


**Research Article**

## The Influence of Maternal Weight During Pregnancy on the Mode of Delivery: A Comprehensive Study

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### Abstract

**Background:** Pre-pregnancy BMI has risen, especially in developed countries. Pre-pregnancy obesity (BMI > 25 kg/m<sup>2</sup>) affects up to 30% of pregnancies, with rates varying regionally. Excessive gestational weight gain (GWG) is defined as surpassing Institute of Medicine guidelines. Being obese before or during pregnancy raises the risk of developing gestational diabetes, hypertension, preeclampsia, and cesarean sections. Proper maternal weight management is crucial to minimize adverse perinatal outcomes and lasting health issues for both the mother and baby.

**Aim of the study:** This study aims to investigate the relationship between maternal weight during pregnancy and the mode of delivery, highlighting the importance of proper weight management to mitigate adverse outcomes.

**Methods:** This retrospective study at Prime Hospital, Dubai, included 1000 pregnant women over ten years from 2012 to 2024, with informed consent. Inclusion criteria: 18 to 35 years old, documented pre-pregnancy BMI, 37 to 40 weeks of gestation, cephalic presentation, and absence of anomalies. Exclusion criteria: missing maternal height/weight records, congenital malformations, antepartum hemorrhage, and factors causing adverse outcomes (e.g., smoking). Participants' BMI was classified as normal, overweight, or obese based on their BMI before pregnancy and at the time of delivery. Data collection involved history, clinical exams, ultrasounds, and routine tests. Outcomes included delivery methods, fetal health assessed by Apgar scores, and NICU needs. Statistical analysis used SPSS, with significance at P<0.05.

**Result:** The study involved 1000 women, mostly younger than 30 years (54.5%) and with high parity (61% had more than two previous births). Most pregnancies were full-term (95.2%). Regarding gestational weight gain, 24.8% had inadequate, 42.3% had adequate, and 32.9% had excessive weight gain. BMI-influenced outcomes: Obese women had more preterm deliveries (6.62%) and cesarean sections (40.07%) compared to normal BMI women. Birth weights varied with BMI: low birth weight was slightly more common in obese women, while macrosomia was highest in obese women (15.33%). Apgar scores were lower in higher BMI groups, and NICU admissions and neonatal mortality rates were slightly higher in obese women.

**Conclusion:** The study associates excessive maternal weight gain and elevated pre-pregnancy BMI with a higher rate of cesarean deliveries. Obese women have the highest cesarean rates and adverse fetal outcomes like macrosomia, lower Apgar scores, and higher NICU admissions. Proper weight management during pregnancy is crucial to reducing delivery complications and improving health outcomes.

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## Introduction

Maternal weight gain during pregnancy naturally results from the development of both fetal and maternal tissues, along with an increase in body fluids [1]. However, in recent years, there has been a significant rise in the pre-pregnancy body mass index (BMI) among women of reproductive age, particularly in developed nations [2]. Data from the Pregnancy Risk Assessment Monitoring System (PRAMS) shows that the prevalence of obesity prior to conception in the U.S. has reached 22%, reflecting a 69.3% increase over the past decade [2]. Pre-pregnancy obesity, defined as a BMI above 25 kg/m<sup>2</sup>, has been observed in up to 30% of pregnancies in certain populations, with regional overweight and obesity rates ranging between 15% and 30% [3,4]. Obesity during pregnancy can result from either pre-pregnancy obesity or excessive weight gain during gestation. Pre-pregnancy BMI serves as a key indicator for identifying women at risk of obesity, while excessive gestational weight gain (GWG) is diagnosed when pregnancy weight gain exceeds the Institute of Medicine's (IOM) recommended limits [5]. These guidelines advise a healthy weight gain of 12.5 to 18 kg for women with a BMI below 19.8 kg/m<sup>2</sup>, 7 to 11.5 kg for those with a BMI between 19.8 and 26.0 kg/m<sup>2</sup>, and no more than 7 kg for women with a BMI above 29.0 kg/m<sup>2</sup> [5]. The nutritional status of pregnant women is a crucial predictor of both perinatal outcomes and future health for the mother and child [6]. Being overweight or obese prior to pregnancy is linked to an increased risk of gestational diabetes mellitus (GDM), hypertensive disorders, and abnormal fetal growth [7,8]. Conversely, underweight women are at greater risk of preterm delivery and giving birth to small-for-gestational-age (SGA) infants [9,10]. Insufficient weight gain during pregnancy can lead to complications such as anemia, low birth weight (LBW), and SGA newborns [10]. On the other hand, excessive weight gain raises the risk of GDM, gestational hypertension, preeclampsia, and cesarean delivery [11]. Numerous studies have identified a linear relationship between maternal pre-pregnancy BMI and the likelihood of cesarean delivery, especially at term. For instance, Barau et al. found a positive association between higher maternal BMI and cesarean section rates, while other research indicated a reduction in the use of forceps and vacuum extraction with increasing BMI [12,13]. However, some research, such as a Norwegian study, suggested a slightly elevated risk of instrumental vaginal deliveries among obese women, while others found no significant difference in this outcome [14]. Obesity during pregnancy is also linked to prolonged labor and an increased need for medical interventions such as labor induction, oxytocin administration, and epidural anesthesia [15]. Higher BMIs are associated with a greater likelihood of emergency cesarean sections, failed labor inductions, and postpartum complications [16]. Additionally, pregnancy-related complications such as hypertensive disorders and fetal macrosomia contribute to the rising rates of labor induction

