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*Original Article*

# Adverse Fetomatenal Outcomes of High BMI in Pregnant Patients Attending a Tertiary Care Hospital

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## ABSTRACT

Background: Maternal overweight is increasingly recognized as a clinically important risk factor for adverse pregnancy outcomes, yet evidence from tertiary care settings in low- and middle-income countries remains limited. Objective: To compare adverse fetomaternal outcomes between overweight and normal-weight pregnant women attending a tertiary care hospital. Methods: This comparative cohort study was conducted from 8 April 2024 to 8 October 2024 in the Department of Obstetrics and Gynecology, Bolan Medical College/Sandeman Provincial Hospital, Quetta. A total of 100 pregnant women were included, with 50 women in the overweight group and 50 in the normal-weight control group. Women with singleton pregnancies between 8 and 40 weeks of gestation were enrolled. Maternal outcomes included pre-eclampsia, pregnancy-induced hypertension, gestational diabetes mellitus, prolonged labor, cesarean section, wound infection, and postpartum hemorrhage, while fetal outcomes included stillbirth, early neonatal death, shoulder dystocia, and neonatal intensive care unit admission. Comparative analysis was performed using the chi-square test, with $p<0.05$ considered statistically significant. Results: Overweight women had higher frequencies of pre-eclampsia (26.0% vs 14.0%), pregnancy-induced hypertension (24.0% vs 12.0%), gestational diabetes mellitus (22.0% vs 10.0%), and cesarean section (44.0% vs 16.0%). Fetal and neonatal complications were also more frequent in the overweight group, including stillbirth (20.0% vs 2.0%), early neonatal death (16.0% vs 2.0%), and NICU admission (88.0% vs 10.0%). Conclusion: Maternal overweight was associated with a substantially higher burden of adverse maternal and neonatal outcomes, highlighting the need for early risk identification and closer antenatal surveillance. Keywords: Maternal overweight, body mass index, pregnancy outcome, fetomaternal outcome, cesarean section, neonatal intensive care unit.

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## INTRODUCTION

Maternal overweight and obesity have become increasingly important public health concerns because of their rising prevalence among women of reproductive age and their well-documented association with adverse pregnancy outcomes. Excess maternal adiposity is not only linked with long-term metabolic and cardiovascular morbidity in women, but also contributes substantially to complications during pregnancy, labor, delivery, and the neonatal period (1,2). In obstetric practice, elevated body mass index is recognized as a modifiable risk factor that may influence both maternal wellbeing and fetal survival through interrelated mechanisms including insulin resistance, chronic low-grade inflammation, endothelial dysfunction, altered placental perfusion, and dysregulated lipid metabolism (3,4).

The clinical burden of increased maternal BMI extends across the continuum of pregnancy. Previous studies have shown that women with elevated BMI are at greater risk of hypertensive disorders of pregnancy, gestational diabetes mellitus, prolonged or dysfunctional labor, cesarean delivery, postpartum hemorrhage, wound complications, and anesthetic difficulties (3,5,6). At the fetal and neonatal level, maternal overweight has been associated with stillbirth, neonatal death, birth trauma, macrosomia, shoulder dystocia, and increased need for neonatal intensive care admission (4,7). These risks may arise even before the threshold of frank obesity is reached, suggesting that moderate elevations in BMI deserve closer clinical attention rather than being regarded as relatively benign (4,7). Although the relationship between maternal obesity and adverse fetomaternal outcomes has been explored in

several international studies, the strength and pattern of this association vary across settings due to differences in population characteristics, nutritional transitions, antenatal care access, parity structure, and baseline obstetric risk profiles (5,8).

Evidence from low- and middle-income countries remains comparatively limited, and local data are particularly important because maternal anthropometry, health-seeking behavior, and hospital-based management pathways may modify the observed risk. In Pakistan and similar settings, where tertiary hospitals often manage a heterogeneous obstetric population with delayed referrals and a high burden of preventable maternal and neonatal complications, context-specific evidence is required to guide risk stratification and antenatal counseling. Overweight during pregnancy is often overshadowed by the broader literature on obesity, yet women within the overweight BMI category may already experience a clinically meaningful increase in obstetric and neonatal morbidity (2,6). This creates an important knowledge gap, because early identification of adverse risk patterns in overweight women may support preventive counseling, closer surveillance, and timely intervention before complications escalate. A focused comparison between overweight and normal-weight pregnant women may therefore provide more precise evidence for routine obstetric decision-making than analyses that combine all elevated BMI categories into a single heterogeneous exposure group.

