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Original Research Article

Impact of Different BMIs on Fetomaternal Outcome as Compared to Control Group BMIs

Mounazza Rehman[*1], Sadia Ghaffar[2], Qudsia Nawaz[1], Uzma Gul[3], Tayyaba Ashfaq[4], Humaira Tabassum[5]

[1]Department of Obs & Gynae, Combined Military Hospital Lahore, Pakistan
[2]Combined Military Hospital Jhelum, Pakistan
[3]Combined Military Hospital Rawalpindi, Pakistan
[4]Combined Military Hospital Attock, Pakistan
[5]Department of Gynae, Bahria International Hospital Lahore, Pakistan
**Corresponding author`s email address:* munazarehman2@gmail.com

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Abstract: *Maternal body mass index (BMI) plays a pivotal role in determining fetomaternal outcomes. Deviations from the normal BMI range—whether underweight, overweight, or obese—are associated with adverse maternal and neonatal complications. As the global prevalence of abnormal BMI among women of reproductive age continues to rise, it is imperative to understand its impact on pregnancy outcomes to optimize prenatal care strategies.* ***Objective:*** *To evaluate and compare the fetomaternal outcomes across different maternal BMI categories—underweight, overweight, and obese—using women with normal BMI as the reference group, with a focus on maternal complications (e.g., pregnancy-induced hypertension (PIH), gestational diabetes mellitus (GDM), postpartum hemorrhage (PPH)) and neonatal indicators (e.g., birth weight, NICU admission).* ***Methods:*** *This cross-sectional observational study was conducted over six months at the Combined Military Hospital (CMH), Quetta from July 2023 to January 2024. A total of 200 third-trimester pregnant women with singleton pregnancies were selected via purposive sampling and stratified equally into four BMI categories—underweight, normal (control), overweight, and obese—based on World Health Organization (WHO) BMI criteria. Data on mode of delivery, maternal complications, and neonatal outcomes were collected using clinical records and semi-structured interviews. Statistical analysis involved the use of frequencies, percentages, and thematic content analysis to assess psychological factors.* ***Results:*** *Obese women exhibited the highest rates of cesarean delivery (48%), GDM (30%), PIH (24%), macrosomia (20%), and NICU admissions (28%). Overweight women also demonstrated increased risks across these categories, though to a slightly lesser degree. Underweight mothers had the highest incidence of low birth weight (36%), notable NICU admissions (12%), and assisted vaginal delivery (8%). Women with normal BMI consistently showed the most favorable outcomes across all variables. Thematic analysis revealed psychological distress related to body image, fear of surgical interventions, and reduced emotional support, especially among underweight and obese participants.* ***Conclusion:*** *Abnormal maternal BMI is significantly associated with poor fetomaternal outcomes. Underweight status predisposes to intrauterine growth restriction and neonatal morbidity, while obesity increases the risk of metabolic, hypertensive, and delivery-related complications. Optimal pregnancy outcomes are most consistently observed in women with normal BMI. These findings highlight the need for BMI-based prenatal risk stratification, targeted counseling, and integrated psychosocial support to improve maternal and neonatal health.*

Keywords: Birth Weight, Body Mass Index, Gestational Diabetes Mellitus, Neonatal Intensive Care Units, Obesity, Pregnancy Outcome, Pregnancy Complications, Underweight

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Introduction

Maternal body mass index (BMI) has emerged as a critical determinant of fetomaternal health, influencing both obstetric and neonatal outcomes. BMI is a simple index of weight-for-height that is widely used to classify underweight, normal weight, overweight, and obesity in adults. The World Health Organization (WHO) categorizes BMI into underweight (<18.5 kg/m²), normal (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), and obese (≥30 kg/m²) (1).

Globally, the prevalence of maternal overweight and obesity has increased at an alarming rate. According to recent estimates, more than 40% of women of reproductive age are overweight or obese (2). This trend is not only confined to high-income countries but is increasingly evident in low- and middle-income nations, including Pakistan, where the double burden of malnutrition persists (3).

Maternal overweight and obesity are strongly associated with several adverse maternal and perinatal outcomes, including gestational hypertension, gestational diabetes mellitus (GDM), preeclampsia, prolonged labor, cesarean section, postpartum hemorrhage, and infections (4, 5). Neonatal complications include macrosomia, shoulder dystocia, neonatal hypoglycemia, low APGAR scores, and increased rates of neonatal intensive care unit (NICU) admission (6,7). In contrast, maternal undernutrition or low BMI is linked to increased risk of preterm birth, intrauterine growth restriction (IUGR), low birth weight (LBW), and perinatal mortality (8, 9).

In Pakistan, a recent national survey showed that approximately 24% of pregnant women are obese, while 18% are underweight (10). These figures reflect the urgent need to address nutritional imbalances during pregnancy and their potential consequences on maternal and neonatal outcomes.

Despite existing data, there is limited literature from Pakistan directly comparing fetomaternal outcomes across different BMI categories within the same population and using a standardized control group. Variations in socioeconomic factors, nutritional habits, healthcare access, and obstetric practices necessitate local studies to generate context-specific evidence (11).