and emergency cesarean sections [16]. These complications highlight the importance of managing maternal weight during pregnancy to lower the risk of unfavorable delivery outcomes. With the increasing prevalence of obesity and its impact on pregnancy outcomes, our study sought to examine the association between maternal pre-pregnancy BMI and the mode of delivery. Specifically, the study focuses on exploring the link between maternal weight during pregnancy and delivery methods, emphasizing the significance of effective weight management in reducing adverse outcomes at Prime Hospital in Dubai, UAE.

## Methodology and Materials

This retrospective observational study was carried out from 2012 to 2024 in the Department of Gynecology and Obstetrics at Prime Hospital in Dubai, UAE. The research involved 1,000 pregnant women who had visited the pre-labor unit over the past ten years. Participants provided informed consent, which was available in both English and Arabic and verified by date and time. Data confidentiality was rigorously upheld, and ethical approval was obtained from the hospital's ethics committee.

### Inclusion Criteria:

- Age between 18-35 years
- Known pre-pregnancy BMI
- Gestational age of 37-40 weeks
- Cephalic presentation
- No fetal or umbilical cord anomalies

### Exclusion Criteria:

- Missing records of maternal height or pre-pregnancy weight
- Presence of congenital fetal malformations
- Antepartum hemorrhage (e.g., placenta previa or accidental hemorrhage)
- Factors independently causing adverse perinatal and neonatal outcomes (e.g., smoking or drug use)

After a comprehensive explanation of the study procedures, written informed consent was obtained from all participants. Basic demographic data, including age, height, weight, gestational age, and cervical dilation, was collected. Maternal BMI was calculated using the pre-pregnancy weight recorded in the women's personal pregnancy health cards and the weight at delivery. The 1,000 term pregnant women were categorized into three BMI classifications according to the WHO guidelines [17], based on both pre-pregnancy and delivery BMI:

- Normal weight (18.50-24.99 kg/m<sup>2</sup>)
- Overweight (25.00-29.99 kg/m<sup>2</sup>)
- Obese (30.00-35.00 kg/m<sup>2</sup>)

## Data Collection

Data was gathered through thorough history taking (medical, obstetrical, and gynecological), clinical examinations, and ultrasonographic findings using a pre-designed case record sheet. Participants underwent routine laboratory tests, which included a complete blood count, urine analysis, random blood sugar, and full liver and kidney profiles, as well as prothrombin time (PT) and partial thromboplastin time (PTT) for cases involving medical disorders. Routine obstetric ultrasounds were conducted to assess fetal status, amniotic fluid levels, umbilical cord conditions, and placental health. Fetal distress was detected by observing fetal bradycardia, variable decelerations, or late decelerations, monitored via partograms and cardiotocography during labor. A pediatrician evaluated fetal outcomes based on Apgar scores and the necessity for NICU admission. Delivery methods performed by supervisors and experts were classified into spontaneous vaginal delivery, instrumental vaginal delivery (including vacuum extraction and forceps), planned cesarean section, and emergency cesarean section.

## Statistical Analysis:

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) software (version 26.0) for Windows. Data were presented as ranges, means, and standard deviations for numeric parametric variables, while categorical variables were reported as counts and percentages. Differences between two independent groups were assessed using the independent student's t-test, mean difference, and chi-squared test for categorical variables. A P-value of less than 0.05 was deemed statistically significant.