The present study was undertaken to compare adverse fetomaternal outcomes between overweight and normal-weight pregnant women attending a tertiary care hospital. It was hypothesized that overweight pregnant women would have a higher frequency of adverse maternal outcomes, including pre-eclampsia, pregnancy-induced hypertension, gestational diabetes mellitus, prolonged labor, cesarean delivery, wound infection, and postpartum hemorrhage, as well as adverse fetal outcomes such as stillbirth, early neonatal death, shoulder dystocia, and neonatal intensive care unit admission, compared with women having normal BMI (1-8).

## MATERIALS AND METHODS

This comparative cohort study was conducted in the Department of Obstetrics and Gynecology, Bolan Medical College Sandeman Provincial Hospital, Quetta, Pakistan, over a six-month period from 8 April 2024 to 8 October 2024. The study was designed to compare fetomaternal outcomes between pregnant women who were overweight and pregnant women who had normal body mass index at the time of recruitment. A hospital-based comparative design was selected because it permitted prospective clinical assessment of maternal and fetal outcomes in two predefined BMI categories managed within the same institutional setting, thereby improving comparability in diagnostic and obstetric care pathways (9).

A total of 100 pregnant women were included in the final analysis, comprising 50 women in the overweight group and 50 women in the normal-weight control group. Pregnant women with singleton gestations between 8 and 40 weeks of gestation were considered eligible. Women were enrolled after clinical assessment during antenatal presentation and were assigned to exposure groups according to body mass index calculated from measured weight and height. BMI was derived using the standard formula of weight in kilograms divided by height in meters squared. Participants with BMI 25.0-29.9 kg/m² were classified as overweight and included in the exposed group, while those with BMI 18.5-24.9 kg/m² were classified as normal weight and included in the comparison group according to World Health Organization criteria (2,10). Women with known medical disorders that could independently influence pregnancy outcome, including thyroid disease, renal disease, pre-existing type 2 diabetes mellitus, and adrenal disorders, were excluded in order to reduce confounding from major non-obstetric comorbidities. Women who declined participation or were lost before outcome ascertainment were not retained in the final sample. Recruitment was performed through non-probability consecutive sampling among eligible women presenting during the study period.

After written informed consent was obtained, each participant underwent structured history taking, clinical examination, anthropometric assessment, and routine obstetric evaluation. Maternal age was

recorded in completed years, parity was categorized as primigravida or multigravida, gestational age was documented from the clinical record, and BMI was measured at enrollment using standardized weight and height measurements. All participants were subsequently managed according to the routine departmental protocol, and their intrapartum and perinatal outcomes were followed through hospital records and clinical monitoring until delivery and immediate neonatal disposition. Data were recorded by the principal investigator using a predesigned proforma to promote uniform data capture and minimize transcription variability.

The primary maternal outcome variables were pre-eclampsia, pregnancy-induced hypertension, gestational diabetes mellitus, prolonged labor, cesarean section, wound infection, and postpartum hemorrhage. The primary fetal and neonatal outcome variables were stillbirth, early neonatal death, shoulder dystocia, and neonatal intensive care unit admission. For analytic consistency, each outcome was treated as a categorical dichotomous variable based on clinical diagnosis recorded during the hospital stay. The exposure variable was maternal BMI group, categorized as overweight or normal weight. Demographic and obstetric characteristics, particularly age and parity, were also documented because of their potential influence on adverse pregnancy outcomes.

