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EFFECTS OF PRE-PREGNANCY BODY MASS INDEX ON MODE OF DELIVERY

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ABSTRACT

Background: Pre-pregnancy body mass index (BMI) is an important determinant of maternal and neonatal outcomes. With the rising prevalence of overweight and obesity among women of reproductive age, understanding its impact on mode of delivery and pregnancy outcomes has become clinically relevant.

Objectives: To evaluate the effect of pre-pregnancy BMI on mode of delivery and to assess its association with maternal and neonatal outcomes among term pregnant women.

Methods: This hospital-based cross-sectional observational study was conducted in a tertiary care centre in Chennai among 90 term pregnant women. Pre-pregnancy BMI was calculated using first-trimester weight and categorized as underweight, normal, overweight, and obese based on WHO criteria. The primary outcome was mode of delivery, while secondary outcomes included maternal complications (postpartum haemorrhage, wound infection), neonatal outcomes (birth weight, Apgar score, NICU admission), and labour characteristics. Data were analysed using SPSS version 25, and associations were assessed using the Chi-square test, with $p<0.05$ considered statistically significant.

Results: Nearly half of the participants (46.6%) were overweight or obese. A significant association was observed between BMI and mode of delivery (p=0.003), with caesarean section rates increasing from 16.7% in underweight women to 75.0% in obese women. Failed induction and cephalopelvic disproportion were more common indications among higher BMI groups (p=0.032). Maternal complications such as postpartum haemorrhage (0% to 25.0%, p=0.018) and wound infection (0% to 18.8%, p=0.021) increased with BMI. Neonatal outcomes showed a progressive rise in mean birth weight (2.58 kg to 3.42 kg, p=0.001) and NICU admissions (0% to 31.3%, p=0.009), with a slight decline in Apgar scores (p=0.024). Labour duration was also prolonged with increasing BMI.

Conclusion: Increasing pre-pregnancy BMI is significantly associated with higher rates of caesarean delivery, maternal complications, and adverse neonatal outcomes. Early identification and optimization of maternal weight are essential to improve obstetric outcomes.

KEYWORDS: Pre-pregnancy BMI; Mode of delivery; Caesarean section; Maternal outcomes; Neonatal outcomes; Obesity in pregnancy

INTRODUCTION

Maternal nutritional status prior to conception is a fundamental determinant of pregnancy outcome, and body mass index (BMI) has emerged as a practical and reliable indicator for its assessment in obstetric care. BMI is calculated as weight in kilograms divided by the square of height in meters (kg/m²) and is routinely used to classify individuals into standard categories: underweight (<18.5 kg/m²), normal (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), and obese (≥30 kg/m²) [1,2]. These categories are clinically significant, as deviations from normal BMI are known to influence maternal physiology, labour dynamics, and perinatal outcomes.

In recent decades, there has been a marked global rise in the prevalence of overweight and obesity among women of reproductive age. This trend reflects broader demographic and lifestyle transitions, including reduced physical activity, increased caloric intake, and urbanization [3]. The World Health Organization has identified obesity as one of the most pressing public health concerns worldwide, with a substantial proportion of women entering pregnancy with elevated BMI [3]. This shift has important implications for obstetric practice, as higher BMI is associated with a spectrum of complications, including gestational diabetes, hypertensive disorders, dysfunctional labour, and increased operative delivery rates [1].

Guidelines from the Centers for Disease Control and Prevention emphasize that prepregnancy obesity is strongly linked to adverse maternal and neonatal outcomes, particularly an increased likelihood of caesarean section, postpartum haemorrhage, and neonatal morbidity [4]. Similarly, recommendations from the American College of

Obstetricians and Gynecologists highlight that obesity alters labour physiology by impairing uterine contractility, prolonging labour, and increasing the risk of failed induction, thereby contributing to higher rates of both elective and emergency caesarean delivery [5]. Evidence summarized by the National Institutes of Health further indicates that maternal obesity is associated with fetal macrosomia, increased need for neonatal intensive care, and potential long-term metabolic consequences in offspring [6].