## Result

The study was conducted with 1,000 women who met the inclusion criteria. There were no significant differences in age among the three groups. Table 1 presents the demographic characteristics of the study population. A total of 545 participants (54.5%) were younger than 30 years, while 455 (45.5%) were aged 30 years or older. Regarding parity, 390 participants (39%) had two or fewer previous births, while

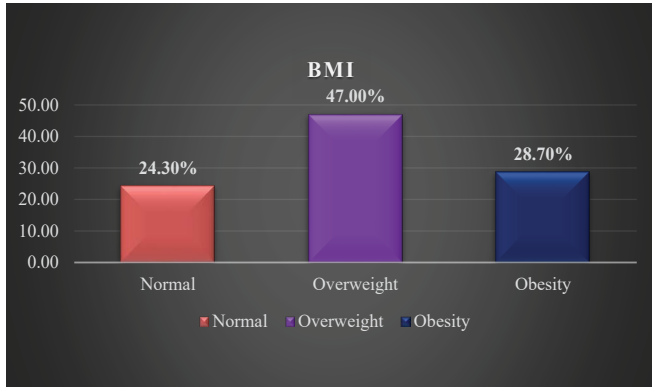
610 (61%) had more than two. In terms of gestational age, 952 pregnancies (95.2%) were full-term (37 to <42 weeks), and 46 (4.6%) were preterm (28 to <37 weeks). This profile highlights that most participants were younger mothers with higher parity and predominantly full-term pregnancies. Analyzing the gestational weight gain categories among the study participants (N=1000) in table 2, a total of 248 women (24.8%) had inadequate weight gain, 423 (42.3%) achieved adequate weight gain, and 329 (32.9%) experienced excessive weight gain. These findings indicate that nearly one-third of the participants gained weight excessively during pregnancy, while a significant proportion did not meet the recommended levels. Table 3 shows the association of BMI with gestational age and mode of delivery among the study population. For gestational age, the majority of participants across BMI categories delivered between 37 to <42 weeks: 95.47% of those with normal BMI (n=232), 94.04% of overweight women (n=442), and 93.38% of obese women (n=268). Preterm deliveries ( $\geq 25$  to <37 weeks) occurred more frequently among obese women (6.62%, n=19) compared to those with normal (4.12%, n=10) and overweight BMI (5.96%, n=28). Only one participant with normal BMI (0.41%, n=1) had a post-term delivery ( $\geq 42$  weeks). The mode of delivery was significantly associated with BMI ( $P < 0.001$ ). Vaginal delivery was more common in the normal (87.24%, n=212) and overweight (81.91%, n=385) groups, but less frequent among obese women (59.93%, n=172). Conversely, caesarean deliveries were highest among obese women (40.07%, n=115), followed by overweight (18.09%, n=85) and normal BMI groups (12.76%, n=31). Table 4 illustrates the relationship between BMI and fetal outcomes within the study population. Birth weight outcomes showed significant variation across BMI categories ( $P < 0.001$ ). Low birth weight was slightly more common among obese women (4.88%, n=14) compared to those with normal (3.29%, n=8) and overweight BMI (2.55%, n=12). The majority of participants had normal birth weight, but the proportion decreased with higher BMI: 90.53% (n=220) in the normal group, 84.04% (n=395) in the overweight group, and 79.79% (n=229) in the obese group. Macrosomia (excessive birth weight) was highest among obese women (15.33%, n=44),

**Table 1:** Demographical characteristics of the study population (N=1000).

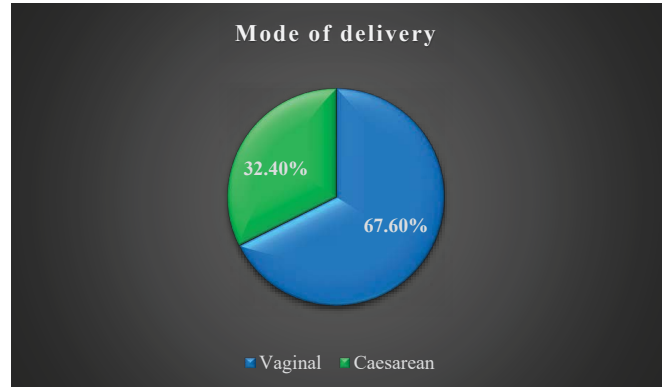
Variables	Frequency (n)	Percentage (%)
Maternal age (in years)		
<30 years	545	54.5
$\geq 30$ years	455	45.5
Parity		
$\leq 2$	390	39
>2	610	61
Gestational age (in weeks)		
$\geq 28$ to <37	46	4.6
37 to <42	952	95.2
$\geq 42$	2	0.2

**Table 2:** Gestational weight gain category of the study pregnant women (N=1000).

Category	Frequency (n)	Percentage (%)
Inadequate	248	24.8
Adequate	423	42.3
Excessive	329	32.9