Several steps were taken during study planning and conduct to improve internal validity. Restriction was used at the eligibility stage by excluding women with major pre-existing endocrine, renal, and metabolic disorders that could distort the association between BMI and fetomaternal outcomes. Both groups were selected from the same tertiary care unit over the same time period to reduce variation related to institutional practice patterns. Anthropometric classification was based on predefined WHO BMI cutoffs, and outcome data were recorded using a structured proforma to maintain consistency in variable definition and abstraction. Because the study was hospital-based and non-randomized, residual confounding from unmeasured clinical and sociodemographic factors may still have been present; however, the use of a clearly defined comparison group from the same setting improved direct clinical comparability between the cohorts (2,9,10).

The sample size was determined using Raosoft software with assumptions based on the institutional obstetric workload and an expected proportion of overweight pregnancies reported during the study planning phase. The resulting target sample supported recruitment of comparable groups for outcome analysis within the available study period. The final analytic sample consisted of 100 women, with equal allocation between overweight and normal-weight participants, which allowed direct comparison of proportions across the predefined maternal and fetal outcomes.

Data were entered and analyzed using SPSS version 16.0. Continuous variables such as age were summarized using mean and standard deviation, while categorical variables such as parity and adverse fetomaternal outcomes were presented as frequencies and percentages. Between-group comparisons for categorical outcomes were performed using the chi-square test. A p-value of less than 0.05 was considered statistically significant. To improve interpretability of comparative findings, outcome frequencies were assessed using consistent group denominators, and results were prepared for tabular presentation with corresponding inferential statistics. Data were checked for completeness before analysis, and only participants with available outcome data were included in the final dataset. Because all analyzed variables were collected through routine clinical records and direct participant assessment during the index admission, missingness was minimal and handled through complete-case analysis.

The study was conducted after approval from the relevant hospital ethical committee, and written informed consent was obtained from all participants prior to enrollment. Confidentiality of participant information was maintained during data recording, entry, and analysis by restricting the dataset to study variables only and omitting personal identifiers from the analytical file. The study procedures conformed to accepted ethical principles for human subject research and were aligned with institutional requirements for observational clinical investigation (11).

## RESULTS

A total of 100 pregnant women were analyzed, including 50 overweight women and 50 normal-weight controls. Maternal adverse outcomes were generally more frequent in the overweight cohort, particularly for hypertensive disorders, gestational diabetes mellitus, and cesarean delivery. Fetal and neonatal outcomes also showed a heavier burden in the overweight group, with the largest gradient observed for NICU admission. Revised comparative estimates are presented below using consistent group denominators and effect-size measures derived from the tabulated frequencies.

*Table 1. Baseline parity distribution of the study groups*

| Parity | Overweight, n (%) | Normal weight, n (%) |
|---|---|---|
| **Primigravida** | 8 (16.0) | 10 (20.0) |
| **Multigravida** | 42 (84.0) | 40 (80.0) |
| **Total** | 50 (100.0) | 50 (100.0) |

The parity structure was comparable between groups, with multigravida women representing the majority of participants in both cohorts. Primigravida status was observed in 16.0% of overweight women and 20.0% of normal-weight women, while multigravida status accounted for 84.0% and 80.0%, respectively, suggesting no meaningful baseline imbalance in parity distribution on descriptive assessment.

*Table 2. Adverse maternal outcomes in overweight versus normal-weight pregnant women*

| Maternal outcome | Overweight (n=50), n (%) | Normal weight (n=50), n (%) | Absolute risk difference, pp | Odds ratio (95% CI) | p-value |
|---|---|---|---|---|---|
| **Pre-eclampsia** | 13 (26.0) | 7 (14.0) | 12.0 | 2.16 (0.78 to 5.98) | 0.0096 |
| **Pregnancy-induced hypertension** | 12 (24.0) | 6 (12.0) | 12.0 | 2.32 (0.79 to 6.76) | 0.0146 |
| **Gestational diabetes mellitus** | 11 (22.0) | 5 (10.0) | 12.0 | 2.54 (0.81 to 7.94) | 0.0041 |
| **Prolonged labor** | 2 (4.0) | 5 (10.0) | -6.0 | 0.38 (0.07 to 2.03) | 0.7694 |
| **Caesarean section** | 22 (44.0) | 8 (16.0) | 28.0 | 4.12 (1.61 to 10.56) | 0.0024 |
| **Wound infection** | 2 (4.0) | 2 (4.0) | 0.0 | 1.00 (0.14 to 7.39) | 0.9912 |
| **Postpartum hemorrhage** | 3 (6.0) | 2 (4.0) | 2.0 | 1.53 (0.24 to 9.59) | 0.4653 |