The Indian scenario reflects a similar, though more complex, epidemiological transition characterized by the coexistence of undernutrition and obesity. A systematic review by Ahirwar and Mondal demonstrated a rising prevalence of obesity across India, particularly among women in urban and semi-urban settings [9]. This dual burden poses unique challenges, as both extremes of BMI—underweight and obesity—are associated with adverse pregnancy outcomes. Moreover, Asian populations are known to exhibit higher metabolic risk at comparatively lower BMI thresholds, further amplifying the clinical significance of maternal weight status in this setting.

A growing body of literature has consistently established a strong association between pre-pregnancy BMI and mode of delivery. In an Indian tertiary care study, Naik et al. observed that women with higher BMI had significantly increased rates of caesarean section compared to those with normal BMI, underscoring the influence of maternal adiposity on obstetric outcomes [8]. Similarly, Sun et al. reported that increasing BMI was associated with a higher incidence of maternal complications, including gestational diabetes and hypertensive disorders, along with adverse neonatal outcomes such as increased birth weight and higher rates of NICU admission [10]. These findings are supported by Simko et al., who demonstrated that both elevated BMI and excessive gestational weight gain contribute independently to pregnancy-related complications, reinforcing the importance of optimal pre-pregnancy weight [11].

Large cohort studies have further highlighted a dose–response relationship between BMI and operative delivery. Vinturache et al. demonstrated that the likelihood of caesarean delivery increases progressively across BMI categories, suggesting that even modest elevations in BMI may influence labour outcomes [12]. The underlying mechanisms are multifactorial and include altered myometrial function, increased fetal size, soft tissue dystocia, and a higher incidence of cephalopelvic disproportion. Collectively, these factors contribute to prolonged labour, increased rates of failed induction, and a greater need for surgical intervention.

Despite substantial global evidence, there remains a need for region-specific data that reflects local population characteristics, healthcare practices, and resource settings. In the Indian context, limited studies have comprehensively evaluated the relationship between pre-pregnancy BMI, mode of delivery, and associated maternal and neonatal outcomes within a single clinical framework. Such data are essential for refining risk assessment, guiding antenatal counselling, and informing clinical decision-making in labour management.

In view of the rising prevalence of abnormal BMI and its significant impact on obstetric outcomes, it becomes imperative to better understand this association in contemporary clinical settings. Early identification of women at risk, coupled with appropriate antenatal interventions, may help reduce unnecessary operative deliveries and improve both maternal and neonatal outcomes. Therefore, the present study aims to evaluate the effect of pre-pregnancy BMI on the mode of delivery and related outcomes, thereby contributing to evidence-based obstetric care and addressing an increasingly important public health concern.

METHODOLOGY

This study was designed as a hospital-based cross-sectional observational study conducted in the Department of Obstetrics and Gynaecology at Sree Balaji Medical College and Hospital, Chennai, a tertiary care teaching institution catering to urban and semi-urban populations. The study population comprised pregnant women aged 18–45 years with singleton pregnancies at term gestation (37–42 weeks), admitted for delivery either in spontaneous labour, induced labour, or for elective caesarean section. Women with multiple gestations, pre-existing medical disorders such as diabetes mellitus, chronic hypertension, thyroid or cardiac disease, history of previous uterine surgery, or incomplete antenatal records were excluded to minimize confounding factors.

A total sample size of 90 participants was included based on feasibility and consecutive sampling. All eligible women admitted during the study period were recruited after obtaining informed written consent. Pre-pregnancy body mass index (BMI) was considered the primary exposure variable. Pre-pregnancy weight was obtained from first-trimester antenatal records, and height was measured at admission using a standardized stadiometer. BMI was calculated using the standard formula (weight in kilograms divided by height in meters squared) and classified according to World Health Organization criteria into underweight (<18.5 kg/m²), normal (18.5–24.9 kg/m²), overweight (25–29.9 kg/m²), and obese (≥30 kg/m²).

