ORIGINAL ARTICLE

# Effect of High Prepregnancy Body Mass Index on Pregnancy Outcomes

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## Abstract

**Aim:** To assess the effect of high maternal body mass index (BMI) on complications during pregnancy, mode of delivery, complications of labor and delivery, and postnatal outcomes.

**Materials and methods:** A prospective and comparative observational study was carried out in 350 antenatal women with singleton pregnancy in the first trimester, divided into two groups of 175 each based on BMI, after taking inclusion and exclusion criteria in the OBGY Department of Fortis Escorts Hospital, Faridabad. Patients were divided into two groups: group I – (Control group) BMI less than 25 and group II – (Study group) BMI equal to or more than 25. Maternal and fetal outcomes were studied during pregnancy, at the time of labor, during delivery, and postnatal stay.

**Results:** In comparison with women of BMI less than 25 kg/m$^2$, women with BMI more than 25 kg/m$^2$ faced more risk of gestational hypertension (13.71% in group I and 33.71% in group II), gestational diabetes (8.57% in group I and 26.86% in group II), intrauterine growth restriction (IUGR) (5.71% in group I and 12% in group II), induction of labor (10.06% in group I and 24.42% in group II), nonprogress of labor (NPOL) (4.69% in group I and 17.55% in group II), and cesarean section (24% in group I and 48.57% in group II) with statistically significant increased incidence. In this study, we also found that high maternal BMI along with excessive gestational weight gain (above recommended value) has a statistically significant association with gestational hypertension and gestational diabetes (*p*-value <0.0001).

**Conclusion:** We concluded that there is high prevalence of complications to the mother when the BMI of the mother is more or equal to 25.

**Clinical significance:** The results of this study add to the emerging body of literature on the consequences of mothers being overweight and obese during pregnancy and childbirth.

**Keywords:** Body mass index, Cesarean section, Fetal distress, Gestational hypertension, Intrauterine growth restriction.

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## Introduction

World Health Organization (WHO) said obesity is one of the most obvious but neglected public health problems that threaten to overwhelm both developed and developing countries, it is a deadly disease second only to HIV and malnutrition.[1]

India, like developing countries, is facing a dual burden of nutritional problems, on one hand, they are underweight and undernourished, and on the other hand, there are overweight and obese women. An NFHS-3 survey (2005–2006) conducted in India found that 52% of women had a normal BMI, overweight or obese women accounted for 13%, while 36% of women were malnourished, on the other hand, the number of obese people doubled in the last 10 years according to NFHS-4 survey.[2]

The BMI also known as the Quetelet index, is a heuristic measure of human body fat based on an individual's weight and height. It was devised between 1830 and 1850 by the Belgian mathematician Adolphe Quetelet while advancing social physics.[1]

In India, over 135 million people suffer from obesity. Various studies have found that the prevalence of obesity in women is much higher than in men.[3]

The side effects of obesity on pregnancy are widespread and well-documented in the scientific literature. In addition to maternal and neonatal morbidity and mortality, there is an increased risk of gestational hypertension and gestational diabetes with related risk of iatrogenic preterm birth. Risk during labor includes increased rate of emergency cesarean delivery, postpartum hemorrhage, and labor dystocia. Postpartum complications that appear to be higher in this group are infections, prolonged hospital stay, and re-admission.[4]

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## Materials and Methods

This study is a prospective, observational comparison of 350 antenatal women with singleton pregnancies who attended the Obstetrics and Gynecology OPD at Fortis Escorts Hospital and Research Centre, Faridabad, Haryana, from August 2015 to March 2017, for routine antenatal care in the first trimester.

This study was approved by the Institutional Ethics Committee, and written consent was obtained from all participating antenatal women.

### Inclusion Criteria

Primigravida and second-gravida patients with singleton pregnancy.