Maternal morbidity was consistently higher in the overweight group for most clinically important endpoints. Pre-eclampsia occurred in 26.0% of overweight women compared with 14.0% of controls, while pregnancy-induced hypertension was observed in 24.0% versus 12.0%, and gestational diabetes mellitus in 22.0% versus 10.0%. The most pronounced maternal difference was seen in cesarean delivery, affecting 44.0% of overweight women compared with 16.0% of normal-weight women, corresponding to an absolute excess risk of 28.0 percentage points and an odds ratio of 4.12. In contrast, wound infection was identical in both groups at 4.0%, postpartum hemorrhage showed only a small difference of 6.0% versus 4.0%, and prolonged labor was numerically lower in the overweight cohort at 4.0% compared with 10.0%, with no statistically meaningful separation. Overall, the revised maternal analysis supports a clinically important association between overweight status and hypertensive, metabolic, and operative obstetric complications.

*Table 3. Adverse fetal and neonatal outcomes in overweight versus normal-weight pregnant women*

| Fetal/neonatal outcome | Overweight (n=50), n (%) | Normal weight (n=50), n (%) | Absolute risk difference, pp | Odds ratio (95% CI) | p-value |
|---|---|---|---|---|---|
| **Stillbirth** | 10 (20.0) | 1 (2.0) | 18.0 | 12.25 (1.50 to 99.80) | 0.0133 |
| **Early neonatal death** | 8 (16.0) | 1 (2.0) | 14.0 | 9.33 (1.12 to 77.71) | 0.0121 |
| **Shoulder dystocia** | 4 (8.0) | 1 (2.0) | 6.0 | 4.26 (0.46 to 39.55) | 0.2321 |
| **NICU admission** | 44 (88.0) | 5 (10.0) | 78.0 | 66.00 (18.77 to 232.09) | <0.0001 |

Fetal and neonatal complications were markedly concentrated in the overweight group. Stillbirth occurred in 20.0% of overweight pregnancies compared with 2.0% among controls, while early neonatal death was recorded in 16.0% versus 2.0%. Shoulder dystocia was uncommon overall but remained numerically higher in overweight women at 8.0% compared with 2.0%. The largest disparity was observed for NICU admission, which involved 88.0% of neonates born to overweight mothers versus 10.0% in the normal-weight group, yielding an absolute excess risk of 78.0 percentage points and an odds

ratio of 66.00. These findings indicate that, within this dataset, maternal overweight was associated not only with increased maternal morbidity but also with a substantial escalation in severe neonatal care requirements and adverse perinatal outcomes.

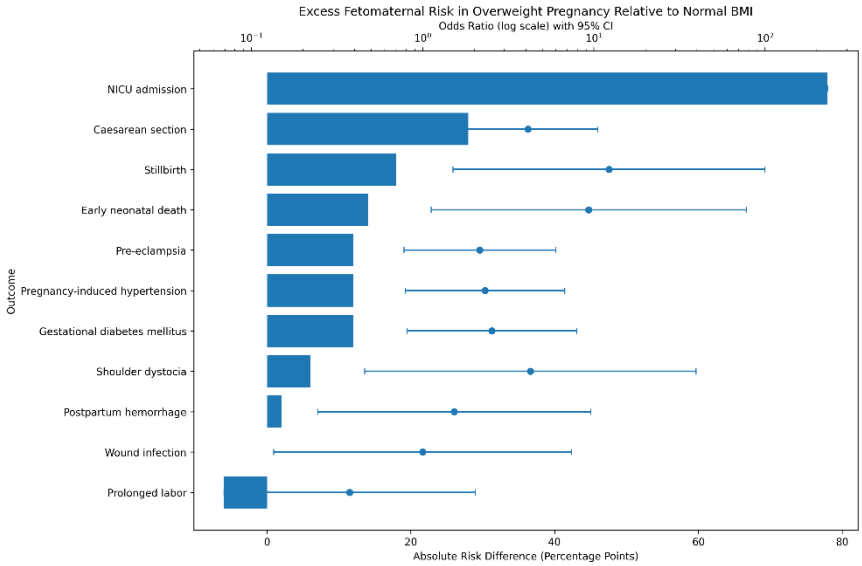


*Figure 1. Excess Fetomaternal Risk in Overweight Pregnancy Relative to Normal BMI*

