EFFECT OF EARLY PREGNANCY BODY MASS INDEX ON PREGNANCY OUTCOMES IN WOMEN DELIVERING SINGLETON BABIES- AN OBSERVATIONAL STUDY

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ABSTRACT

BACKGROUND
Maternal overweight/obesity causes many complications during pregnancy and delivery. It can also increase neonatal and infant morbidity and mortality. BMI is an important measure of under/overweight. This observational study examines the correlation between maternal Body Mass Index (BMI) with maternal outcome in women.

MATERIALS AND METHODS
This study was conducted at Department of Obstetrics and Gynaecology, Government Medical College, Kottayam, Kerala, for a period of one year. A sample of 300 pregnant women with intrauterine pregnancy of gestational age <12 weeks at first visit was taken for this study with an age between 18 and 35 years with singleton pregnancy. BMI of these women were calculated and they were classified into two categories (BMI <23 kg/m² and BMI ≥23 kg/m²). The Chi-square test was done to find the association of BMI and various maternal outcomes.

RESULTS
In the sample of 300 pregnant women, 39% were having BMI <23 kg/m² and 61% were having BMI ≥23 kg/m². Pregnant women with BMI ≥23 kg/m² were found to have significantly increased risk of developing gestational hypertension, gestational diabetes and macrosomia. We found that a significantly increased need of induction and increased risk of developing intra partum and postpartum complications in those with BMI ≥23 kg/m². Our study also found out that an increased incidence of elective as well as emergency caesareans and increased risk of neonatal complications in women whose BMI ≥23 kg/m².

CONCLUSION
Adverse maternal and perinatal outcomes are significantly related to extremes of BMI categories and least complications were seen in normal BMI group. Therefore, it is ideal to reduce the body weight to an optimal level so that the complications, which are attributed to overweight and obesity can be reduced. We recommended future research on the association of BMI and maternal outcomes involving large samples comparable to those done in developed countries.

KEYWORDS
Body Mass Index, Overweight, Obesity, Mode of Delivery, Gestational Hypertension, Gestational Diabetes Mellitus.


BACKGROUND
The increased risk of serious health consequences that encompass metabolic and cardiovascular complications due to overweight and obesity has emerged as an important health concern all over the world. According to World Health Organisation (WHO) more than 1.9 billion adults and 41 million children are overweight or obese across the world. As the occurrence of obesity has risen worldwide, the rate of overweight and obesity among pregnant women has also shown an increasing trend.¹ Maternal overweight and obesity increase the risks of complications during pregnancy and delivery. It also increases neonatal and infant morbidity and mortality.²,³ In India, the epidemic of overweight and obesity is seen alongside continuing problems of under-nutrition creating a double burden.⁴,⁵ Body Mass Index (BMI) is an universal method of classifying obesity. BMI is the ratio of the body mass (weight in kilograms) to the square of the body height (meters).

In previous researches, the relationship between maternal height and weight with pregnancy complications was widely explored. However, in recent times, BMI is widely accepted as a better measure of over or underweight.⁶ Various studies are conducted in developed world using BMI, but very limited studies only conducted in developing nations.
to explore the correlation between the maternal BMI and pregnancy outcomes. In order to fill the above-mentioned research gap, the present study was conducted to examine the correlation between the maternal BMI with maternal and perinatal outcomes.

**OBJECTIVE**
To study the correlation between maternal overweight and obesity with pregnancy outcomes including Gestational Diabetes Mellitus (GDM), Gestational Hypertension (GHTN), amniotic fluid volume, intrapartum complications, instrumental delivery, birth weight, NICU admission.

**MATERIALS AND METHODS**
This study was an observational study conducted at the Department of Obstetrics and Gynaecology (OB-GYN), Government Medical College, Kottayam. The study protocol was approved by the Regional Committee for Medical Research Ethics. The period of study was for one year from July 2014 to July 2014. Information was collected from 300 women with singleton term pregnancies who were in early pregnancy (on or before 12 weeks of pregnancy). All the participants were informed about this research and written consents were obtained from each participant.

**Inclusion Criteria**
Women admitted to the Department of OB-GYN who meets the following inclusion criteria were selected for the study.
- Intrauterine pregnancy of gestational age <12 weeks at first visit.
- Maternal age between 18 and 35 years.
- Singleton pregnancy.

**Exclusion Criteria**
Pregnant women with the following conditions were excluded from our study.
- History of diabetes or any drug intake known to cause insulin resistance.
- History of thyroid or pituitary disorders.
- Other co-morbid conditions.
- Metabolic and inherited disorders.

Important anthropometric details were recorded from the patients using a standard questionnaire. Newborn baby weight was taken at the time of birth without any clothes. To avoid interobserver and instrumental bias, all measurements were taken by the same measuring instrument/scale and by same person.

