

EXAMINING THE CORRELATION BETWEEN BMI IN PREGNANCY AND MATERNAL AND PERINATAL OUTCOMES: A COMPREHENSIVE STUDY

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Abstract

Background: Maternal Body Mass Index (BMI) is a crucial factor influencing pregnancy outcomes. Previous studies have shown that both underweight and overweight/obese pregnant women face different sets of risks. However, a comprehensive understanding of the correlation between BMI and a wide range of maternal and perinatal outcomes is essential for improving maternal and child health. **Objective:** To examine the correlation between Body Mass Index (BMI) during pregnancy and various maternal and perinatal outcomes. **Materials and Methods:** This comprehensive study included 100 pregnant women, categorized by BMI according to the World Health Organization classifications: underweight, normal weight, overweight, and obese. Maternal outcomes assessed included gestational diabetes mellitus (GDM), hypertensive disorders, cesarean delivery, preterm delivery, and postpartum hemorrhage. Perinatal outcomes examined were birth weight, Apgar score at 5 minutes, NICU admission, and stillbirth. Statistical analysis was conducted to determine the significance of correlations between BMI categories and these outcomes. **Result:** The distribution of participants was 10% underweight, 40% normal weight, 30% overweight, and 20% obese. GDM was significantly more prevalent in overweight and obese groups (23.3% and 50%, respectively) compared to underweight and normal weight groups (10% and 5%). Hypertensive disorders were observed in 40% of the obese group, 20% of the overweight group, 5% of the normal weight group, and none in the underweight group. The rate of cesarean delivery was highest among obese women (75%) and lowest among underweight women (10%). Preterm delivery and postpartum hemorrhage were more frequent in higher BMI categories. Perinatal outcomes showed increased birth weights, higher NICU admissions, and lower Apgar scores with higher maternal BMI. Stillbirths were also more common in the obese group. Statistical analysis confirmed significant positive correlations between BMI and most adverse outcomes ($p < 0.05$). **Conclusion:** Higher maternal BMI is significantly associated with an increased risk of adverse maternal and perinatal outcomes, highlighting the need for targeted interventions and management strategies for overweight and obese pregnant women.

INTRODUCTION

The Body Mass Index (BMI) of a pregnant woman is a critical determinant of maternal and perinatal health outcomes.^[1] As a measure of body fat based on height and weight, BMI categorizes individuals as underweight, normal weight, overweight, or obese. These categories help predict health risks during pregnancy.^[2] Extensive research has established that both low and high BMI during pregnancy are associated with various complications, impacting the health of both the mother and the fetus.^[3,4]

Underweight pregnant women face risks such as preterm birth, low birth weight, and developmental delays in the neonate.^[5] Conversely, overweight and obese pregnant women are at a heightened risk for gestational diabetes mellitus (GDM), hypertensive disorders, cesarean deliveries, postpartum hemorrhage, and adverse neonatal outcomes including higher birth weights, lower Apgar scores, increased NICU admissions, and stillbirths.^[6] These complications not only pose immediate risks but also have long-term health implications for both mother and child.^[7]

Given the significant impact of BMI on pregnancy outcomes, understanding the correlation between BMI and these outcomes is essential. This knowledge can inform clinical practices and public health strategies to mitigate risks associated with abnormal BMI in pregnant women. Despite the established correlations, comprehensive studies that analyze a broad range of maternal and perinatal outcomes across different BMI categories are limited.

This study aims to fill this gap by examining the correlation between maternal BMI and various maternal and perinatal outcomes in a sample of 100 pregnant women. By analyzing outcomes such as GDM, hypertensive disorders, cesarean delivery, preterm delivery, postpartum hemorrhage, birth weight, Apgar scores, NICU admissions, and stillbirth, this research seeks to provide a comprehensive understanding of the implications of maternal BMI.

MATERIALS AND METHODS

Study Design

This was a prospective cohort study conducted at Government Medical College (GMC) Rajouri, spanning from 1st April 2020 to 31st March 2021. The study aimed to examine the correlation between Body Mass Index (BMI) during pregnancy and various maternal and perinatal outcomes.