### Exclusion Criteria

Multigravida, multifetal gestation, patients with BMI less than 20 (underweight), essential hypertension or family history of hypertension, diabetes mellitus type I and II or any family history of DM, chronic renal disease, any other chronic illness, history of any addiction/smoking/alcoholism, and history of previous LSCS.

### Methods

Detailed history of all patients taken, presenting complaints and history of present illness if any, menstrual history, history of previous surgery/past medical history, family history—especially for high blood pressure, obesity, and diabetes, was asked, general examination was done, weight was measured in kilograms, the patient was weighed without shoes, wearing light clothes and height was measured using a stadiometer, in Frankfurt plane, BMI was calculated by using BMI formula/Quetelet index—weight in kilograms/height in meters square, pregnancy-associated outcomes were studied in each OPD visit of antenatal women by specific investigations like blood pressure measurement to know gestational hypertension, OGTT at 24–28 weeks for gestational diabetes, mode of delivery and labor-related outcomes were studied when the patient came to labor room for delivery, postnatal outcomes were studied during her postnatal stay in hospital and subsequent visits in OPD. After detailed history and examination and after fulfilling the criteria for inclusion in the study, patients were divided into two groups: group I – (control group) BMI less than 25 and group II – (study group) BMI equal to or more than 25.

### Statistical Analysis

Data were statistically analyzed by using the Statistical Package for Social Sciences (SPSS) version 21. Categorical variables were presented in number and percentage (%), and continuous variables were presented as mean ± SD and median. Kolmogorov–Smirnov test is used for testing the normality of data. If the normality is rejected then nonparametric test was used. Quantitative variables were compared using unpaired *t*-test/Mann–Whitney test (when the data sets were not normally distributed) between the two groups. Chi-square test/Fisher's exact test is used for comparing qualitative variables. A *p*-value of <0.05 was considered statistically significant.

## Results

A total of 350 antenatal women were taken for study, which was divided into two groups of 175 each based on their prepregnancy BMI. Group I, which was the control group, had 175 women with BMI <25 kg/m$^2$, and group II, which was the study group, had 175 women with BMI ≥25 kg/m$^2$.

The mean age of patients was 27 years in group I and 30 years in group II. Primigravidas and second gravidas were almost equally distributed in both groups. The mean BMI in group I was 22 kg/m$^2$, and in group II, it was 28 kg/m$^2$.

Out of 350 women who participated in the study, 163 (47%) had excessive gestational weight gain (above recommended range) during pregnancy, patients who have excessive weight gain were mostly from the higher BMI group (78%), while only 15% of patients were from low BMI (<25) group.

Patients who have more weight gain during pregnancy were more prone to gestational diabetes (39% vs 11%) and gestational hypertension (32% vs 5%), as shown in Table 1.

Out of 350 patients, 83 patients developed gestational hypertension in which 14% patients were from group I and 34% patients from group II, *p*-value <0.0001, making the difference statistically significant, as depicted in Table 2 and Figure 1.

**Table 1:** Effect of excessive gestational weight gain on gestational hypertension and gestational diabetes

| | *Excessive gestational weight gain* | | | | |
|---|---|---|---|---|---|
| | *No (n = 187)* | | *Yes (n = 163)* | | |
| | *No.* | *%* | *No.* | *%* | *p-value* |
| Gestational hypertension | | | | | |
| No | 168 | 89.84 | 99 | 60.74 | <0.0001 |
| Yes | 19 | 10.64 | 64 | 39.26 | |
| Gestational diabetes | | | | | |
| No | 177 | 94.65 | 111 | 68.10 | <0.0001 |
| Yes | 10 | 5.35 | 52 | 31.90 | |

**Table 2:** Effect of high BMI on gestational hypertension

| | *Group I* | | *Group II* | | *Total* | | |
|---|---|---|---|---|---|---|---|
| | *No.* | *%* | *No.* | *%* | *No.* | *%* | *p-value* |
| Gestational hypertension | | | | | | | |
| No | 151 | 86.29 | 116 | 66.29 | 267 | 76.29 | <0.0001 |
| Yes | 24 | 13.71 | 59 | 33.71 | 83 | 23.71 | |
| Total | 175 | 100 | 175 | 100 | 350 | 100 | |

