ORIGINAL ARTICLE

Impact of Pre-Pregnancy BMI On Short-Term Maternal and Perinatal Outcomes: A Cross-Sectional Study at Lahore

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ABSTRACT

Objective: To compare short-term maternal and perinatal outcomes in women with normal BMI (<25 kg/m^2) and high BMI (>25 kg/m^2).

Study Design: Analytical cross-sectional study.

Place and Duration of Study: This study was conducted in the Department of Obstetrics and Gynecology at CMH Lahore from April 2023 to February 2024.

Methods: The women's BMI at the first antenatal visit was noted by patient records, and they were categorized first antenatal visit noted from patient records, and they were categorized as having a normal BMI (<25 kg/m^2) and high BMI (>25 kg/m^2). Maternal outcomes considered were pre-eclampsia, gestational hypertension, gestational diabetes, fever, prolonged surgery time, and postpartum hemorrhage. Perinatal outcomes considered were the mode of delivery, gestational age at delivery, duration of labor, APGAR score at 1 minute and 5 minutes, birth weight, birth condition, admission in neonatal ICU, neonatal mortality, and hypoglycemia. For data analysis, SPSS version 26.0 was used. The chi-square test was applied to evaluate the significance of the association between the variables.

Results: Out of 151 women, 102 (67.5%) had normal BMI and 49 (32.5%) had a high BMI on their first antenatal visit. Increased frequency of gestational hypertension (P = 0.021), pre-eclampsia (P = 0.0003), prolonged surgery time (P = 0.022), and macrosomia (P = 0.009) were found to be associated with high pre-pregnancy BMI.

Conclusion: The study emphasizes a strong association between maternal pre-pregnancy BMI with gestational hypertension, pre-eclampsia, birth weight, and surgery time. It also calls attention to the need for increased prenatal and perinatal care so that appropriate protocol can be established for women with high pre-pregnancy BMI.

Keywords: *Body Mass Index, Gestational Hypertension, Perinatal Care, Pre-Eclampsia, Pregnancy Outcomes.*

How to cite this: *Sultan M, Aaien K, Tufail S, Mustafa N, Ahmad J, Tabassum H. Impact of Pre-Pregnancy BMI On Short-Term Maternal and Perinatal Outcomes: A Cross-Sectional Study at Lahore. Life and Science. 2025; 6(1): 28-35. doi: http://doi.org/10.37185/LnS.1.1.844*

Introduction

High Body Mass Index (BMI) has become a major health problem worldwide, and its prevalence has been increasing alarmingly.[1] Nagpal TS et al. categorize BMI in two categories: BMI <25 kg/m^2 and BMI >25kg/m^2.[2] High BMI during pregnancy is among the vital challenges in obstetrics due to the possible unfavorable impacts on the mother and fetus.[3-5] Maternal mortality, pre-eclampsia, gestational diabetes mellitus (GDM), gestational hypertension, and long-term health effects such as the onset of type 2 diabetes are among some of the adverse maternal outcomes.[6,7] The adverse neonatal outcomes include pre-term

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Received: Sep 20, 2024; Revised: Dec 05, 2024
Accepted: Dec 08, 2024

birth, low or increased birth weight, and neonatal mortality.[8,9] The prolonged hospitalization associated with these adverse outcomes can significantly strain healthcare resources. Extended stays require additional medical staff, more intensive care, and greater use of hospital facilities and equipment, all of which increase operational costs. This ripple effect can hinder the overall efficiency and capacity of healthcare institutions, making the management of high BMI in pregnancy not only a clinical challenge but also an economic one.

According to the Society of Obstetricians and Gynecologists of Canada (SOGC) Guideline 391, women with a higher BMI should receive focused prenatal care to lower their chance of having a difficult pregnancy.[10] Women with high BMI need assistance to lower their BMI before pregnancy and minimize gestational weight gain.

There are limited studies in Pakistan that determine the relationship between maternal BMI and adverse pregnancy-related results. The aim of our study was to compare short-term maternal and perinatal outcomes in women with normal BMI (<25 kg/m^2) and high BMI (>25 kg/m^2). Public awareness regarding the topic is necessary, especially in women at risk of poor maternal and neonatal outcomes. Our study highlighted the need for increased prenatal and perinatal care of these patients. It can help plan the appropriate protocol for such patients who present with high BMI.

