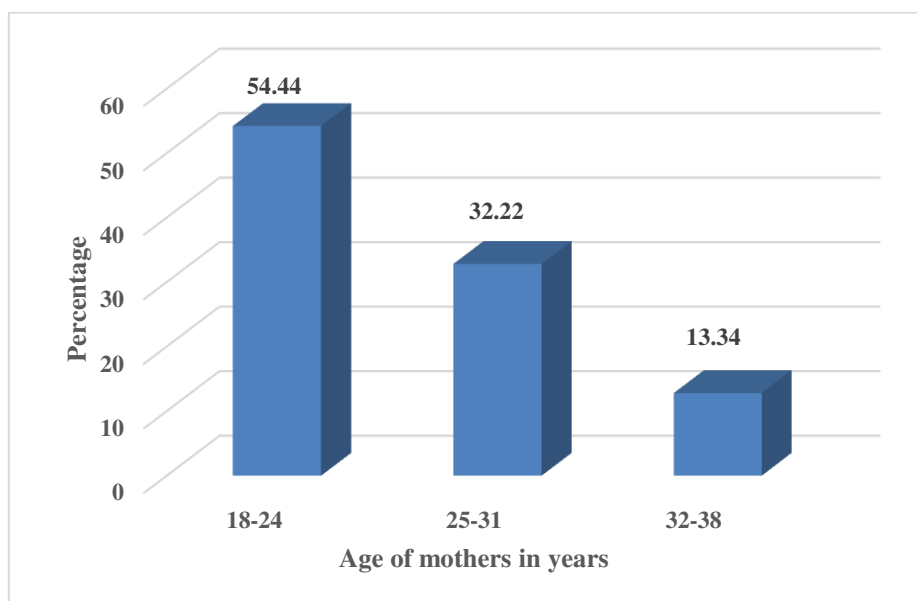
Data management and analysis were performed using Statistical Package for Social Sciences (SPSS) version 20 and the results presented in frequency tables; bivariate analyses were conducted to determine the effects of maternal BMI on placental morphology and fetal birth weight

Results

In our present study, the majority (54.44%) of mothers were in the age group of 18 – 24 years, while the rest (32.22%) in the age group between 25 – 31 years and (13.34%) in the age group between 32 – 38 years respectively, as shown in Table 1 and Graph 1.

Table 1: Distribution of Age group

Age years	Frequency	Percentage
18-24	49	54.44
25-31	29	32.22
32-38	12	13.34
Total	90	100

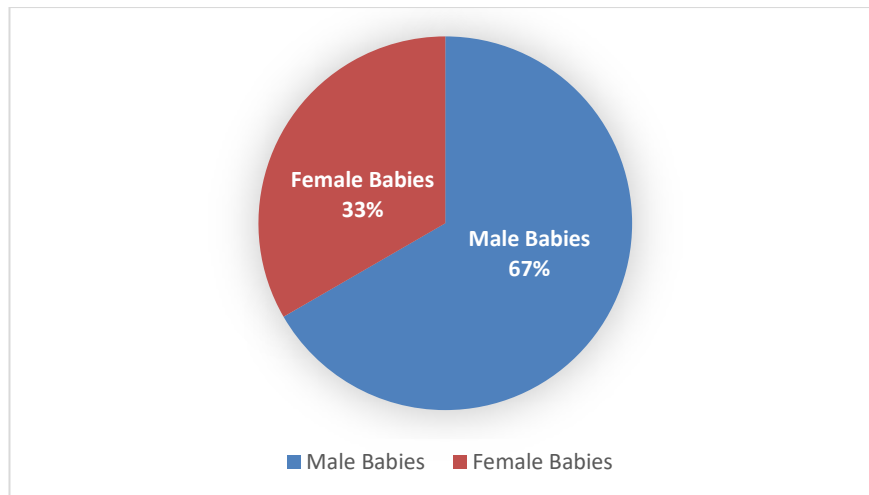


Graph 1: Distribution of Age group of Mothers

Out of total 90 new-borns, 66.66% were male babies and 33.34 % were female babies as shown in Table 2 & Graph 2. Primipara females were 46.66% and multipara were 53.34 as shown in Table 3 and Graph 3.