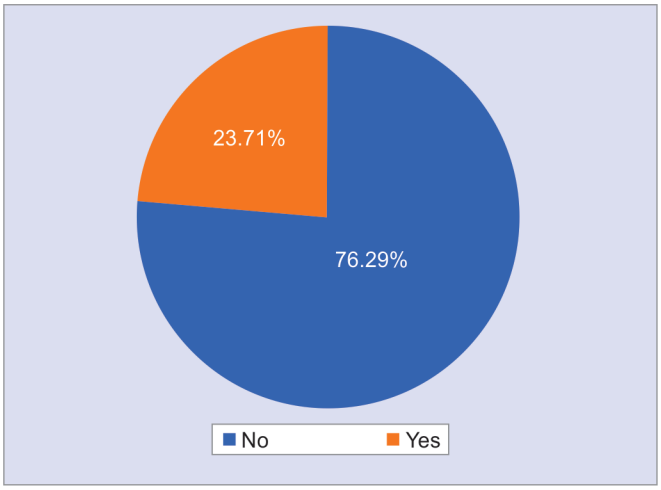


**Fig. 1:** Incidence of gestational hypertension

Out of 350 patients, 62 patients had gestational diabetes, of which 9% were from group I and 27% were from group II. The difference was statistically significant with *p*-value <0.0001, as shown in Table 3 and Figure 2.

Intrauterine growth restriction was more in higher BMI group (12% vs 6%). *p*-value was 0.039, so the difference was statistically significant, as demonstrated in Table 4.

Out of 350 patients, preterm deliveries occurred in 46 (13.14%) patients, but no statistically significant difference between the two groups. *p*-value was 0.114, as shown in Figure 3.

The incidence of post-term pregnancy and malpresentation was almost the same in both groups, the need for induction was more in higher BMI group (24% vs 10%, $p = 0.002$). The average duration of labor in group I was 7.66 hours, and in group II, it was 10.41 hours.

Out of 280 patients, 30 (10.71%) went into NPOL, of which 5% patients were from group I and 18% patients were from group II. The results were statistically significant with *p*-value of 0.001, as charted in Table 5.

**Table 3:** Effect of high BMI on gestational diabetes

| | *Group I* | | *Group II* | | *Total* | | |
|---|---|---|---|---|---|---|---|
| | *No.* | *%* | *No.* | *%* | *No.* | *%* | *p-value* |
| Gestational diabetes | | | | | | | |
| No | 160 | 91.43 | 128 | 73.14 | 288 | 82.29 | <0.0001 |
| Yes | 15 | 8.57 | 47 | 26.86 | 62 | 17.71 | |
| Total | 175 | 100 | 175 | 100 | 350 | 100 | |