Methods

The analytical cross-sectional study was conducted in the obstetrics and gynecology department, CMH Lahore, between April 2023 to February 2024 following the acquisition of ethical approval from the Ethical Review Committee (approval number: 722/ERC/ dated: 29-03-2023). The calculated sample size was 151, using the Cochran formula ($n=Z^2p(1-p)/d^2$), having a 5% margin of error and 95% confidence level. Data collection was done using a non-probability consecutive sampling technique.

The study was conducted on pregnant women from low-income bracket (income <50,000 PKR). Pregnant women of any gestational age and having record of pre-pregnancy BMI were included in this study while women with preexisting hypertension and preexisting diabetes mellitus were excluded from the study. Informed verbal consent was taken from participants, ensuring confidentiality. Demographic information of women (age, BMI, parity, previous cesarean section, education and smoking history) along with their comorbidities (hypertension, diabetes, and pre-eclampsia) were noted from patient records. They were categorized as normal BMI and high BMI. Women with BMI less than 25 kg/m^2 were placed in the normal BMI category, while women with BMI equal to or more than 25 kg/m^2 were considered to have a high BMI. The maternal and perinatal outcomes were then observed for these mothers. Maternal outcomes considered were pre-eclampsia, gestational hypertension, gestational diabetes, fever, prolonged surgery time and postpartum hemorrhage. Perinatal outcomes considered were mode of delivery, gestational age at delivery, duration of labor, APGAR score at 1 minute and 5 minutes, birth weight, birth condition, admission in neonatal ICU, neonatal mortality and hypoglycemia. The newborns were followed for 48 hours, and any mortality, as well as prolonged stay (more than 2 days) in the neonatal ICU, were also noted. The collected data was compiled on a specially designed proforma.

For data analysis, SPSS version 26.0 was used. Mean and standard deviation were used for quantitative variables and frequencies and percentages for categorical variables. Chi-square test was applied to evaluate the significance of association between the variables. A *P*-value of less than 0.05 was deemed significant.

Results

This study included 151 women who gave birth at CMH Lahore. The variables characteristic of the participants were analyzed. (Table-1).There were 102 (67.5%) women with normal BMI and

Table-1: Demographic Characteristics of Study Participants (n = 151)

Characteristic		Frequency (%age)
Age	Up to 19 years	2 (1.3)
	20-34 years	129 (85.4)
	35-39 years (advanced)	18 (11.9)
	40-45 years (very advanced)	2 (1.3)
Parity	Primiparous	32 (21.2)
	Para 1	44 (29.1)
	Multiparous (2-3 children)	57 (37.7)
	Multiparous (4 or more children)	18 (11.9)
Previous cesarean section	Yes	69 (45.7)
	No	82 (54.3)
Smoking History	Yes	0
	No	151 (100)
Education	No formal education	12 (7.9)
	Matric/O levels	37 (24.5)
	FSc/FA/A levels	24 (15.9)
	Graduate	49 (32.5)
	Postgraduate	29 (19.2)
BMI on 1st antenatal visit	Normal BMI (<25 kg/m^2)	102 (67.5)
	High BMI (≥25 kg/m^2)	49 (32.5)

Table-2: Association of BMI with maternal outcomes (n = 151)

Maternal outcome		Normal BMI (<25 kg/m^2) n = 102	High BMI (≥25 kg/m^2) n = 49	*Chi-Square* value	*P*-value*
Preeclampsia	Yes	8	15	13.290	0.0003
	No	94	34		
Gestational Diabetes	Yes	19	14	1.916	0.166
	No	83	35		
Gestational Hypertension	Chronic	5	9	7.723	0.021
	Mild	12	7		
	Absent	85	33		
Fever	Yes	27	18	1.667	0.197
	No	75	31		
Postpartum hemorrhage	Yes	26	14	0.161	0.688
	No	76	35		
Prolonged surgery time	Yes	12	13	5.224	0.022
	No	90	36		

**Chi-Square test*

Table-3: Association of BMI with perinatal outcomes (n = 151)