Table 2: Distribution of Gender of New-borns

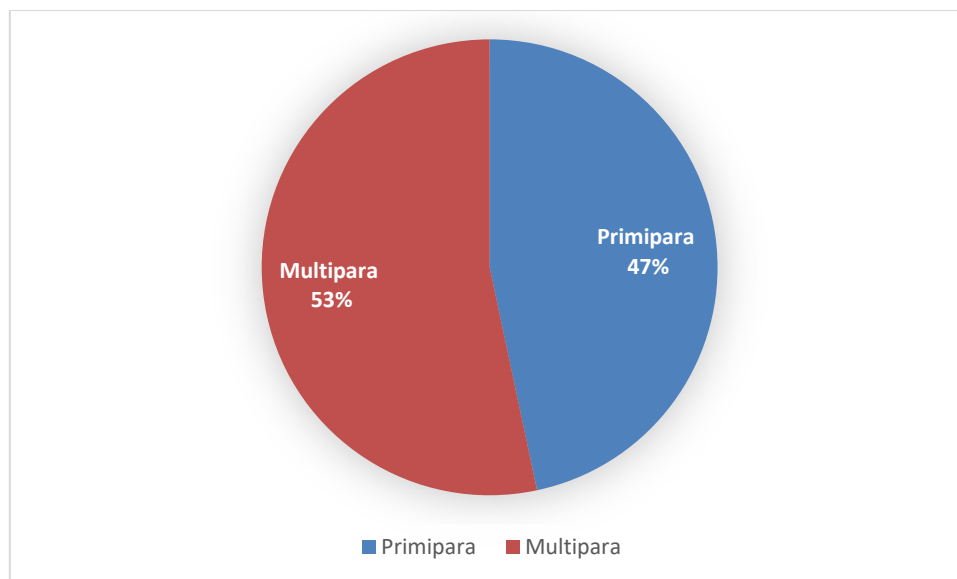
Gender	Frequency	Percentage
Male Babies	60	66.66
Female Babies	30	33.34
Total	90	100



Graph 2: Distribution of Gender of New-borns

Table 3: Distribution of Parity of Mothers

Parity	Frequency	Percentage
Primipara	42	46.66
Multipara	48	53.34
Total	90	100

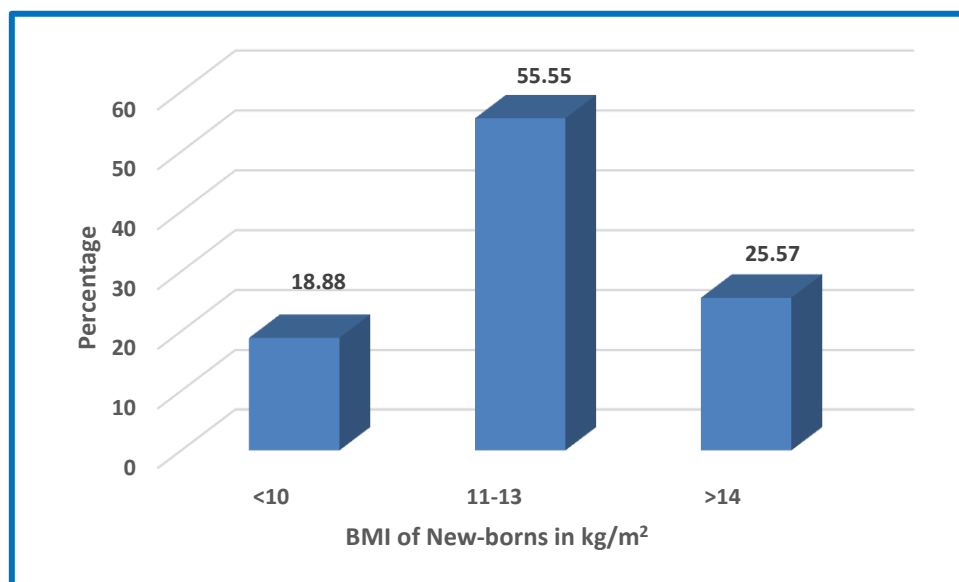


Graph 3: Distribution of Parity of Mothers

New-born body mass index BMI (kg/m^2) was measured. Majority (55.55%) of the new-borns were within BMI range of 11-13 kg/m^2 followed by 25.57% of the new-born were with BMI $>14 \text{ kg/m}^2$ and the lesser proportion of 18.88% new-born with BMI $<10 \text{ kg/m}^2$, as shown in Table4 and Graph 4.

Table 4: Distribution of body mass index of New-born

Body Mass Index of New-born (BMI in (Kg/m ²))	Frequency	Percentage
<10	17	18.88
11-13	50	55.55
>14	23	25.57
Total	90	100

**Graph 4: Distribution of body mass index (BMI) of New-borns in (kg/m²)**

Mean placental weight (in gms) for female babies with BMI <10 kg/m² was 402.23±56.81. Mean placental weight (in gms) for the male and female babies with BMI 11-13 kg/m² came out to be 421.35±58.67 and 501.28±60.84 respectively. In addition, mean placental weight (in gms) for the male and female babies with BMI >14 kg/m² were 569.54±54.37 and 556.76±67.91 respectively as shown in Table 5.