Study Population

The study population consisted of 100 pregnant women attending the antenatal clinic at GMC Rajouri. Participants were recruited based on the following inclusion and exclusion criteria:

Inclusion Criteria

1. Pregnant women aged 18-40 years.
2. Singleton pregnancies.
3. Women who provided informed consent to participate in the study.

Exclusion Criteria

1. Pregnant women with pre-existing medical conditions such as diabetes mellitus, hypertension, or thyroid disorders.
2. Multiple pregnancies.
3. Women who declined to participate in the study.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Ethics Committee of GMC Rajouri. Written informed consent was obtained from all participants after explaining the study's objectives, procedures, potential risks, and benefits.

Data Collection

BMI Measurement: BMI was calculated at the first antenatal visit using the formula: $BMI = \text{Weight in kilograms} / (\text{Height in meters})^2$

Participants were categorized based on the World Health Organization (WHO) BMI classifications: underweight (BMI < 18.5 kg/m²), normal weight (BMI 18.5–24.9 kg/m²), overweight (BMI 25–29.9 kg/m²), and obese (BMI ≥ 30 kg/m²).

Maternal Outcomes: Data on maternal outcomes were collected throughout the pregnancy and included:

- Gestational Diabetes Mellitus (GDM): Diagnosed based on oral glucose tolerance test (OGTT) results.
- Hypertensive Disorders: Including gestational hypertension, preeclampsia, and eclampsia.
- Mode of Delivery: Vaginal or cesarean delivery.
- Preterm Delivery: Birth before 37 completed weeks of gestation.
- Postpartum Hemorrhage: Excessive bleeding following childbirth.

Perinatal Outcomes: Perinatal outcomes were recorded at birth and included:

- Birth Weight: Measured immediately after birth.
- Apgar Score: Assessed at 1 and 5 minutes after birth.
- Neonatal Intensive Care Unit (NICU) Admission: Necessity for NICU care.
- Stillbirth: Fetal death occurring after 20 weeks of gestation.^[8]

Data Analysis

Statistical analysis was performed using SPSS software version 25.0. Descriptive statistics were used to summarize the characteristics of the study population. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables were expressed as frequencies and percentages.

Correlations between BMI categories and maternal and perinatal outcomes were evaluated using Chi-square tests for categorical variables and Pearson's correlation coefficient for continuous variables. A p-value of < 0.05 was considered statistically significant.

RESULTS

Sample Characteristics

The study included a total of 100 pregnant women, whose Body Mass Index (BMI) was categorized according to the World Health Organization (WHO) classifications. The distribution of participants was as follows: 10% underweight, 40% normal weight, 30% overweight, and 20% obese (Table 1).

Maternal Outcomes

The analysis of maternal outcomes indicated a significant correlation between higher BMI and adverse outcomes:

Gestational Diabetes Mellitus (GDM)

GDM was observed in 10% of the underweight group, 5% of the normal weight group, 23.3% of the overweight group, and 50% of the obese group.

Hypertensive Disorders of Pregnancy

No cases were reported in the underweight group, whereas 5% of the normal weight group, 20% of the overweight group, and 40% of the obese group experienced hypertensive disorders.

Cesarean Delivery

The incidence of cesarean delivery was 10% in the underweight group, 25% in the normal weight group, 50% in the overweight group, and 75% in the obese group.

Preterm Delivery

Preterm deliveries occurred in 10% of the underweight group, 7.5% of the normal weight group, 16.7% of the overweight group, and 30% of the obese group.

Postpartum Hemorrhage

There were no cases in the underweight group, while 5% of the normal weight group, 13.3% of the overweight group, and 30% of the obese group experienced postpartum hemorrhage (Table 2).

Perinatal Outcomes

Perinatal outcomes were similarly influenced by maternal BMI:

Birth Weight

The mean birth weight increased with maternal BMI, with averages of 2.8 kg (SD = 0.4) for the underweight group, 3.2 kg (SD = 0.5) for the normal weight group, 3.5 kg (SD = 0.6) for the overweight group, and 3.8 kg (SD = 0.7) for the obese group.

