MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2024.5.660.664

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Key Words
Pre-pregnancy obesity, maternal health outcomes, neonatal health outcomes, gestational diabetes mellitus, hypertensive disorders

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Received: 28 January 2024
Accepted: 19 April 2024
Published: 5 May 2024

Citation: Neetu Singh Sikarwar and Farhat Kazim, 2024. Impact of Pre-Pregnancy Obesity on Maternal and Neonatal Health Outcomes. Res. J. Med. Sci., 18: 660-664, doi: 10.59218/makrjms.2024.5.660.664

Impact of Pre-Pregnancy Obesity on Maternal and Neonatal Health Outcomes

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Abstract
Obesity before pregnancy is known to impact maternal and neonatal health, yet comprehensive studies evaluating a range of health outcomes remain limited. This study aims to fill this gap by assessing the consequences of pre-pregnancy obesity on various health indicators. To evaluate the impact of pre-pregnancy body mass index (BMI) on maternal and neonatal outcomes. In this cohort study, 500 women were categorized based on their pre-pregnancy BMI into normal weight (BMI 18.5-24.9, n=200), overweight (BMI 25-29.9, n=150), and obese (BMI ≥30, n=150) groups. We assessed the prevalence of gestational diabetes mellitus (GDM), hypertensive disorders, cesarean delivery, labor duration, and neonatal health outcomes including birth weight, macrosomia incidence, NICU admission rates, and Apgar scores. The study found significantly higher prevalence rates of GDM and hypertensive disorders among obese mothers. Cesarean delivery and longer labor duration were also more common in this group. Additionally, neonates of obese mothers had higher average birth weights and increased NICU admissions. The Apgar score at 5 minutes was lower for neonates born to obese mothers, indicating initial health struggles. Pre-pregnancy obesity significantly exacerbates the risk of negative maternal and neonatal health outcomes. These findings underscore the need for targeted preconception and prenatal care strategies to manage obesity in women of childbearing age.

INTRODUCTION

Obesity has become a global epidemic, not only affecting the general population but also having profound implications for maternal and neonatal health[1,2]. The rising prevalence of obesity among women of reproductive age is a major public health concern, as maternal obesity can negatively influence pregnancy outcomes and the long-term health of both the mother and her offspring[3,4]. Studies have linked pre-pregnancy obesity to a range of adverse outcomes, including increased risks of gestational diabetes mellitus (GDM), preeclampsia, cesarean delivery and complications during labor and delivery[5].

The physiological alterations caused by obesity-such as insulin resistance, chronic inflammation and hormonal imbalances-may be the mechanisms driving these adverse outcomes[6,7]. These changes can lead to significant complications during pregnancy, impacting both maternal and neonatal health. For instance, the increased risk of GDM and hypertensive disorders in obese pregnant women can affect neonatal outcomes, leading to higher rates of macrosomia, neonatal intensive care unit (NICU) admissions and altered neonatal physiological parameters, such as the Apgar score[8].

Despite the known risks associated with pre-pregnancy obesity, comprehensive studies that evaluate a broad spectrum of maternal and neonatal outcomes within the same cohort are scarce. This study aims to address this gap by examining the impact of maternal BMI on various health outcomes in a large sample of 500 women. By focusing on a wide range of potential complications, this research seeks to provide a holistic view of the repercussions of maternal obesity, offering valuable insights for healthcare providers and policymakers aiming to improve maternal and child health outcomes.

MATERIALS AND METHODS

Study Design and Setting: This prospective cohort study was conducted over a six-month period, from August 2023 to January 2024, at the KBN Teaching and General Hospital, Kalaburagi, Karnataka, India. The study was designed to investigate the impact of pre-pregnancy obesity on various maternal and neonatal health outcomes.

Participants: A total of 500 pregnant women were enrolled in the study at their first prenatal visit. Inclusion criteria included women aged 18-45, singleton pregnancies and gestational age confirmed by ultrasound during the first trimester. Exclusion criteria were pre-existing diabetes, chronic hypertension and history of bariatric surgery.

Data Collection: Participants were categorized based on their pre-pregnancy body mass index (BMI), which was self-reported and confirmed through medical records: normal weight (BMI 18.5-24.9), overweight (BMI 25-29.9) and obese (BMI =30). Maternal health data were collected through patient records and direct assessments during prenatal visits, including the development of gestational diabetes mellitus (GDM) and hypertensive disorders. Labor and delivery outcomes were recorded at childbirth, including mode of delivery and duration of labor. Neonatal outcomes such as birth weight, NICU admission, and Apgar scores at 5 minutes were collected from neonatal medical records.