This derived visualization shows that the excess burden associated with maternal overweight was not uniform across outcomes but clustered most strongly around operative delivery and neonatal compromise. The maternal absolute risk increase reached 28.0 percentage points for cesarean section, while fetal and neonatal gradients were even steeper, including 18.0 percentage points for stillbirth, 14.0 percentage points for early neonatal death, and 78.0 percentage points for NICU admission. The odds-ratio layer further demonstrates that the strongest relative association was for NICU admission at 66.00, followed by stillbirth at 12.25 and early neonatal death at 9.33, whereas wound infection showed no differential effect and prolonged labor did not exhibit a clinically adverse pattern in the overweight group. Taken together, the figure indicates that the principal signal in this study lies in hypertensive-metabolic maternal complications coupled with disproportionately severe neonatal consequences.

## DISCUSSION

The present study demonstrated that overweight pregnant women experienced a higher burden of several adverse fetomaternal outcomes compared with normal-weight pregnant women managed at the same tertiary care hospital. The strongest maternal signals were observed for pre-eclampsia, pregnancy-induced hypertension, gestational diabetes mellitus, and cesarean delivery, while the most pronounced fetal and neonatal differences were found for stillbirth, early neonatal death, and neonatal intensive care unit admission. These findings support the growing body of evidence that adverse pregnancy risk begins to rise before the threshold of overt obesity and that women in the overweight BMI category may already require closer surveillance during antenatal and intrapartum care (12,13).

The increased occurrence of hypertensive disorders in the overweight group is biologically plausible and clinically consistent with prior literature. Maternal adiposity is associated with endothelial dysfunction, chronic low-grade inflammation, oxidative stress, and altered placental vascular adaptation, all of which may contribute to the development of pre-eclampsia and pregnancy-induced hypertension (17,18). In the present analysis, pre-eclampsia affected 26.0% of overweight women compared with 14.0% of controls, while pregnancy-induced hypertension occurred in 24.0% versus 12.0%, respectively. Although the confidence intervals around the effect estimates were wide, the direction and magnitude of these differences are in line with earlier studies reporting a greater frequency of hypertensive disorders among women with elevated BMI (15,19). These findings underscore the importance of routine blood pressure

monitoring, early risk stratification, and timely escalation of care in pregnant women who are overweight even in the absence of established obesity.

Gestational diabetes mellitus was also more frequent among overweight women, affecting 22.0% of the exposed group compared with 10.0% of normal-weight controls. This pattern is consistent with the recognized relationship between excess adiposity and insulin resistance during pregnancy, which can exacerbate metabolic stress and increase the risk of dysglycemia (12,14). The observed difference is clinically meaningful because hyperglycemia in pregnancy not only affects maternal health but may also contribute to downstream fetal compromise, altered growth patterns, delivery complications, and postnatal morbidity. From a service-delivery perspective, this finding supports greater emphasis on nutritional counseling, glycemic screening, and targeted antenatal follow-up in women entering pregnancy with elevated BMI.

One of the most prominent maternal findings in this study was the high rate of cesarean section in overweight women. Operative delivery occurred in 44.0% of overweight participants compared with 16.0% of controls, representing the largest maternal absolute risk gradient in the dataset. This is broadly consistent with previous reports showing that elevated maternal BMI is associated with longer labor, impaired labor progress, higher rates of induction failure, anesthesia-related complexity, and a lower threshold for operative intervention in the setting of fetal or maternal concern (4,20-23). Although prolonged labor itself was not more common in the overweight group in the present analysis, the marked difference in cesarean delivery suggests that overweight status may still influence the overall intrapartum decision pathway through mechanisms not fully captured by a single labor-duration endpoint. In practical terms, this has implications for staffing, operative preparedness, and counseling regarding mode of delivery in women with excess gestational weight burden.