Data were collected using a structured and pre-tested case record form. Baseline demographic details, obstetric history including gravida, parity, booking status, and onset of labour were recorded. The primary outcome assessed was mode of delivery, categorized as spontaneous vaginal delivery, assisted vaginal delivery, elective caesarean section, or emergency caesarean section. Secondary outcomes included indications for operative delivery, maternal complications such as postpartum haemorrhage and wound infection, and neonatal outcomes including birth weight, Apgar scores, and need for neonatal intensive care unit admission.

All data were obtained from medical records, antenatal charts, and direct observation during labour and delivery. Data entry was performed using Microsoft Excel and analysed using SPSS version 25. Descriptive statistics such as mean, standard deviation, frequencies, and percentages were used to summarize variables. The association

between BMI categories and mode of delivery, as well as maternal and neonatal outcomes, was assessed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.
Ethical approval was obtained from the Institutional Ethics Committee prior to commencement of the study. Participation was voluntary, and confidentiality of patient information was strictly maintained throughout the study.

RESULTS

This study was conducted among 90 term pregnant women in a tertiary care hospital to evaluate the effect of pre-pregnancy body mass index on mode of delivery. It further assessed the association between BMI categories and maternal as well as neonatal outcomes to understand its clinical implications in obstetric practice.

Table 1. Baseline Demographic and Obstetric Characteristics of Study Participants (n=90)

Category	n (%)
Age	
18–25	28 (31.1)
26–30	36 (40.0)
31–35	18 (20.0)
>35	8 (8.9)
Gravida	
Primigravida	44 (48.9)
Multigravida	46 (51.1)
Booking Status	
Booked	72 (80.0)
Unbooked	18 (20.0)
Onset of Labour	
Spontaneous	60 (66.7)
Induced	30 (33.3)

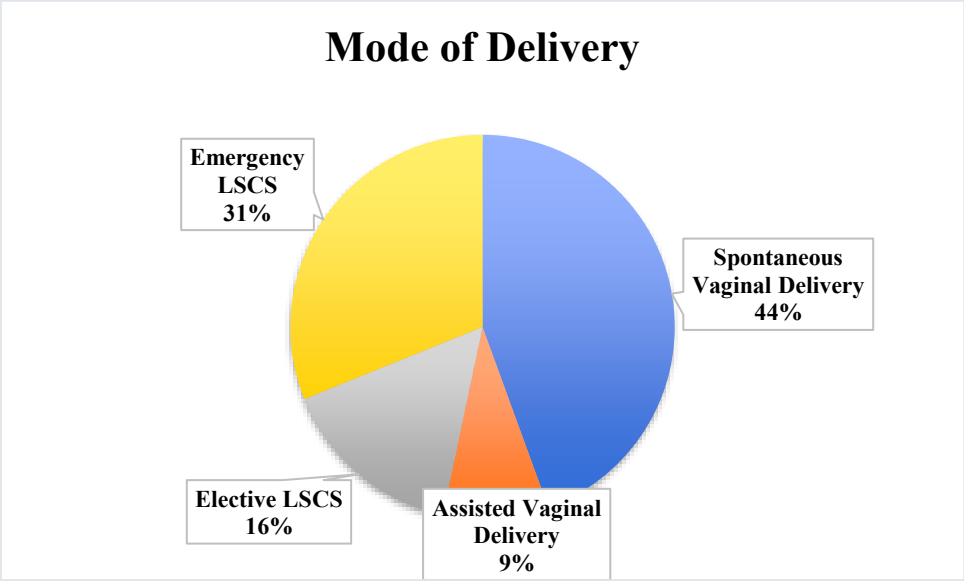
The study included a total of 90 pregnant women. The majority of participants were aged 26–30 years (40.0%), followed by 18–25 years (31.1%). Women aged 31–35 years constituted 20.0%, while only 8.9% were above 35 years, indicating that most participants were in the optimal reproductive age group. With respect to parity, the distribution was nearly equal, with 48.9% primigravida and 51.1% multigravida, suggesting a balanced representation of first-time and previously pregnant women.
In terms of antenatal care, a large proportion of women were booked cases (80.0%), while 20.0% were unbooked, reflecting good utilization of antenatal services among the study population.
Regarding the onset of labour, the majority of women (66.7%) had spontaneous labour, whereas 33.3% required induction.
Overall, the baseline demographic and obstetric characteristics indicate a well-distributed study population, predominantly comprising women in the prime reproductive age, with adequate antenatal care coverage and a higher prevalence of spontaneous labour onset.