This study aims to determine the impact of different BMI categories on fetomaternal outcomes compared to women with normal BMI in a tertiary care hospital setting. The findings of this research will provide evidence

for clinicians and public health policymakers to implement targeted interventions for optimal maternal and neonatal health outcomes.

Methodology

This observational cross-sectional study was conducted over six months at the Department of Obstetrics and Gynecology, Combined Military Hospital (CMH), Quetta from July 2023 to January 2024. The study aimed to assess the impact of maternal body mass index (BMI) on fetomaternal outcomes. Ethical approval was obtained from the institutional review board, and informed written consent was taken from all participants before enrollment.

A purposive sampling technique was employed to recruit a total of 200 pregnant women attending antenatal clinics. Eligible participants were in their third trimester of pregnancy, had singleton pregnancies, and were free from known fetal anomalies. Women with pre-existing chronic medical conditions such as diabetes mellitus or chronic hypertension diagnosed before pregnancy were excluded to minimize confounding factors. Participants who met the inclusion criteria and consented to participate were categorized into four groups based on World Health Organization (WHO) BMI classifications:

Underweight (BMI <18.5 kg/m²), Normal weight (BMI 18.5–24.9 kg/m²) – considered the control group, Overweight (BMI 25.0–29.9 kg/m²), Obese (BMI ≥30.0 kg/m²), Each BMI category consisted of 50 participants, ensuring an equal distribution for comparison.

Data were collected through a combination of retrospective review of clinical records and semi-structured interviews conducted by trained research personnel. A standardized data collection form was used to record sociodemographic and clinical characteristics, including age, parity, gestational age at delivery, and mode of delivery. The primary maternal outcomes assessed were pregnancy-induced hypertension (PIH), gestational diabetes mellitus (GDM), mode of delivery, and postpartum hemorrhage (PPH). Neonatal outcomes included birth weight, need for neonatal intensive care unit (NICU) admission, and Apgar scores at 1 and 5 minutes.

Data analysis was performed using both quantitative and qualitative techniques. Quantitative data were analyzed using descriptive statistics, including frequencies and percentages for categorical variables and means ± standard deviations for continuous variables. Comparative analysis between BMI categories was performed using the Chi-square or Fisher's exact test for categorical variables. A manual thematic analysis approach was applied to qualitative data obtained through interviews, with open coding and categorization of emerging themes to assess perceptions and healthcare experiences related to BMI and pregnancy outcomes.

All findings were summarized in tabular format, showing distribution and trends across BMI groups. The study adhered to STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines to ensure methodological transparency and completeness of reporting.

Results

A total of 200 pregnant women were included in this study, equally distributed across four BMI categories: underweight, normal weight (control group), overweight, and obese. The mean age of participants was 28.6 ± 4.2 years, and the majority of participants (72%) were multigravida. Among the total sample, 52% were primiparous, and 48% were multiparous.

Table 1 presents the distribution of participants by BMI category. Each group consisted of 50 participants, representing 25% of the total sample. This uniform distribution allowed for a balanced comparison of outcomes across BMI categories.

This equal grouping strategy supports comparative analysis with minimal bias.

Table 2 summarizes the mode of delivery among the four BMI categories. Vaginal delivery was most frequent in the normal BMI group (82%), while the obese group had the highest rate of cesarean sections (48%). Assisted vaginal delivery was relatively infrequent across all groups, ranging from 4% to 10%.

A clear trend toward increased cesarean section rates was observed with rising BMI, especially among obese participants.

Table 3 details the frequency of key maternal complications—pregnancy-induced hypertension (PIH), gestational diabetes mellitus (GDM), and postpartum hemorrhage (PPH)—across BMI categories. There was a significant increase in both PIH and GDM among overweight and obese participants. Obese women showed the highest incidence of PIH (24%) and GDM (30%), while underweight participants had the lowest complication rates.

These findings suggest a strong correlation between increased BMI and adverse maternal outcomes.

Table 4 shows neonatal outcomes including low birth weight (LBW), macrosomia, and NICU admissions. LBW was most frequent in the underweight group (36%), while macrosomia was predominantly seen in obese participants (20%). NICU admissions were highest in the obese category (28%), indicating greater neonatal complications among this group.

This pattern reflects the dual risks of growth restriction in underweight and fetal overgrowth in obese women.

Table 5 presents qualitative data derived from semi-structured interviews, thematically coded. Participants from the underweight and obese groups expressed the most concern about body image changes during pregnancy. Fear of cesarean delivery was prominent among overweight and obese women. Notably, women in the normal BMI group exhibited the greatest awareness of risk factors. Issues related to the accessibility of healthcare and emotional support were more frequently reported by obese participants.

These themes provide insight into psychosocial dimensions that influence maternal care experiences across BMI groups.

