

# To Study the Correlation between Maternal Body Mass Index and Birth Weight of the Baby

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## Abstract

Maternal BMI directly or indirectly indicates maternal health and wellbeing. Birth weight of the baby is an important determinant of the neonate's wellbeing. A total of 150 women who had delivered at a tertiary care hospital fulfilling the inclusion criteria were studied. They were classified into underweight, average weight, overweight according to the BMI noted in the first trimester. 22 women (14.7%) were underweight having BMI less than 18.5 kg/m<sup>2</sup>. 97 women (64.7%) belonged to the average weight group with BMI between 18.5 kg/m<sup>2</sup> to 25 kg/m<sup>2</sup>. 31 women (20.7%) belonged to the overweight group with BMI more than 25 kg/m<sup>2</sup>. In the underweight group, 13 (59.1%) had underweight babies, 9 (40.9%) had appropriate for gestational age babies and there were no large for gestational age babies. In the average weight group, 22 (22.7%) had underweight babies, 72 (74.2%) had appropriate for gestational age babies and 3 (3.1%) had large for gestational age babies. In the overweight group, 6 (19.4%) had underweight babies, 17 (54.8%) had appropriate for gestational age babies while 8 (25.8%) had large for gestational age babies. Correlation of maternal BMI and birth weight of the babies was found to be statistically significant. Underweight mothers had significantly more chance of having a small for gestational age baby as compared to the average weight mothers. Overweight mothers have significantly more chance of having a large for gestational age baby as compared to average weight mothers.

**Keywords:** Maternal Body Mass Index, Birth Weight

## 1. Introduction

Maternal BMI directly or indirectly indicates maternal health and wellbeing. It indicates the nutritional status of the mother. BMI is calculated by dividing weight by height in meters squared<sup>1</sup>. Birth weight of the baby is a mirror of the intrauterine environment, genetics, nutritional, socio-economic and educational status of the mother<sup>2</sup>. Prenatal correction of maternal BMI will help in reducing perinatal morbidity and mortality. Studies have suggested that maternal BMI has an impact on the birth weight of the baby. Maternal BMI is a prenatally modifiable factor. The objective of this study is to determine the correlation between maternal BMI and birth weight of the infant. Decrease in birth weight of the baby results in failure to

thrive, increased rate of infections resulting in increased neonatal mortality<sup>3</sup>. Increase in birth weight of the baby results in increased rate of obstructed labor, instrumental deliveries, caesarean sections etc<sup>4</sup>.

## 2. Methods

150 pregnant women who delivered in this hospital who fulfilled the inclusion and exclusion criteria were inducted in the study.

Inclusion criteria were

- Singleton pregnancy
- Full term birth
- Attendance at ANC clinic in first trimester.

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- Exclusion criteria were
- Preterm delivery
- Still birth
- Any medical disorders complicating pregnancy.

Detailed history of the patient was recorded.

Height of the woman was measured using a measuring tape with the woman standing on level ground without footwear against a wall to the nearest of 0.5 cm. Weight of the woman during 1<sup>st</sup> trimester was taken from her ANC records. The maternal weight and height was used to calculate BMI during 1st trimester.

Weight of the unclothed newborn was taken just after delivery using an electronic weighing scale to the nearest 10 gms. Weight of the placenta was recorded to the nearest 10 gms.

BMI of the mother was grouped as underweight BMI<18.5, average weight- 18.5-25, overweight >25<sup>5</sup>. Baby weight was grouped as low for gestational age <2.5 kg, appropriate for gestational age 2.5-3.6 kg, large for gestational age >3.6 kg<sup>6,7</sup>.

The other parameters that were assessed were the age of the patient, age less than 20 years, age between 21 to 30 years and age more than 30 years. The chronology of pregnancy of the patients was assessed. They were divided into two groups as primigravida and multigravida. Gestational weight gain was assessed. The mode of delivery was assessed. The groups being full term normal delivery, LSCS, operative vaginal delivery and vaginal birth after caesarean section.

The neonatal outcome was assessed based on the birth weight, APGAR score at birth and at 1 minute after birth and the requirement of neonatal ICU care.

The data was analyzed using appropriate statistical tests. Data were statistically described in terms of frequencies (number of cases) and percentages. For comparison of categorical data, Chi square test was performed. A probability value (p value) less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs Microsoft Excel 2007 (Microsoft Corporation, NY, USA) and SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 21.

### 3. Results

14% of the women were less than 20 years, 76% were between 21-30 years while 10% were more than 30 years.

22 women (14.7%) were underweight having BMI less than 18.5 kg/m<sup>2</sup>. 97 women (64.7%) belonged to the average weight group with BMI between 18.5 kg/m<sup>2</sup> to 25 kg/m<sup>2</sup>. 31 women (20.7%) belonged to the overweight group with BMI more than 25 kg/m<sup>2</sup>.

**Table 1.** Correlation of age and BMI

Age(yrs)	underweight	Average weight	overweight
<20	18.17%	16.49%	3.26%
21-30	77.27%	75.26%	77.42%
>30	4.56%	8.25%	19.35%

No statistically significant correlation was found between the age of the patients and BMI. Out of 150 women, 56 (37.3%) were primigravida and (table 1) 94 (62.7%) were multigravida. In women undergoing full term vaginal deliveries, 13.2% were underweight, 66% were average weight, 20.8% were overweight. In women undergoing LSCS, 13.5% were underweight, 67.6% were average weight, 18.9% were overweight. Total 5 women underwent vaginal birth after caesarean section. 60 % were underweight while 40% were average weight. None of the women in overweight category underwent a successful VBAC. 2 women required operative vaginal deliveries. Both of them belonged to the overweight group. Out of the 150 babies, 41 (27.3%) were small for gestational age, 98 (65.3%) were appropriate for gestational age, 11 (7.3%) were large for gestational age. Among the women who had low birth weight babies, 31.7% were underweight, 53.7 % were average weight and 14.6 % were overweight. Among the women who had appropriate for gestational age babies, 9.2% were underweight, 73.5% were average weight while 17.3% were overweight. Among the women who had large for gestational age babies, none were underweight, 27.3% were average weight, 72.7% were overweight.