Table 2. Distribution of Pre-Pregnancy Body Mass Index Categories among Study Participants (n=90)

BMI Category	n (%)
Underweight (<18.5)	6 (6.7)
Normal (18.5–24.9)	42 (46.7)
Overweight (25–29.9)	26 (28.9)
Obese (≥30)	16 (17.7)

Table 2 shows the distribution of pre-pregnancy BMI among the study participants. Nearly half of the women (46.7%) had a normal BMI (18.5–24.9 kg/m²), representing the largest group. A considerable proportion of participants had elevated BMI, with 28.9% classified as overweight and 17.7% as obese. Together, these categories account for 46.6% of the study population, indicating a high prevalence of increased BMI among pregnant women.
In contrast, only 6.7% of participants were underweight (<18.5 kg/m²), making it the least common category.
Overall, the findings highlight a substantial burden of overweight and obesity in the study population, which may have important implications for maternal and neonatal outcomes.

Figure 1: Distribution of Mode of Delivery among Study Participants



The pie chart illustrates the distribution of modes of delivery among the study participants. The most common mode was spontaneous vaginal delivery, accounting for 44% of cases. Caesarean section constituted a substantial proportion of deliveries, with emergency LSCS accounting for 31% and elective LSCS for 16%. Together, caesarean deliveries comprised 47% of all deliveries, slightly exceeding the proportion of spontaneous vaginal deliveries.

Assisted vaginal delivery (forceps/vacuum) was the least common mode, observed in only 9% of participants. Overall, the findings indicate a relatively high rate of caesarean deliveries in the study population, highlighting the need to evaluate contributing factors such as maternal BMI and other obstetric determinants influencing the mode of delivery.

Table 3. Association between Pre-Pregnancy Body Mass Index and Mode of Delivery (n=90)

BMI Category	Vaginal n (%) (n=48)	LSCS n (%) (n=42)	p value
Underweight (n=6)	5 (83.3)	1 (16.7)	0.003
Normal (n=42)	28 (66.7)	14 (33.3)	
Overweight (n=26)	11 (42.3)	15 (57.7)	
Obese (n=16)	4 (25.0)	12 (75.0)	

Table 3 demonstrates a statistically significant association between pre-pregnancy BMI and mode of delivery ($p = 0.003$). Among underweight women, the majority (83.3%) had vaginal deliveries, with only 16.7% undergoing LSCS. Similarly, in the normal BMI group, 66.7% delivered vaginally, while 33.3% required caesarean section. In contrast, the proportion of LSCS increased progressively with rising BMI. Among overweight women, 57.7% underwent LSCS compared to 42.3% vaginal deliveries. The highest LSCS rate was observed in the obese group, where 75.0% of women required caesarean section and only 25.0% had vaginal delivery.

This trend indicates that increasing maternal BMI is associated with a higher likelihood of operative delivery. The statistically significant p-value confirms that pre-pregnancy BMI is an important determinant of mode of delivery. Overall, the findings support the study objective by demonstrating a clear increase in caesarean section rates with increasing BMI.

Table 4A. Distribution of Type of Caesarean Section across BMI Categories

BMI Category	Elective n (%) (n=14)	Emergency n (%) (n=28)	p-value
Underweight	0 (0.0)	1 (100.0)	
Normal	4 (28.6)	10 (71.4)	
Overweight	5 (33.3)	10 (66.7)	
Obese	5 (41.7)	7 (58.3)	**0.041**

Table 4A shows a statistically significant association between pre-pregnancy BMI and the type of caesarean section performed ($p = 0.041$). Among underweight women, all LSCS cases (100%) were emergency procedures, with no elective caesarean sections reported. In the normal BMI group, the majority of LSCS were emergency (71.4%), while 28.6% were elective.