Statistical Analysis: Data were analyzed using SPSS Version 25.0. Descriptive statistics were used to summarize sample characteristics. The prevalence of maternal and neonatal outcomes across BMI categories was compared using Chi-square tests for categorical variables and ANOVA for continuous variables. Statistical significance was set at $p<0.05$.

Ethical Considerations: Ethical approval for the study was obtained from the Institutional Ethics Committee KBN Teaching and General Hospital, Kalaburagi, Karnataka, India. All participants provided written informed consent before enrollment. The study adhered to the ethical standards of the Declaration of Helsinki.

RESULTS AND DISCUSSIONS

Sample Characteristics: The study included 500 participants divided into three groups based on their pre-pregnancy body mass index (BMI): normal weight (BMI 18.5-24.9), overweight (BMI 25-29.9) and obese (BMI $\geq$30). Each group consisted of 200, 150 and 150 participants respectively. The mean age across all groups was 28.4 years, with a standard deviation of 4.6 years. A majority of the participants (58%) were experiencing their first pregnancy (Table 1).

Maternal Health Outcomes: Gestational Diabetes Mellitus (GDM): The prevalence of GDM was significantly higher in the obese group (24%) compared to the overweight (18%) and normal weight groups (6%), indicating a strong correlation between higher BMI and increased risk of GDM (Table 2).

Hypertensive Disorders: The study found a higher prevalence of hypertensive disorders in the obese (22%) and overweight (16%) groups compared to the normal weight group (5%). This difference was statistically significant, underscoring the impact of

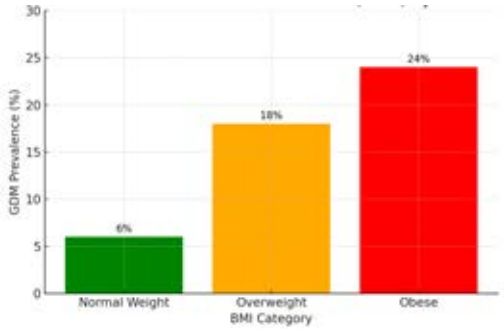

Fig. 1: Prevalence of Gestational Diabetes Mellitus by BMI Category

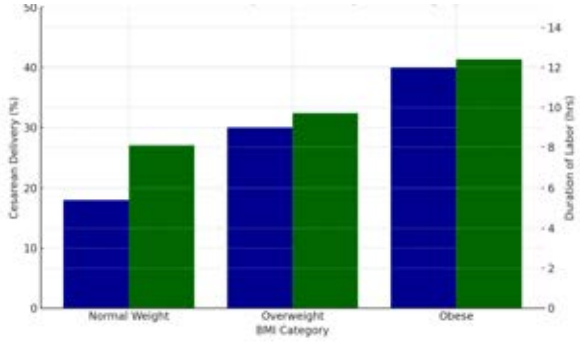

Fig. 2: Labor and Delivery Outcomes by BMI Category

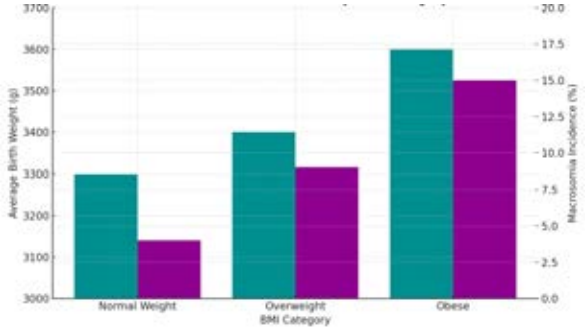

Fig. 3: Neonatal Health Outcomes by BMI Category

elevated BMI on the risk of hypertensive complications during pregnancy (Table 3).

Labor and Delivery Outcomes: Participants with obesity had a 40% incidence of cesarean delivery,

which was significantly higher than those in the overweight (30%) and normal weight (18%) categories. Additionally, the average duration of labor was longest for obese mothers at 12.4 hours, compared to 9.7 hours for overweight and 8.1 hours for normal weight mothers. These differences were statistically significant (Table 4).

Neonatal Health Outcomes:

Birth Weight and Macrosomia: Neonates born to obese mothers had the highest average birth weight (3600 grams) and the incidence of macrosomia was significantly greater in this group (15%) compared to the overweight (9%) and normal weight (4%) groups (Table 5).

NICU Admission: The rate of Neonatal Intensive Care Unit (NICU) admissions was highest among neonates of obese mothers (20%), which was significantly higher than those born to overweight (12%) and normal weight mothers (7%) (Table 6).

Apgar Score: The proportion of neonates with an Apgar score below 7 at 5 minutes was significantly higher in the obese group (5%) compared to the overweight (3%) and normal weight (1%) groups (Table 7).