Correlation of maternal BMI and birth weight of the babies was found to be statistically significant (Table 2, 3). Underweight mothers had significantly more chance of having a small for gestational age baby as compared to the average weight mothers. Overweight mothers have significantly more chance of having a large for gestational age baby as compared to average weight mothers.

13.3% of the total babies who required NICU care were born to underweight mothers. 53.3% of the total babies who required NICU care were born to average

**Table 2.** Correlation of BMI and birth weight of the baby.

	BMI	BMI	BMI	Total
Birth Weight	< 18.5	18.5-25	> 25	
< 2.5	59.1% (13)	22.7% (22)	19.4% (6)	27.3% (41)
2.5-3.6	40.9% (9)	74.2% (72)	54.8% (17)	65.3% (98)
>3.6	0.0% (0)	3.1% (3)	25.8% (8)	7.3% (11)
Total	100.0% (22)	100.0% (97)	100.0% (31)	100.0% (150)
<b>p- value &lt;0.01</b>				

weight mothers while 33.4 % of the babies who required NICU care were born to overweight mothers.

## 4. Discussion

22 women (14.7%) were underweight having BMI less than 18.5 kg/m<sup>2</sup>. 97 women (64.7%) belonged to the average weight group with BMI between 18.5 kg/m<sup>2</sup> to 25 kg/m<sup>2</sup>. 31 women (20.7%) belonged to the overweight group with BMI more than 25 kg/m<sup>2</sup>. Though other studies have divided the obese groups in subcategories, we have included all women with BMI more than 25 in one group.

Correlation of maternal BMI and birth weight of the baby.

**Table 3.** Significance of correlation of maternal BMI and Birth weight of the baby

Study	Significance
Our study	Significant (p<0.01)
S. Singh <i>et al.</i> , <sup>8</sup>	Significant (p<0.02)
Bharpoda NY <i>et al.</i> , <sup>9</sup>	Significant

The results of our study were in agreement with the results of the above studies where correlation of maternal BMI and birth weight of the baby was found to be statistically significant.

A study by Sahu MT *et al.*, found that forty-six women (12.1%) out of 380 were underweight, 99 (26.1%) were overweight, 30 (7.9%) were obese and the remaining 205 (53.9%) had normal BMI. Low birth weight ( $P = 0.008$ ) was significantly present among lean women. Obese women had a significant risk for cesarean delivery ( $P = 0.01$ ) and macrosomia ( $P = 0.02$ )<sup>10</sup>. Two large Chinese studies conducted in Tianjin (n=33,973) and Hebei, Jiangsu, and Zhejiang provinces (n=292,568), respectively, showed that both overweight/obesity and

excessive Gestational Weight Gain (GWG) increased the risks of fetal macrosomia and LGA infants, and both underweight and inadequate GWG were the risk factors for low birthweight and SGA infants<sup>11,12</sup>. Results from a meta-analysis revealed a negative association between pre-pregnancy underweight and offspring overweight/obesity (OR, 0.46; 95% CI, 0.37–0.56;  $P<0.001$ ). In contrast, pre-pregnancy overweight or obesity was associated with an increased risk of offspring overweight/obesity in comparison with subjects with a normal BMI in the meta-analysis (OR, 1.95; 95% CI, 1.77–2.13; and OR, 3.06; 95% CI, 2.68–3.49;  $P<0.001$ )<sup>13</sup>. Macrosomia is the most common complication observed in the study, the incidence being 22% in obese group and 2% in control group. There is increase in incidence by eleven fold<sup>12</sup>.

In our study we found the incidence of vaginal delivery (FTND as well as VBAC) to be more (77.2%) in underweight population as compared to the average weight (74.3%) and the overweight group (71%). In women undergoing full term vaginal deliveries, 13.2% were underweight, 66% were average weight, and 20.8% were overweight. Operative vaginal delivery was required in the overweight group only. The incidence of a successful VBAC was found to be more (23.6%) in the underweight group as compared to the average weight group. (2.1%). A recent study revealed that incidence of instrumental delivery is 14% in obese group and 6% in control group<sup>14</sup>. In our study, we found that 22.7% underwent a LSCS as compared to 25.8% in the average weight group, 22.6% in the overweight group. This is in contradiction to many studies which report an increase in number of caesarean sections in the obese group. In a study by Sharmila G and Sudha M., 32% of obese group underwent cesarean section when compared to 12% of control group<sup>14</sup>. The incidence of cesarean section is 3 times higher in obese group. Institute of medicine guidelines recommend

weight gain of 12.7 kg- 18.1 kg in the underweight group, 11.3-15.9 kg in the average weight group, and 6.8-11.3 kg in the overweight group<sup>15</sup>. However, in the women gaining more than 11 kg, only 18.7% were underweight .in the obese group, only 67.8% women gained less than 11 kg.

## 5. Conclusion

Correlation of maternal BMI and birth weight of the babies was found to be statistically significant. Underweight mothers had significantly more chance of having a small for gestational age baby as compared to the average weight mothers. Overweight mothers have significantly more chance of having a large for gestational age baby as compared to average weight mothers. Overweight mothers had more chance of having an operative vaginal delivery while underweight women had more chance of having a successful VBAC though not statistically significant.

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