A similar pattern was observed in the overweight group, where emergency LSCS accounted for 66.7% and elective procedures for 33.3%. However, in the obese group, although emergency LSCS remained more common (58.3%), the proportion of elective LSCS (41.7%) was comparatively higher than in other BMI categories. These findings suggest that while emergency LSCS predominates across all BMI groups, increasing BMI is associated with a relative rise in elective caesarean sections. The statistically significant p-value indicates that maternal BMI plays an important role in determining not only the likelihood of caesarean delivery but also its type.

Table 4B. Indications for Caesarean Section in Relation to Pre-Pregnancy BMI

Indication	Normal n (%) (n=14)	Overweight n (%) (n=15)	Obese n (%) (n=12)	p-value
Fetal Distress	5 (35.7)	4 (26.7)	3 (25.0)	
Failed Induction	3 (21.4)	5 (33.3)	4 (33.3)	
CPD	2 (14.3)	4 (26.7)	3 (25.0)	
Others	4 (28.6)	2 (13.3)	2 (16.7)	**0.032**

Table 4B demonstrates a statistically significant association between pre-pregnancy BMI and the indications for caesarean section (p = 0.032). Among women with normal BMI, the most common indication for LSCS was fetal distress (35.7%), followed by other causes (28.6%) and failed induction (21.4%). In contrast, among overweight women, failed induction emerged as the leading indication (33.3%), followed by fetal distress and cephalopelvic disproportion (CPD), each accounting for 26.7%.

A similar pattern was observed in the obese group, where failed induction (33.3%) was the most frequent indication, followed by fetal distress (25.0%) and CPD (25.0%). The proportion of LSCS due to “other” indications was comparatively lower in both overweight and obese groups.

These findings suggest that with increasing maternal BMI, failed induction and CPD become more prominent indications for caesarean section, whereas fetal distress is more commonly observed among women with normal BMI. The statistically significant p-value indicates that BMI influences not only the rate but also the underlying reasons for operative delivery.

Table 5. Maternal Outcomes in Relation to Pre-Pregnancy Body Mass Index

BMI Category	PPH n (%)	Wound Infection n (%)
Underweight (n=6)	0 (0.0)	—
Normal (n=42)	2 (4.8)	1 (2.4)
Overweight (n=26)	3 (11.5)	2 (7.7)
Obese (n=16)	4 (25.0)	3 (18.8)
p value	0.018	0.021

Table 5 demonstrates a statistically significant association between pre-pregnancy BMI and maternal complications, including postpartum haemorrhage (PPH) and wound infection. The incidence of PPH increased progressively with rising BMI (p = 0.018). None of the women in the underweight group developed PPH (0.0%), while 4.8% of women with normal BMI experienced PPH. The proportion increased to 11.5% among overweight women and was highest in the obese group at 25.0%.

A similar increasing trend was observed for wound infection (p = 0.021). Only 2.4% of women with normal BMI developed wound infection, compared to 7.7% in the overweight group and 18.8% in the obese group. No cases of wound infection were reported among underweight women. These findings indicate that higher maternal BMI is significantly associated with an increased risk of postpartum complications, particularly PPH and wound infection. The progressive rise in complication rates with increasing BMI underscores the clinical importance of pre-pregnancy weight management in improving maternal outcomes.