Perinatal outcome		Normal BMI (<25 kg/m²) n = 102	High BMI (≥25 kg/m²) n = 49	*Chi-Square* value	*P*-value*
Mode of delivery	Vaginal	41	16	3.150	0.207
	Forceps Assisted	4	0		
	Cesarean section	57	33		
Gestational age at delivery	Extreme preterm (<28 weeks)	2	0	1.559	0.450
	Preterm (<37 weeks)	10	3		
	Term (≥37 weeks)	90	46		
Duration of laor	More than 3 hr	31	5	8.525	0.074
	Less than 3 hr	16	11		
	Absent	55	33		
Birth weight	<4000g	99	42	6.889	0.009
	>4000g (Macrosomia)	3	7		
APGAR at 1 min	≤7	21	15	1.832	0.176
	>7	81	34		
APGAR at 5 mins	≤7	5	5	1.505	0.220
	>7	97	44		
Birth condition	Live birth	101	46	3.774	0.152
	Stillbirth	0	1		
	Fetal Death	1	2		
Admission in NICU	Yes	16	14	3.452	0.063
	No	86	35		
Neonatal mortality	Yes	1	2	1.635	0.201
	No	101	47		
Neonatal hypoglycemia	Yes	3	0	1.470	0.225
	No	99	49		

**Chi-Square test*

49 (32.5%) women with a high BMI on their first antenatal visit. Majority of the women (85.4%) were aged between 20 to 34 years. Maternal and perinatal outcomes were compared in each of these groups.

Among maternal outcomes (table-2), a significant proportion of women with high BMI (30.6%) experienced the onset of pre-eclampsia in contrast to those with a normal BMI (7.8%) (*P* = 0.0003). 32.7% of women with high BMI and 16.6% of normal BMI women were associated with gestational hypertension (*P* = 0.021). Prolonged surgery time (table-2) was found in 26.5% of women with high BMI as compared to 11.7% of normal BMI women (*P* = 0.022).

Among perinatal outcomes (table-3), 14.3% of women with high BMI delivered macrosomic (>4kg) babies (*P* = 0.009). Macrosomic babies (>4kg) were delivered to 3 (2.9%) out of 102 normal BMI women.

Discussion

In this cross-sectional analytical study, high pre-pregnancy BMI was found to be associated with increased frequency of gestational hypertension

(P = 0.021), pre-eclampsia (P = 0.0003), prolonged surgery time (P = 0.022) and macrosomia (P = 0.009). This study demonstrates that the frequency of women with normal pre-pregnancy BMI (<25 kg/m^2) was 67.5%, while the frequency of women with high pre-pregnancy BMI (≥25 kg/m^2) was 32.5%. Our results are comparable with other studies conducted in Pakistan and Bangladesh, which show an increased trend towards overweight (23.9% and 40.1%) and obesity (6.3% and 21.2%), respectively.[11-13] Studies conducted in US population have shown 4% underweight, 47% normal, and 48% overweight statistics.[14]

Out of 102 women with normal BMI, 23.5% went into spontaneous labor, 23.5% underwent labor induction, and 52.9% delivered through cesarean section. Comparing this with 49 women with high BMI, 26.5% went into spontaneous labor, 6% underwent labor induction, and 67.3% delivered through cesarean section. Kei et al., in 2018, has made observations that women with a high pre-pregnancy BMI were less likely to enter spontaneous labor.[15] In our study, frequencies of spontaneous labor were similar among both groups. However, there was a higher rate of induction of labor in females with a normal BMI. A higher incidence of cesarean section has been observed in our study in women with high BMI as well as women with normal BMI. A possible explanation for this is that high-risk cases like placenta previa, repeated scar pregnancies, and other obstetric-related complications are referred from different medical centers to our tertiary care hospital. Hence, the increased frequency of cesarean sections irrespective of BMI.

Gestational hypertension and pre-eclampsia are common complications that are linked to pre-pregnancy BMI.[16] According to a Chinese study, women who were overweight or obese had 1.92- and 5.06-fold higher risks of pre-eclampsia, respectively, than women with normal BMI.[17] According to a different Chinese study, pregnant women who are overweight have a 2.80-fold increased risk of developing gestational hypertension when compared to pregnant women who are normal weight.[18] These studies support our results where 16.6% of women with normal BMI experienced gestational hypertension and 7.8% of of women with normal BMI experienced pre-eclampsia. Whereas in women with BMI >25 kg/m^2, an increased rate of gestational hypertension (32.7%) and pre-eclampsia (30.6%) was noticed. The results demonstrate that a higher pre-pregnancy BMI is linked with a significantly increased risk of gestational hypertension (P = 0.021) and pre-eclampsia (P = 0.0003).