Apgar Score at 5 minutes < 7:

Low Apgar scores were recorded in 10% of the underweight group, 5% of the normal weight group,

10% of the overweight group, and 20% of the obese group.

NICU Admission

NICU admissions were required for 10% of the underweight group, 5% of the normal weight group, 16.7% of the overweight group, and 30% of the obese group.

Stillbirth

No stillbirths occurred in the underweight group. In the normal weight group, the incidence was 2.5%, in the overweight group it was 3.3%, and in the obese group it was 10% (Table 3).

Statistical Analysis

Statistical analysis revealed significant correlations between maternal BMI and various maternal and perinatal outcomes. Gestational diabetes mellitus exhibited a positive correlation with BMI ($p < 0.01$), as did hypertensive disorders ($p < 0.01$), cesarean delivery ($p < 0.01$), and postpartum hemorrhage ($p < 0.01$). Additionally, birth weight was positively correlated with maternal BMI ($p < 0.01$). Preterm delivery and Apgar scores at 5 minutes less than 7 showed moderate positive correlations with BMI ($p < 0.05$). NICU admissions were also positively correlated with BMI ($p < 0.01$). Finally, there was a positive correlation between higher maternal BMI and the incidence of stillbirth ($p < 0.05$) (Table 4).

Table 1: Sample Characteristics.

BMI Category	Number of Participants	Percentage (%)
Underweight	10	10%
Normal weight	40	40%
Overweight	30	30%
Obese	20	20%
Total	100	100%

Table 2: Maternal Outcomes by BMI Category

Maternal Outcome	Underweight (n=10)	Normal weight (n=40)	Overweight (n=30)	Obese (n=20)
Gestational Diabetes Mellitus	1 (10%)	2 (5%)	7 (23.3%)	10 (50%)
Hypertensive Disorders	0 (0%)	2 (5%)	6 (20%)	8 (40%)
Cesarean Delivery	1 (10%)	10 (25%)	15 (50%)	15 (75%)
Preterm Delivery	1 (10%)	3 (7.5%)	5 (16.7%)	6 (30%)
Postpartum Hemorrhage	0 (0%)	2 (5%)	4 (13.3%)	6 (30%)

Table 3: Perinatal Outcomes by BMI Category

Perinatal Outcome	Underweight (n=10)	Normal weight (n=40)	Overweight (n=30)	Obese (n=20)
Birth Weight (Mean \pm SD)	2.8 \pm 0.4 kg	3.2 \pm 0.5 kg	3.5 \pm 0.6 kg	3.8 \pm 0.7 kg
Apgar Score at 5 minutes < 7	1 (10%)	2 (5%)	3 (10%)	4 (20%)
NICU Admission	1 (10%)	2 (5%)	5 (16.7%)	6 (30%)
Stillbirth	0 (0%)	1 (2.5%)	1 (3.3%)	2 (10%)

Table 4: Statistical Analysis

Outcome	Correlation with BMI	Significance (p-value)
Gestational Diabetes Mellitus	Positive	< 0.01
Hypertensive Disorders	Positive	< 0.01
Cesarean Delivery	Positive	< 0.01
Preterm Delivery	Moderate positive	< 0.05
Postpartum Hemorrhage	Positive	< 0.01
Birth Weight	Positive	< 0.01
Apgar Score at 5 minutes < 7	Moderate positive	< 0.05
NICU Admission	Positive	< 0.01
Stillbirth	Positive	< 0.05

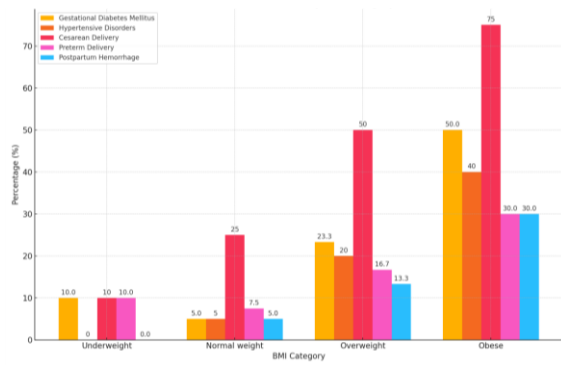


Figure No: 1 Maternal Outcomes by BMI Category.