**Statistical Analysis**
The BMI of pregnant women in the sample was calculated by using the formula in equation 1.

\[
BMI = \frac{\text{Weight in Kilograms}}{\text{Height in Meter}^2} \quad (1)
\]

According to the ministry of health guidelines in India, people with BMI between 18-22.9 kg/m² fall in normal weight group. People are overweight if the BMI is between 23-24.9 kg/m² and obese if they have a BMI ≥25 kg/m². We followed this categorisation of BMI and based on that we categorised women into two groups- women with BMI <23 kg/m² and women with BMI ≥23 kg/m². We calculated the descriptive statistics of the sample population and Chi-square test was carried out to study the association of BMI and pregnancy outcomes.

**RESULTS**
In the sample of 300 women, 184 women (61.3%) had BMI ≥23 kg/m² and 116 women (38.7%) were with a BMI <23 kg/m² (Figure 1). Out of the total population, 60% were nulliparous and 40% were multiparous (Figure 2).

![Figure 1. Distribution of BMI of Sample Population](image1.png)

![Figure 2. Parity of the Sample Population](image2.png)

Table 1 to 8 shows the association of BMI with various pregnancy outcomes. The descriptive statistics show that in obese group, GDM, GHTN-induced labour, Lower Segment Caesarean Section (LSCS)/instrumental delivery, intrapartum and postpartum complications, neonatal complications were higher.
BMI Classification (kg/m²) | GDM    | Without GDM | P value
|-------------------------|--------|-------------|--------
| ≥23                     | 54     | 130         | 0.000***
| <23                     | 3      | 113         | 19     | 81     |

**Table 1. Association of GDM with Body Mass Index**

***Significant at 0.01, odds ratio (95% CI)- 15.6 (4.8-51.4).

The occurrence of GDM is significantly more in group with BMI ≥23 kg/m². The odds ratio indicates that when compared to normal BMI group (BMI >23 kg/m²) risk of developing GDM 15.6 times more in overweight or obese group (Table 1).

BMI Classification (kg/m²) | GHTN    | Without GHTN | P value
|--------------------------|---------|---------------|--------
| ≥23                      | 43      | 141           | 0.000***
| <23                      | 6       | 110           | 118    | 251    |

**Table 2. Association of GHTN with Body Mass Index**

***Significant at 0.01, odds ratio (95% CI)- 5.6 (2.3-13.6).

There is significant increase in the incidence of GHTN in overweight or obese group than normal weight group. Women who are overweight or obese have 5.6 times more risk of developing GHTN than normal weight group (Table 2).

BMI Classification (kg/m²) | Induced    | Spontaneous | P value
|---------------------------|------------|-------------|--------
| ≥23                       | 120        | 64          | 0.000***
| <23                       | 51         | 65          | 56     |
| Total                     | 171        | 129         | 43     |

**Table 3. Association of Onset of Labour with Body Mass Index**

***Significant at 0.01, odds ratio (95% CI)- 2.4 (1.5-3.8).

Table 3 results show that the onset of labour has significant association with BMI ≥23 kg/m². The chance of labour being induced is 2.4 times more in pregnant women with BMI ≥23 kg/m².

BMI Classification (kg/m²) | LSCS/Instrumental | Normal | P value
|---------------------------|-------------------|--------|--------
| ≥23                       | 80                | 104    | 56.5   | 0.000***
| <23                       | 19                | 97     | 83.6   |
| Total                     | 99                | 201    | 67     |

**Table 4. Association of Mode of Delivery with Body Mass Index**

***Significant at 0.01, odds ratio (95% CI)- 3.9 (2.2-6.4).

Pregnant women with high BMI (≥23 kg/m²) are at increased risk of undergoing abnormal delivery, which includes caesarean or instrumental delivery. Odds ratio of 3.9 indicates 3.9 times increased risk of abnormal labour in overweight or obese pregnant women than those who are with BMI >23 kg/m² (Table 4).

BMI Classification (kg/m²) | Complications | Without Complications | P value
|---------------------------|---------------|-----------------------|--------
| ≥23                       | 15            | 169                   | 0.048**
| <23                       | 3             | 113                   | 97.4   |
| Total                     | 18            | 282                   | 94     |

**Table 5. Association of Intrapartum and Postpartum Complications with Body Mass Index**

**Significant at 0.05, odds ratio (95% CI)- 3.4 (0.9-11.8).
Intrapartum and postpartum complications are more significant in overweight/obese pregnant women (Table 5). Risks of such complications are 3.4 times more in group with BMI ≥23 kg/m².