The fetal and neonatal findings deserve particular attention because they indicate that maternal overweight was associated not only with maternal morbidity but also with substantial perinatal risk. Stillbirth and early neonatal death were notably more frequent in the overweight cohort, while NICU admission showed the most dramatic disparity, affecting 88.0% of neonates in the overweight group compared with 10.0% among controls. Previous literature has similarly linked elevated maternal BMI with adverse perinatal outcomes, including fetal death, respiratory complications, birth trauma, and increased need for neonatal support (4,14,16). The pathways underlying these neonatal effects are likely multifactorial and may include placental insufficiency, hypertensive disease, dysglycemia, operative delivery, and intrapartum compromise. Although the magnitude of the NICU admission difference in this study appears especially large and should therefore be interpreted cautiously, the overall pattern remains clinically coherent in suggesting that overweight pregnancy may carry downstream neonatal consequences that extend beyond delivery itself.

The interpretation of shoulder dystocia, postpartum hemorrhage, wound infection, and prolonged labor should be more cautious. Although these outcomes were numerically higher in some cases among overweight women, the between-group differences were either small or statistically unstable, and the confidence intervals were wide. This likely reflects the modest sample size and the low event frequency for several secondary outcomes. Therefore, while the direction of some estimates is compatible with existing literature, these specific findings should not be overgeneralized. Instead, they should be viewed as exploratory signals that merit reassessment in larger and more analytically adjusted studies (20,24).

The study contributes useful local evidence from a tertiary care setting in Pakistan, where context-specific data on maternal overweight and pregnancy outcome remain comparatively sparse. This is an important strength because obstetric risk profiles, healthcare access, referral behavior, and clinical thresholds for intervention may differ across regions and health systems. By directly comparing overweight women with normal-weight controls in the same hospital environment, the study provides a practical estimate of how moderately elevated BMI may translate into clinically relevant maternal and

neonatal burden within routine care pathways. Such data may help strengthen local antenatal protocols focused on nutritional assessment, early complication screening, and risk-informed obstetric planning.

At the same time, several limitations should be considered when interpreting the findings. First, the study was conducted at a single center using non-probability consecutive sampling, which limits generalizability. Second, the sample size was relatively small, reducing precision for low-frequency outcomes and contributing to wide confidence intervals around several effect estimates. Third, the analysis was based primarily on unadjusted comparisons, so residual confounding by factors such as age, parity, socioeconomic status, antenatal care utilization, prior obstetric history, and gestational age at delivery cannot be excluded. Fourth, the originally reported manuscript contained internal inconsistencies in sample counts and tabulated labels, which required harmonization during revision and emphasize the need for final verification against the source dataset before publication. Despite these limitations, the overall direction of the findings is internally coherent and aligns with the broader clinical literature indicating that elevated maternal BMI is associated with worse obstetric and neonatal outcomes (12-24). Future studies should use larger multicenter cohorts, prospectively standardized outcome definitions, and multivariable modeling to clarify the independent contribution of maternal overweight to specific adverse fetomaternal endpoints and to distinguish more precisely the relative impact of overweight versus obesity across different obstetric populations (12-24).

## CONCLUSION

Maternal overweight was associated with a higher frequency of several important adverse fetomaternal outcomes in this tertiary care cohort, particularly pre-eclampsia, pregnancy-induced hypertension, gestational diabetes mellitus, cesarean delivery, stillbirth, early neonatal death, and NICU admission. These findings indicate that clinically meaningful obstetric and neonatal risk may emerge even before the BMI threshold for obesity is reached. Early identification of overweight women during pregnancy, combined with closer antenatal monitoring, timely screening for hypertensive and metabolic complications, and proactive delivery planning, may help reduce preventable maternal and neonatal morbidity. Larger and methodologically robust studies are needed to confirm these associations and support more refined risk-based care pathways.

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