Table 5: Comparison of body mass index (BMI) of new-born and mean placental weight

Body Mass Index of New-born (Kg/m ²)	Placental Weight (in gms) Mean ±SE	
	Male	Female
<10	-	402.23±56.81
11-13	421.35±58.67	501.28±60.84
>14	569.54±54.37	556.76±67.91

The mean placental diameter (in cms) for female babies with BMI <10 kg/m² was 19.23±2.68. The mean placental diameter (in cms) for male and female babies were 20.89±2.87 and 21.58±2.76 respectively with BMI of 11-13 kg/m². Moreover, mean placental diameter (in cms) for male and female babies were 22.61±2.93 and 20.97±2.99 respectively with BMI of >14 kg/m² as shown in Table 6.

Table 6: Comparison of body mass index (BMI) of new-born and mean placental diameter

Body Mass Index of New-born (Kg/m ²)	Placental Diameter (in cms)	
	Mean ±SE	
	Male	Female
<10	-	19.23±2.68
11-13	20.89±2.87	21.58±2.76
>14	22.61±2.93	20.97±2.99

Discussion

Placenta is a functional unit between the mother and the foetus. Human placenta is discoid, deciduate, haemochorial, chorioallantoic, labyrinthine and endocrine gland which connects developing embryo by umbilical cord to the endometrium of mother's uterus. It develops from two sources.^[12] The fetal component which is the principal component develops from chorion frondosum and the maternal component from decidua basalis. The fetal surface is smooth, covered by amnion and presents the attachment of the umbilical cord close to its centre. The maternal surface is rough, irregular and spongy and is mapped out into 15-20 convex polygonal areas known as lobes or cotyledons which are limited by fissures.^[13]

In our study, the majority of (54.44%) were in the age group of women between 18 – 24 years while the rest were (32.22%) in the age group between 25 – 31 years, (13.34%) in the age group between 32 – 38 years. Our findings were in agreement, with similar findings.^[14] 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.^[15]

Mean placental weight (in gms) for female babies with BMI <10 kg/m² was 402.23±56.81. Mean placental weight (in gms) for the male and female babies with BMI 11-13 kg/m² came out to be 421.35±58.67 and 501.28±60.84 respectively. In addition, mean placental weight (in gms) for the male and female babies with BMI >14 kg/m² were 569.54±54.37 and 556.76±67.91 respectively. It was reported that the weight of the placenta ranged 321 to 534 gm, which was almost similar to our study and we found that the weight ranged 400 to 570 grams.^[16] 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.^[17] In addition, mean placental weight and its range differs from place to place and may be influenced by the factors such as the environmental factors, maternal and paternal nutritional status, and genetics.^[18]

The mean placental diameter (in cms) for female babies with BMI <10 kg/m² was 19.23±2.68. The mean placental diameter (in cms) for male and female babies were 20.89±2.87 and 21.58±2.76 respectively with BMI of 11-13 kg/m². Moreover, mean placental diameter (in cms) for male and female babies were 22.61±2.93 and 20.97±2.99 respectively with BMI of >14 kg/m².

According to Sivarao S, their study reported that mean placental diameter of the major axis is 21 and minor axis is 18 cms respectively.^[19] It was found that the diameter of the placenta varied from 12.2 cm to 15.8 cm.^[20] The difference in the placental diameter area might be due to nutritional status, maternal and paternal anthropometry, genetic constitution, Rh-incompatibility and other environmental factors.^[21]

The endogenous and extrinsic factors influencing the birth weight were: Maternal factors (ethnicity, race, stature and genetics), paternal factors (height and genetic), environmental factors (high altitude and availability of proper nutrition), and physiological factors (altered glucose metabolism, hemoglobin concentration, micro vascular integrity), pathological factors (uterine malformation), complications of pregnancy (gestational diabetes mellitus,

pre-eclampsia) and also the gestational age.^[22] Besides these factors, the study of Pathak S declares the placental weight, volume, and surface area are also significant determinants of birth weight.^[23] Previous studies have reported that placental weight had significant positive correlation with the birth weight, as we found in our present study.^[24-26]

Conclusion

This study confirms that morphometric observation of placenta is associated with birth weight of new-born, therefore an early examination of not only the fetus, but also the placenta by non-invasive techniques like ultrasonography will be helpful to predict and avoid low birth weight babies and other consequent complications. It can lead to take better preventive measures. This study will also help the obstetricians and researchers to focus on the impact of placenta on new-born.

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