Table 6A. Neonatal Outcomes across Pre-Pregnancy BMI Categories

BMI Category	Birth Weight Mean±SD	Apgar Mean±SD	NICU n (%)
Underweight (n=6)	2.58 ± 0.32	8.9 ± 0.4	0 (0.0)
Normal (n=42)	2.86 ± 0.41	8.8 ± 0.5	3 (7.1)
Overweight (n=26)	3.14 ± 0.46	8.6 ± 0.6	4 (15.4)
Obese (n=16)	3.42 ± 0.52	8.3 ± 0.7	5 (31.3)
p value	0.001	0.024	0.009

Table 6A demonstrates a statistically significant association between pre-pregnancy BMI and neonatal outcomes, including birth weight, Apgar score at 5 minutes, and NICU admission. The mean birth weight increased progressively with rising maternal BMI (p = 0.001). Neonates born to underweight mothers had the lowest mean

birth weight (2.58 ± 0.32 kg), followed by those with normal BMI (2.86 ± 0.41 kg), overweight (3.14 ± 0.46 kg), and obese mothers (3.42 ± 0.52 kg), indicating a clear positive relationship between maternal BMI and neonatal birth weight.

In contrast, the mean Apgar score at 5 minutes showed a gradual decline with increasing BMI ($p = 0.024$). The highest scores were observed among underweight (8.9 ± 0.4) and normal BMI mothers (8.8 ± 0.5), while lower scores were noted in overweight (8.6 ± 0.6) and obese women (8.3 ± 0.7). Although all values remained within clinically acceptable limits, the decreasing trend suggests a potential impact of higher BMI on immediate neonatal well-being. Similarly, NICU admissions increased significantly with rising BMI ($p = 0.009$). No neonates born to underweight mothers required NICU admission, whereas 7.1% of neonates in the normal BMI group were admitted. This proportion increased to 15.4% among overweight and 31.3% among obese mothers.

Overall, these findings indicate that higher maternal BMI is associated with increased birth weight, lower Apgar scores, and a higher likelihood of NICU admission, highlighting its significant impact on neonatal outcomes.

Table 6B.Duration of Labour in Relation to Pre-Pregnancy Body Mass Index

BMI Category	First Stage (hrs) Mean ± SD	Second Stage (min) Mean ± SD
Underweight	6.12 ± 1.84	32.14 ± 8.21
Normal	7.48 ± 2.16	38.52 ± 10.33
Overweight	8.96 ± 2.41	45.73 ± 11.24
Obese	10.32 ± 2.88	52.46 ± 13.18

Table 6B illustrates the relationship between pre-pregnancy BMI and the duration of labour across its first and second stages. The mean duration of the first stage of labour increased progressively with rising BMI. Women in the underweight group had the shortest duration (6.12 ± 1.84 hours), followed by those with normal BMI (7.48 ± 2.16 hours). The duration was longer among overweight women (8.96 ± 2.41 hours) and was highest in the obese group (10.32 ± 2.88 hours).

A similar trend was observed in the second stage of labour. The mean duration increased from 32.14 ± 8.21 minutes in underweight women to 38.52 ± 10.33 minutes in the normal BMI group, further rising to 45.73 ± 11.24 minutes in overweight women and reaching 52.46 ± 13.18 minutes among obese women.

These findings suggest that increasing maternal BMI is associated with prolonged labour in both the first and second stages. This progressive increase may reflect the impact of higher BMI on uterine contractility, labour progression, and overall delivery dynamics, potentially contributing to the higher rates of operative delivery observed in women with elevated BMI.

DISCUSSION

The present study, conducted among 90 term pregnant women, demonstrated a clear and progressive association between increasing pre-pregnancy BMI and adverse obstetric outcomes. Nearly half of the study population (46.6%) belonged to overweight and obese categories. A stepwise increase in caesarean section rates was observed, rising from 16.7% in underweight women to 33.3% in normal BMI, 57.7% in overweight, and 75.0% in obese women. Maternal complications showed a similar gradient, with postpartum haemorrhage increasing from 4.8% in normal BMI to 25.0% in obese women, and wound infection from 2.4% to 18.8%. Neonatal outcomes were also significantly influenced, with mean birth weight increasing from 2.58 kg in underweight to 3.42 kg in obese women, and NICU admissions rising from 7.1% to 31.3%. In addition, labour duration increased markedly with BMI, with first-stage labour prolonging from 6.12 hours in underweight women to 10.32 hours in obese women . These findings indicate a strong dose–response relationship between maternal BMI and adverse outcomes.