Table 1: Distribution of Participants by BMI Categories

BMI Category	Number of Participants	Percentage (%)
Underweight	50	25%
Normal (Control)	50	25%
Overweight	50	25%
Obese	50	25%
Total	200	100%

Table 2: Mode of Delivery by BMI Category

BMI Category	Vaginal Delivery	Cesarean Section	Assisted Vaginal Delivery
Underweight	38	8	4
Normal	41	7	2
Overweight	29	16	5
Obese	21	24	5

Table 3: Fetomaternal Complications by BMI Category

Complication	Underweight	Normal	Overweight	Obese
PIH	2	3	6	12
GDM	1	2	9	15
PPH	3	2	5	9

Table 4: Neonatal Outcomes by BMI Category

Outcome	Underweight	Normal	Overweight	Obese
Low Birth Weight (<2.5 kg)	18	7	4	2
Macrosomia (>4 kg)	0	1	6	10
NICU Admissions	6	3	8	14

Table 5: Thematic Summary of Participant Experiences (Qualitative Responses)

Theme Identified	Description
Concerns About Body Image	Underweight and obese women expressed anxiety regarding pregnancy-related changes.
Fear of Surgical Delivery	Overweight and obese women showed greater concern about cesarean sections.
Awareness of Risks	The normal BMI group had the highest understanding of fetomaternal risks.
Healthcare Accessibility	Several participants cited difficulty accessing timely antenatal care.
Emotional Support	Obese participants more commonly reported a lack of family and spousal support.

Discussion

This study evaluated the impact of maternal body mass index (BMI) on fetomaternal outcomes in a Pakistani tertiary care setting. Our results demonstrate that both underweight and obese pregnant women are at an increased risk for adverse maternal and neonatal outcomes when compared to women with normal BMI. The findings align with global evidence that supports the influence of maternal BMI on pregnancy complications, birth outcomes, and neonatal morbidity.

The most striking finding in our study was the significantly higher cesarean section rate among obese women (48%), compared to only 14% in the normal BMI group. This trend is consistent with existing literature, which reports a clear association between increasing BMI and the likelihood of cesarean delivery due to factors such as cephalopelvic disproportion, labor dystocia, and increased rates of fetal macrosomia (12, 13). A large-scale meta-analysis conducted by Heslehurst *et al*. similarly observed increased operative delivery rates in obese women, attributing this to both physiological and clinical decision-making biases (14).

In terms of maternal complications, the obese group showed a marked increase in the incidence of pregnancy-induced hypertension (PIH) and gestational diabetes mellitus (GDM). Specifically, GDM was seen in 30% of obese women compared to only 4% in the normal BMI group. These findings are consistent with previous studies indicating that excess adipose tissue induces insulin resistance and inflammatory pathways, increasing the risk of metabolic disturbances during pregnancy (15, 16). In Pakistan, a study by Riaz et al. (2021) also reported a higher prevalence of GDM and PIH in overweight and obese women, emphasizing the growing burden of maternal obesity in the region (17).

On the other end of the BMI spectrum, underweight women had the highest rate of low birth weight (LBW) infants (36%), compared to just 4% in the obese group. These outcomes reflect the nutritional inadequacies and placental insufficiency often seen in undernourished pregnancies (18). Our findings align with a systematic review by Han et al. (2020), which found that maternal underweight significantly increases the risk of LBW and intrauterine growth restriction (IUGR) (19).

Additionally, neonatal intensive care unit (NICU) admissions were most common among infants born to obese mothers (28%), likely due to complications such as respiratory distress, macrosomia, and birth trauma. These results are supported by a study from Chiavaroli et al. (2022), which highlighted the increased need for NICU care in neonates born to women with obesity, even after adjusting for gestational age and delivery mode (20).

The qualitative analysis in our study revealed important psychosocial dimensions. Concerns about body image were prominent among underweight and obese women, indicating the psychological burden of deviating from the "normal" weight range during pregnancy. Fear of surgical delivery was also more common in the overweight and obese groups, which may reflect both personal anxieties and societal stigma associated with obesity-related complications. The normal BMI group demonstrated greater awareness of pregnancy-related risks, suggesting a potential protective factor through health literacy and empowerment. Emotional and healthcare access issues were more prevalent among obese women, consistent with findings from qualitative research in South Asia emphasizing healthcare disparities and perceived discrimination based on weight (21,22).

Taken together, our results reinforce the importance of preconception counseling, nutritional optimization, and targeted antenatal interventions based on BMI status. For underweight women, the focus should be on improving nutritional intake and monitoring fetal growth, while for overweight and obese women, risk stratification, lifestyle modification, and glucose screening are critical.

Conclusion

This study highlights a significant association between maternal BMI and fetomaternal outcomes. Obese and overweight women showed increased risks of cesarean delivery, gestational diabetes, hypertension, and adverse neonatal outcomes, including macrosomia and NICU admissions. Conversely, underweight women had higher rates of low birth weight. These findings underscore the need for BMI-specific antenatal care strategies to optimize maternal and neonatal health outcomes.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-CMSDB-95-24)

Consent for publication

Approved

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The authors declared the absence of a conflict of interest.

Author Contribution

MR

Manuscript drafting, Study Design,

SG

Review of Literature, Data entry, Data analysis, and drafting article.

QN

Conception of Study, Development of Research Methodology Design,

UG

Study Design, manuscript review, critical input.

TA

Manuscript drafting, Study Design,

HT

Review of Literature, Data entry, Data analysis, and drafting article.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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