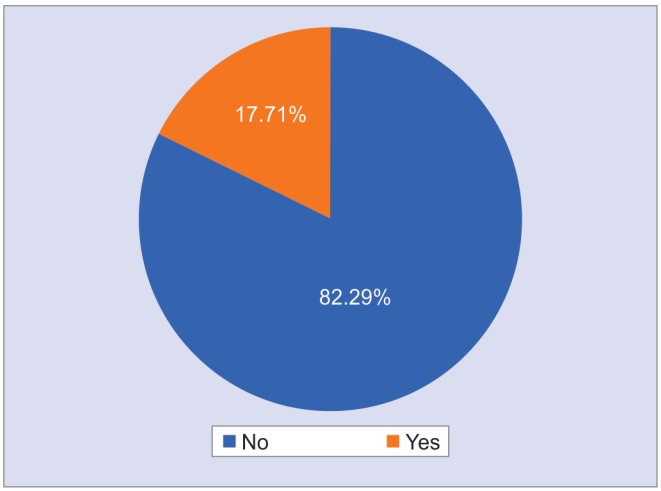


**Fig. 2:** Incidence of gestational diabetes

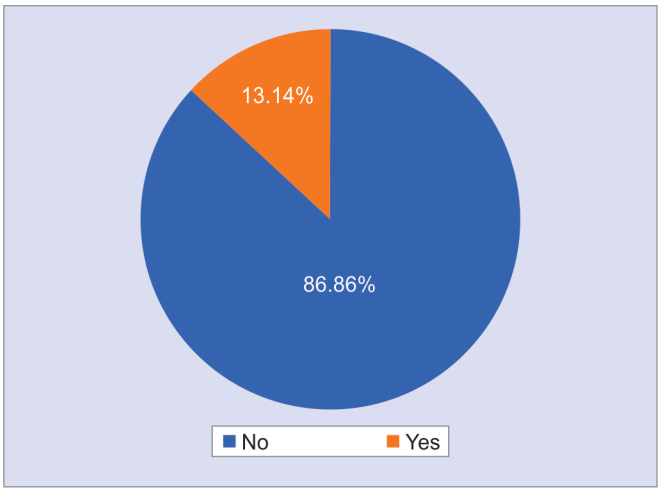


**Fig. 3:** Incidence of preterm deliveries

**Table 4:** Effect of high BMI on IUGR

| | *Group I* | | *Group II* | | *Total* | | |
|---|---|---|---|---|---|---|---|
| | *No.* | *%* | *No.* | *%* | *No.* | *%* | *p-value* |
| IUGR | | | | | | | |
| No | 165 | 94.29 | 154 | 88 | 319 | 91.14 | 0.039 |
| Yes | 10 | 5.71 | 21 | 12 | 31 | 8.86 | |
| Total | 175 | 100 | 175 | 100 | 350 | 100 | |

**Table 5:** Effect of high BMI on progress of labor

| | *Group I* | | *Group II* | | *Total* | | |
|---|---|---|---|---|---|---|---|
| | *No.* | *%* | *No.* | *%* | *No.* | *%* | *p-value* |
| Progress of labor | | | | | | | |
| Nonprogress | 7 | 4.69 | 23 | 17.55 | 30 | 10.71 | 0.001 |
| Progress | 142 | 95.30 | 108 | 82.44 | 250 | 89.28 | |
| Total | 149 | 100 | 131 | 100 | 280 | 100 | |

The risk of fetal distress during labor was also higher in obese group, but *p*-value not significant. The cesarean section rate in the study group was 49%, which was significantly higher than the 24% cesarean section rate observed in the control group. The incidence of instrumental delivery was more in higher BMI group (6% compared with 2% in the control group).

We did not find statistically significant differences in the incidence of PPH, episiotomy/surgical-site infection, postpartum endometritis, and febrile morbidity.

## Discussion

In our study, we found that apart from prepregnancy high BMI, if women put on excessive gestational weight gain (above recommended value), it causes statistically significant increased incidence of gestational hypertension and gestational diabetes, our results were similar to Baugh et al.[5] confidence interval (1.205–1.534) and Robitaille,[6] who found that excessive gestational weight gain was associated with increased risk of gestational diabetes mellitus with *p*-value of <0.001 and OR 1.40 (95% confidence interval 1.21–1.61).

Now, if we discuss about our main topic, the effect of high (prepregnancy) BMI on antenatal women, the risk of gestational hypertension was more in patients with increased BMI and the results were statistically significant. Similar results were seen by Dasgupta et al.,[7] who reported that the overall incidence of hypertensive disorder was more in the higher BMI group.

Also, the risk of gestational diabetes was more in obese group with statistically significant difference. Our results were similar to Dasgupta et al.[7] In their study, the risk of GDM increased with increase in BMI ($p$ <0.05).

Intrauterine growth restriction was also found to be more in group II. The difference was statistically significant with a *p*-value of 0.039. Our results corroborated with the findings of Radulescu et al.[8] in which the frequency of IUGR was 41.08% in BMI <40 and 50% in BMI >40 groups.