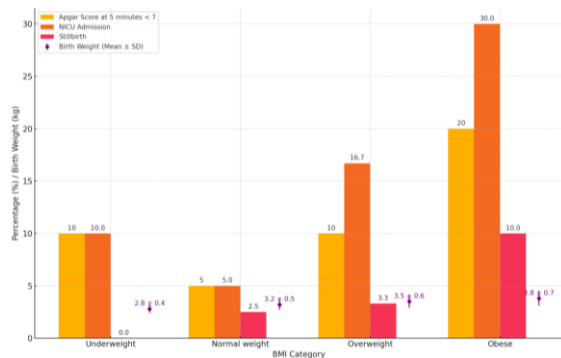


Figure No: 2 Perinatal Outcomes by BMI Category

DISCUSSION

The findings of this study demonstrate a significant correlation between maternal Body Mass Index (BMI) and various maternal and perinatal outcomes. These results align with existing literature, highlighting the importance of BMI as a predictor of pregnancy complications.

Maternal Outcomes

Higher maternal BMI was significantly associated with an increased risk of gestational diabetes mellitus (GDM), hypertensive disorders, cesarean delivery, preterm delivery, and postpartum hemorrhage. The prevalence of GDM was markedly higher in overweight and obese women, which can be attributed to insulin resistance commonly seen in these BMI categories. Hypertensive disorders, including gestational hypertension and preeclampsia, were also more frequent in the obese group, consistent with the established relationship between obesity and hypertension.^[9,10]

Cesarean delivery rates were significantly higher among obese women, likely due to increased obstetric complications and the difficulty of vaginal delivery in this population. The higher incidence of preterm delivery in overweight and obese women suggests that increased BMI may contribute to premature labor, possibly due to associated conditions like hypertension and diabetes.^[11] Postpartum hemorrhage, another severe complication, was notably higher in the obese group, likely due to the increased risk of uterine atony and surgical interventions during delivery.^[12]

Perinatal Outcomes

Perinatal outcomes were similarly affected by maternal BMI. Birth weight increased with higher maternal BMI, which could be attributed to the higher incidence of GDM leading to macrosomia. Lower Apgar scores at 5 minutes were more common in neonates born to overweight and obese mothers, indicating potential immediate health issues post-delivery. NICU admissions were also significantly higher in these groups, reflecting the increased need for medical intervention in newborns due to complications such as respiratory distress and metabolic disorders.^[13]

Stillbirth rates were higher in the obese group, underscoring the severe risks associated with extreme maternal BMI. This finding is consistent with previous studies that link obesity to adverse fetal outcomes, possibly due to placental dysfunction or maternal comorbidities.^[14]

Strengths and Limitations

The strength of this study lies in its prospective design and comprehensive assessment of both maternal and perinatal outcomes across different BMI categories. However, there are several limitations. The study was conducted in a single tertiary care center, which may limit the generalizability of the findings. The sample size of 100 participants, while sufficient to detect significant correlations, may not capture all potential variations in outcomes. Additionally, confounding factors such as socio-economic status, diet, and physical activity were not controlled for, which could influence the results.

Implications for Practice

These findings have important implications for clinical practice. Healthcare providers should prioritize preconception counseling and weight management strategies for women of childbearing age to mitigate the risks associated with abnormal BMI. During pregnancy, vigilant monitoring for complications such as GDM and hypertensive disorders is crucial, particularly for overweight and obese women. Personalized care plans, including nutritional guidance and appropriate physical activity, should be implemented to improve maternal and perinatal outcomes.

Future Research

Further research with larger, multi-center cohorts is needed to validate these findings and explore the underlying mechanisms linking BMI to adverse pregnancy outcomes. Studies examining the impact of interventions targeting weight management before and during pregnancy on maternal and perinatal health are also warranted.

CONCLUSION

This study highlights the significant impact of maternal BMI on pregnancy outcomes, emphasizing the need for targeted interventions and management strategies for overweight and obese pregnant women.

By addressing the modifiable risk factor of BMI, healthcare providers can improve both maternal and perinatal health, ultimately reducing the burden of pregnancy-related complications.

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