Gestational diabetes mellitus (GDM) is another chronic condition associated with multiple adverse consequences, including preterm birth, labor induction, instrumental delivery, cesarean delivery, pre-eclampsia, postpartum hemorrhage, stillbirth, neonatal death, macrosomia, neonatal hypoglycemia, poor APGAR score and admission to neonatal ICU. This highlights the importance of prevention of risk factors of gestational diabetes.[19] A Chinese cohort study reveals that the odds ratio in overweight pregnant women was 2.01 times higher suffering GDM compared to normal-weight pregnant women.[18] However, in our study no significant difference was seen in the number of patients developing gestational diabetes (P = 0.166) in both groups. This can be explained by a generally high incidence of GDM in our country (16.7%).[20,21]

There is a higher risk of complication during surgery in women with high BMI and more chances of prolonged labor induction followed by Cesarean Section.[22] In our study, 11.7% of normal BMI women underwent prolonged surgery as compared to 26.5% of women with high BMI. This shows a significant association between pre-pregnancy BMI and prolonged surgery time (P = 0.022).

It has been indicated in several studies that maternal obesity is an independent risk factor for fetal macrosomia.[23] High pre-pregnancy BMI increases the risk of macrosomia.[24] In our study, women with higher BMI (14.3%) had a 7–8-fold higher incidence of macrosomia than women

with normal BMI (2.9%). In a study by Gul et. al, in comparison to other BMI groups, women with normal pre-pregnancy BMI tended to have normal birth weight neonates, while macrosomic babies were observed in women who had a high pre-pregnancy BMI.[25]

High pre-pregnancy BMI was also found to be associated with significantly increased risks of preterm birth (PTB), large for gestational age (LGA), and neonatal ICU (NICU) admission.[26] NICU admissions were seen in 15.6% and 28.5% of women with normal and high BMI, respectively (P = 0.063). Majority of neonates were admitted in NICU for observation due to low APGAR scores, respiratory distress syndrome and hypoglycemia.[20]

Other outcomes such as low APGAR score (P = 0.220), stillbirth (P = 0.152), neonatal hypoglycemia (P = 0.225) and neonatal mortality (P = 0.201) were also studied but no significant difference between both groups was observed.

To avoid the adverse maternal and perinatal outcomes of high BMI, initiatives must be developed and put into practice. The best way to manage BMI is to combine a balanced diet with regular exercise, yet interventions that encourage lifestyle changes to control weight continue to be very difficult to implement. Before conception, women of reproductive age should try to maintain a healthy weight and avoid gaining too much weight throughout the pregnancy. It is imperative to acknowledge preconception as the ideal stage for intervention, and public health strategies can be crucial for intervention with women of reproductive age.

To our knowledge, there are limited studies on this topic in Pakistan. The present study, despite its limitations, managed to gather significant contextual information explaining the difference of maternal and neonatal outcomes associated with pre-pregnancy BMI.

This study was conducted in a tertiary care hospital where more women come from low-income brackets, impeding the acquisition of data from a high-income bracket. In our tertiary care hospital, most of the high-risk cases are transferred from other healthcare centers, which may impact the analysis. It is recommended that similar studies be conducted in Pakistan with a bigger sample size and in more diverse socioeconomic groups. This will help to increase awareness regarding the importance of BMI in relation to pregnancy in women of Pakistan and help them understand the importance and means to have optimum BMI before and during pregnancy to avoid unfavorable outcomes.

Conclusion

Our study calls attention to the need for increased prenatal and perinatal care so that appropriate protocols can be established for women with high pre-pregnancy BMI. According to our research, there is a significant association between a mother's BMI and gestational hypertension, pre-eclampsia, neonatal birth weight, and prolonged surgery time. Women should be targeted for health education and healthy pre-pregnancy BMI for a healthy new generation.

Acknowledgment: None

Conflict of Interest: The authors declare no conflict of interest

Grant Support and Financial Disclosure: None

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Authors Contribution

MS: Idea conception, study designing, data collection, data analysis, results and interpretation, manuscript writing and proofreading

KA: Idea conception, study designing, data collection, data analysis, results and interpretation, manuscript writing and proofreading

ST: Idea conception, study designing, data analysis, results and interpretation, manuscript writing and proofreading

NM: Idea conception, study designing, manuscript writing and proofreading

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HT: Study designing, manuscript writing and proofreading