An increase in operative delivery with rising BMI has been consistently observed across populations. Enomoto et al. reported that caesarean rates increased from approximately 18–20% in women with normal BMI to 35–40% among obese women [13]. While the direction of association is similar, the present study demonstrated a substantially higher LSCS rate of 75.0% in obese women, suggesting a more pronounced effect in our cohort, possibly due to tertiary care referral patterns or higher baseline risk.

A similar trend has been reported in large cohort analyses, where Li et al. observed that overweight and obese women had nearly 1.5–2 times higher risk of caesarean delivery compared to normal BMI women [14]. In comparison, our findings show a sharper escalation, with LSCS rates increasing from 33.3% in normal BMI to 57.7% in overweight and 75.0% in obese women, reinforcing a strong and graded risk pattern.

The effect of maternal BMI on fetal growth has also been well documented. Xiao et al. demonstrated a significant increase in birth weight with rising BMI, with higher rates of macrosomia among obese women [15]. This observation closely parallels our findings, where mean birth weight increased progressively from 2.58 kg to 3.42 kg across BMI categories, indicating a consistent biological relationship between maternal adiposity and fetal growth.

Further evidence from meta-analysis, as described by Goldstein et al., highlights that increased BMI and gestational weight gain are associated with higher rates of caesarean delivery and neonatal complications [16].

Our study supports this association, with a marked increase in NICU admissions from 7.1% in normal BMI to 31.3% in obese women, suggesting a comparable but more pronounced clinical impact.

Alterations in labour dynamics form another important aspect of obesity-related complications. Mamun et al. reported prolonged labour duration and increased operative delivery in obese women [17]. In the present study, a similar pattern was evident, with first-stage labour increasing by over 4 hours and second-stage labour by approximately 20 minutes from underweight to obese categories, reflecting impaired labour progression.

At the lower end of the BMI spectrum, underweight status has been associated with reduced operative delivery but lower birth weight. Findings by Sebire et al. indicate that underweight women have lower caesarean rates but increased risk of delivering low birth weight infants [18]. Our results are consistent, with underweight women showing the lowest LSCS rate (16.7%) and lowest mean birth weight (2.58 kg), though without a corresponding rise in NICU admissions.

Similarly, reduced birth weight among women with low BMI has been reported by Ronnenberg et al., with a clear association between maternal undernutrition and fetal growth restriction [19]. This aligns with our findings, although the absence of significant neonatal complications in our study may reflect differences in population characteristics or sample size.

A graded increase in adverse outcomes with rising BMI has been emphasized by Wei et al., who demonstrated a dose–response relationship across BMI categories [20]. This pattern is strongly reflected in our study, where maternal and neonatal complications increased consistently from normal to overweight to obese groups.

Neonatal morbidity has also been shown to increase with maternal obesity. Faucett et al. reported significantly higher NICU admissions among obese women compared to those with normal BMI [21]. In comparison, our study demonstrated a more pronounced rise, with NICU admissions increasing more than fourfold (7.1% to 31.3%), indicating a substantial neonatal impact.

Maternal complications such as postpartum haemorrhage and wound infection have also been strongly linked to obesity. Cedergren reported increased rates of these complications with higher BMI [22]. Our findings mirror this, with PPH increasing fivefold (4.8% to 25.0%) and wound infection nearly eightfold (2.4% to 18.8%), highlighting the clinical significance of maternal obesity.

The independent effect of maternal obesity on pregnancy outcomes, even in the absence of associated comorbidities, has been clearly demonstrated, with Yogev et al. reporting significantly higher rates of adverse outcomes, including operative delivery, among obese women compared to normal BMI counterparts (approximately 30–35% vs 15–20%) [23]. This observation is strongly reflected in the present study, where major medical disorders were excluded, yet caesarean section rates increased markedly from 33.3% in normal BMI to 75.0% in obese women, indicating that BMI alone acts as a significant determinant of obstetric risk.