In our study, preterm deliveries were more in group II. But the results were not statistically significant with *p*-value of 0.114. Likewise, Athukorala et al.[9] also could not find statistically significant incidence of preterm deliveries.

Mothers reaching beyond term were 1.71% in both the groups, *p*-value was 1, so the results were not statistically significant. Similarly, Yazdani et al.[10] also found the same in their study.

In this study, the incidence of malpresentation was 9.14% in group I and 10.29% in group II. The difference was statistically insignificant with $p = 0.718$. Our results were comparable with Sheiner et al.[11] who also reported higher rate of malpresentation in the obese patients. Need for induction was more in higher BMI group with a statistically significant difference and the most common indication for induction was preeclampsia.

Nonprogress of *labor* was more in group II and the difference was statistically significant with *p* value of 0.0002. Similar results were seen in the study by Athukorala et al.[9] who demonstrated that more number of overweight and obese women required a cesarean section for NPOL.

Fetal distress was seen more in group II, but the difference was statistically not significant with *p*-value of 0.104. Similarly, Cedergren[12] found increased risk of fetal distress in the morbidly obese.

In our study, 2.29% patients of group I and 5.71% patients of group II had instrumental deliveries, the overall incidence was 4%. Cesarean section was done in 24% cases of group I and 48.57% cases of group II, the overall incidence was 36.29%. The most common indication for cesarean sections in group II was NPOL and in group I was fetal distress.

Our results were comparable to Dasgupta et al.,[7] who found that the overall incidence of instrumental delivery was 18.9%. Incidence in morbidly obese was 37.5%, 27.1% in obese patients, and 11% in normal weight group. The results were statistically significant with *p*-value of <0.05.

In our study, 4% patients had PPH in group I, while 8.57% patients had PPH in group II, although the incidence was more, but the results were not statistically significant ($p = 0.078$). Butwick et al.[13] also showed that compared with normal BMI women, the odds of hemorrhage were modestly increased for overweight women.

About 3.43% patients had wound infection in group I and 8.57% patients had wound infection in group II. Although the incidence was high, but *p* value was not significant ($p = 0.072$), similar results were shown by Yazdani et al.[10]

In this study, the results were not statistically significant for endometritis and febrile morbidity, similar results were shown by Myles et al.[14] and De Paiva et al.,[15] respectively.

## Conclusion

From this study, it can be concluded that maternal complication rates are high when BMI is 25 or higher.

Statistically significant incidence of gestational hypertension, gestational diabetes, IUGR, need for induction, NPOL, and cesarean section was found in women of BMI ≥25.

Incidence of preterm delivery, malpresentation, fetal distress, postpartum hemorrhage, wound sepsis, endometritis, and febrile morbidity was more in BMI ≥25 group, however, the results were not statistically significant.

The incidence of post-term pregnancies was the same in both groups.

Along with prepregnancy high BMI, excessive gestational weight gain has also statistically significant association with gestational hypertension and gestational diabetes.

### Clinical Significance

We should educate all pregnant and nonpregnant women about the feto-maternal complications arising due to higher BMI like gestational hypertension, preeclampsia, eclampsia, gestational diabetes, postoperative wound infection, endometritis, febrile morbidity to the mother and prematurity, and IUGR to the fetus.

The schedule of antenatal visits should be adjusted according to the severity of obesity, and frequency of visits should be increased, particularly in the third trimester, due to the risk of preeclampsia and undetected growth restriction.

Nutritional counseling and exercise encouragement should be done.

Appropriate precautions and experienced obstetricians and pediatricians should be available during labor in obese women, as increased risk of intrapartum and perinatal complications in these women.

Last, in order to prevent obesity, it is necessary to start changing lifestyle and eating habits from an early age as primary prevention.

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Permission from Ethical committee and Research committee of the Escorts Hospital was taken.

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