<table>
<thead>
<tr>
<th>BMI Classification (kg/m²)</th>
<th>Neonatal Complications</th>
<th>Without Neonatal Complications</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
<td>Frequency</td>
</tr>
<tr>
<td>≥23</td>
<td>9</td>
<td>4.9</td>
<td>175</td>
</tr>
<tr>
<td>&lt;23</td>
<td>1</td>
<td>0.9</td>
<td>115</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>3.3</td>
<td>290</td>
</tr>
</tbody>
</table>

Table 6. Association of Neonatal Complications with Body Mass Index

Neonatal complications are higher in overweight or obese group. However, there is no statistical significant different between two groups (Table 6).

<table>
<thead>
<tr>
<th>BMI Classification (kg/m²)</th>
<th>Baby Weight (3.5 kg and above)</th>
<th>Baby Weight (up to 3.5 kg)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
<td>Frequency</td>
</tr>
<tr>
<td>≥23</td>
<td>55</td>
<td>29.9</td>
<td>129</td>
</tr>
<tr>
<td>&lt;23</td>
<td>2</td>
<td>1.7</td>
<td>114</td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
<td>19</td>
<td>243</td>
</tr>
</tbody>
</table>

Table 7. Association of Baby Weight with Body Mass Index

***Significant at 0.01, odds ratio (95% CI)- 24.3 (5.8-101.8).

Our study reveals that there is significant increase in body weight of babies of women who are overweight or obese (Table 7). Odd ratio of 24.3 indicates that there is 24.3 times chance of increase in baby weight over 3.5 kg when maternal BMI is ≥23 kg/m².

<table>
<thead>
<tr>
<th>BMI Classification (kg/m²)</th>
<th>Preterm</th>
<th>Term</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
<td>Frequency</td>
</tr>
<tr>
<td>≥23</td>
<td>15</td>
<td>8.2</td>
<td>169</td>
</tr>
<tr>
<td>&lt;23</td>
<td>6</td>
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<td>110</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>7</td>
<td>279</td>
</tr>
</tbody>
</table>

Table 8. Association of Gestational Age of Delivery with Body Mass Index

We found out no significant association between the BMI and gestational age (Table 8).

DISCUSSION

Overweight and obesity during pregnancy is an important and increasing risk factor for GDM development. GDM is associated with obstetric complications affecting health outcomes of both mother and neonate. These complications include macrosomia, caesarean delivery, shoulder dystocia and birth trauma, preeclampsia, etc. Our study also showed a similar trend. In our study, the occurrence of GDM is significantly higher in group with BMI ≥23 kg/m².

Over the world, the Hypertensive Disorders of Pregnancy (HDP), including GTHN remains as a leading cause of maternal and perinatal mortality and morbidity. Several studies indicate that HDP are more likely to develop in women who have greater BMI. Our study gave a significant association between high BMI and development of GTHN. O’Brien et al demonstrated a consistently strong association between maternal pre-pregnancy BMI and risk of preeclampsia. The risk of preeclampsia typically doubled with each 5-7 kg/m² of increase in pre-pregnancy BMI.

Our results supported previous studies regarding increased incidence of Caesarean Section (CS) in cases of increased maternal BMI. In the current study, there were 80 patients who delivered by CS were in group with BMI ≥23 kg/m² (43.5%), while 19 women (33%) who delivered by CS were in group with BMI <23 kg/m². The increased incidence of CS among obese women may be attributed to increased soft tissue in maternal pelvis in cases of obese women.

Maternal obesity is a risk factor for a range of intrapartum and postpartum complications. Intrapartum risks include increased rates of emergency CS, labour dystocia and postpartum haemorrhage. Postpartum complications in overweight/obese include infection, thromboembolism as well as prolonged hospital stay and/or hospital readmission. Although, a vast research shows the increase in complications in overweight/obese pregnant women. There is sufficiently less information regarding the causes for these complications. The intrapartum and postpartum complications were higher in group with BMI ≥23 kg/m² in our study also.

CONCLUSION

Our research investigated the association between maternal overweight/obesity and adverse pregnancy outcomes including GDM, GTHN, amniotic fluid volume, intrapartum complications, instrumental delivery, birth weight and NICU.
admission. We used Chi-square test to estimate the association of BMI and maternal outcomes. Our study proved that increase in BMI during pregnancy will result many maternal and foetal complications. Our study recommends to reduce body weight before conception, ideally to BMI <23 kg/m². Therefore, it is ideal to reduce the body weight to an optimal level so that the complications which are attributed to overweight and obesity can be reduced. There is also a need to develop guidelines on attaining normal BMI to optimise pregnancy and neonatal outcomes. Necessary counselling must be provided to pregnant women regarding the importance of having a normal BMI (<23 kg/m²). We recommended further studies involving large samples comparable to those done in Western countries.

REFERENCES