From a physiological perspective, impaired uterine contractility has been proposed as a key mechanism underlying labour dysfunction in obese women. Jarvie et al. described increased rates of failed induction and prolonged labour, with obese women demonstrating significantly higher intervention rates compared to normal BMI groups [24]. In concordance, our study demonstrated a clear prolongation of labour, with first-stage duration increasing from 7.48 hours in normal BMI women to 10.32 hours in obese women, and second-stage duration increasing from 38.52 minutes to 52.46 minutes, thereby contributing to the higher LSCS rates observed.

Interventional evidence suggests that optimization of maternal weight prior to pregnancy can significantly improve outcomes. Bogaerts et al. reported reduced rates of adverse maternal and neonatal outcomes following weight reduction in obese women, including lower operative delivery rates and improved neonatal parameters [25]. The findings of the present study support this, as the highest burden of complications—including LSCS (75.0%), postpartum haemorrhage (25.0%), and wound infection (18.8%)—was concentrated in the obese group, highlighting the potential benefits of preconception weight management.

At the lower end of the spectrum, inadequate weight gain and low BMI have been associated with adverse fetal outcomes. Han et al. reported an increased risk of low birth weight and preterm delivery in women with insufficient weight gain [26]. In our study, underweight women demonstrated the lowest mean birth weight (2.58 kg) compared to 2.86 kg in normal BMI and 3.42 kg in obese women, reflecting a similar pattern, although without a corresponding increase in NICU admissions.

Conversely, Xu et al. observed that inadequate weight gain among obese women may predispose to small-for-gestational-age infants, suggesting a complex interaction between baseline BMI and gestational weight dynamics [27]. However, our findings demonstrated a consistent increase in birth weight with rising BMI, indicating that excessive maternal adiposity, rather than inadequate weight gain, was the dominant factor influencing fetal growth in our population.

The relationship between excessive weight gain and hypertensive disorders has also been described, with Macdonald-Wallis et al. reporting increased risk of hypertensive complications among women with higher gestational weight gain [28]. Although such cases were excluded in the present study, the progressive increase in maternal complications such as postpartum haemorrhage (from 4.8% to 25.0%) and wound infection (from 2.4% to 18.8%) with rising BMI suggests overlapping pathophysiological mechanisms related to vascular dysfunction and inflammatory pathways.

Preventive strategies targeting obesity in pregnancy have been strongly emphasized, with Agha et al. demonstrating that preconception and antenatal interventions can significantly reduce obesity-related

complications [29]. The current study reinforces this need, as nearly half of the study population (46.6%) belonged to overweight and obese categories, with disproportionately higher adverse outcomes observed in these groups.
Finally, the role of adipokines and inflammatory mediators in mediating obesity-related complications has been increasingly recognized. Vrachnis et al. described the contribution of altered inflammatory pathways to conditions such as gestational diabetes, labour dysfunction, and adverse neonatal outcomes [30]. These mechanisms provide a plausible biological explanation for the findings of the present study, where increasing BMI was associated with higher rates of operative delivery, prolonged labour, and increased neonatal morbidity, including NICU admissions rising from 7.1% in normal BMI to 31.3% in obese women.

CONCLUSIOS

Pre-pregnancy body mass index was found to have a significant and graded influence on obstetric outcomes in this study. Increasing BMI was associated with a higher likelihood of caesarean delivery, prolonged labour, and increased maternal complications such as postpartum haemorrhage and wound infection. Neonatal outcomes were also affected, with higher birth weights and increased NICU admissions observed among overweight and obese women.
Overall, the findings highlight that both extremes of BMI carry risks, but adverse outcomes were more pronounced with increasing BMI. These results emphasize the importance of optimizing maternal weight before pregnancy and incorporating BMI-based risk stratification into antenatal care to improve maternal and neonatal outcomes.

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