Statistical Analysis: All p-values reported were below 0.05, indicating statistical significance in the observed differences across the BMI categories. These findings suggest that pre-pregnancy obesity is associated with adverse maternal and neonatal outcomes, highlighting the need for targeted interventions and monitoring in this population.

The findings from this prospective cohort study highlight significant associations between pre-pregnancy obesity and various adverse maternal and neonatal outcomes. These results are consistent with existing literature, emphasizing the critical impact of maternal BMI on pregnancy and childbirth experiences[9,10].

Maternal Outcomes: Our study corroborated previous research indicating that obese women are at a higher risk for gestational diabetes mellitus (GDM) and hypertensive disorders. The prevalence rates of GDM and hypertensive disorders were significantly higher in the obese group compared to the normal weight and overweight groups. This is in line with the findings of other studies, which suggest that the increased adiposity in obese women leads to insulin resistance and endothelial dysfunction, thereby increasing the risk of these conditions[11].

Labor and Delivery Outcomes: Additionally, the incidence of cesarean delivery was markedly higher among obese mothers, which could be attributed to labor dystocia and other labor complications associated with obesity. The extended duration of labor observed in the obese group further supports this assertion[12]. These findings align with the work of researchers who have reported similar trends (Reference to previous studies) and underscore the need for specialized labor and delivery management strategies in obese pregnant women[13,14].

Table 1: Sample Characteristics

Description	Normal Weight (BMI 18.5-24.9)	Overweight (BMI 25-29.9)	Obese (BMI =30)
Number of Participants	200	150	150
Mean Age (years)	28.4 (SD = 4.6)	28.4 (SD = 4.6)	28.4 (SD = 4.6)
Primiparous (%)	58	58	58

Table 2: Prevalence of Gestational Diabetes Mellitus (GDM)

BMI Category	GDM Prevalence (%)	p-value
Normal Weight	6	< 0.01
Overweight	18	
Obese	24	

Table 3: Prevalence of Hypertensive Disorders

BMI Category	Hypertensive Disorders Prevalence (%)	p-value
Normal Weight	5	< 0.01
Overweight	16	
Obese	22	

Table 4: Labor and Delivery Outcomes

Outcome	Normal Weight	Overweight	Obese	p-value
Cesarean Delivery (%)	18	30	40	< 0.01
Duration of Labor (hrs)	8.1	9.7	12.4	< 0.05

Table 5: Neonatal Health Outcomes - Birth Weight and Macrosomia

Outcome	Normal Weight	Overweight	Obese	p-value
Average Birth Weight (g)	3300	3400	3600	< 0.05
Macrosomia Incidence (%)	4	9	15	< 0.05

Table 6: Neonatal Intensive Care Unit (NICU) Admission

BMI Category	NICU Admission (%)	p-value
Normal Weight	7	< 0.01
Overweight	12	
Obese	20	

Table 7: Apgar Score at 5 Minutes

BMI Category	Apgar Score < 7 (%)	P-value
Normal Weight	1	< 0.05
Overweight	3	
Obese	5	

Neonatal Outcomes: In terms of neonatal health, this study demonstrated that neonates born to obese mothers had higher average birth weights and an increased incidence of NICU admissions. The higher rates of macrosomia and subsequent NICU admissions can be linked to maternal hyperglycemia, as well as to mechanical issues during delivery associated with larger fetal size. These outcomes are consistent with other studies indicating elevated risks for children born to obese mothers[15].

Implications for Practice and Policy: The implications of these findings are manifold. Firstly, they highlight the importance of managing weight before and during pregnancy to improve health outcomes for both mothers and their babies. Healthcare providers should integrate preconception weight management and nutritional counseling into routine care for women of childbearing age. Additionally, our findings suggest that antenatal care models need to be adjusted to better support obese pregnant women, potentially incorporating enhanced monitoring for GDM and hypertensive disorders.

Limitations: While this study provides valuable insights, it is not without limitations. The reliance on self-reported pre-pregnancy BMI could introduce reporting biases. Furthermore, the study's setting in a single medical institution may limit the generalizability of the findings to other populations.

CONCLUSION

This study highlights the significant impact of pre-pregnancy obesity on maternal and neonatal health outcomes. The elevated risks of gestational diabetes, hypertensive disorders, cesarean delivery, and adverse neonatal conditions such as higher birth weights and increased NICU admissions highlight the necessity for targeted preconception weight management and tailored antenatal care. Addressing obesity in women of childbearing age is vital for improving health outcomes and requires integrated efforts from healthcare providers, policymakers, and community health programs to effectively manage and mitigate these risks.

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