**Figure 1:** BMI status of the study pregnant women (N=1000).



**Figure 2:** Mode of delivery of the study population (N=1000).

**Table 3:** Association of BMI with gestational age and mode of delivery of the study population.

Variables	Normal (N=243)		Overweight (N=470)		Obesity (N=287)		P-value
	n	%	n	%	n	%	
Gestational age (in weeks)							
≥25 to <37	10	4.12	28	5.96	19	6.62	0.254
37 to <42	232	95.47	442	94.04	268	93.38	
≥42	1	0.41	0	0	0	0	
Mode of delivery							
Vaginal	212	87.24	385	81.91	172	59.93	<0.001
Caesarean	31	12.76	85	18.09	115	40.07	

**Table 4:** Association of BMI with fetal outcomes of the study.

Variables	Normal (N=243)		Overweight (N=470)		Obesity (N=287)		P-value
	n	%	n	%	n	%	
Birth weight							
Low birth weight	8	3.29	12	2.55	14	4.88	<0.001
Normal birth weight	220	90.53	395	84.04	229	79.79	
Macrosomia	15	6.17	63	13.4	44	15.33	
Apgar score							
1 min	8.1±0.9		7.6±0.8		7.7±0.7		0.001
5 min	8.8±0.8		8.4±0.8		8.3±0.6		
NICU admission	13	5.35	32	6.81	28	9.76	0.321
Neonatal mortality	1	0.41	2	0.43	3	1.05	0.405

followed by the overweight group (13.40%, n=63) and the normal BMI group (6.17%, n=15). Apgar scores at both 1 and 5 minutes were significantly lower in overweight and obese groups compared to the normal group ( $P = 0.001$ ). NICU admissions were more frequent among obese women (9.76%, n=28) compared to overweight (6.81%, n=32) and normal BMI groups (5.35%, n=13), though this difference was not statistically significant ( $P = 0.321$ ). Neonatal mortality rates were low across all groups, with slightly higher rates in the obese group (1.05%, n=3) compared to overweight (0.43%, n=2) and normal BMI groups (0.41%, n=1), but the difference was not significant ( $P = 0.405$ ).

## Discussion

Obesity is a significant global health issue, particularly prevalent among pregnant women, where it raises obstetrical risks and the likelihood of cesarean section (CS). Given the widespread nature of obesity, understanding its effects on labor is crucial. Our study demonstrated that obesity, rather than simply being overweight, has a more pronounced impact on labor and the mode of delivery. This was evidenced by the notably higher cesarean rates observed among the normal, overweight, and obese groups, which were 12.76%, 18.09%, and 40.07%, respectively. These findings are consistent with prior research showing that obese pregnant women have higher rates of cesarean deliveries [18,19]. Several factors could explain our study's results. In Egypt, 35% of the adult population is affected by obesity, the highest percentage globally within this age group [20]. Carlson et al. (2017) reported that obese women required higher doses of oxytocin for labor induction due to their increased body volume [21]. A 2018 meta-analysis further confirmed that maternal obesity results in longer labor and higher cesarean section rates, primarily due to fetal macrosomia and an increased risk of shoulder dystocia [22]. Additionally, maternal obesity has been linked to a greater risk of fetal distress, leading to more frequent cesarean deliveries [23]. In 2017, Maged et al. investigated how elevated BMI affects labor progression, finding that obese women experienced a significantly prolonged first stage of labor and a higher rate of emergency cesarean deliveries [24]. These results are in line with our study's findings. Moreover, a large analytical study of 118,978 laboring women identified a significant negative correlation between BMI and labor progression, showing that women with a normal BMI delivered 2 to 4 hours earlier than their obese or morbidly obese counterparts. The study recommended adapting labor management protocols to account for maternal BMI differences [19]. Catalano and Shankar found that obese women were more likely to experience postpartum hemorrhage, a finding consistent with our study [25]. Additionally, their research supports our observation of a significant positive correlation between maternal weight and fetal weight [25]. Our study, which included 1,000 women meeting the inclusion criteria,

also confirmed that there were no significant age differences among the three groups. Among the participants, 545 (54.5%) were under 30 years old, while 455 (45.5%) were aged 30 or older. In terms of parity, 390 participants (39%) had two or fewer previous births, whereas 610 (61%) had more than two. Regarding gestational age, 952 pregnancies (95.2%) were full-term (between 37 and less than 42 weeks), and 46 (4.6%) were preterm (between 28 and less than 37 weeks). This demographic profile indicates that most participants were younger mothers with higher parity and primarily full-term pregnancies. In our analysis of gestational weight gain categories among the 1,000 study participants, we found that 248 women (24.8%) had inadequate weight gain, 423 (42.3%) achieved adequate weight gain, and 329 (32.9%) experienced excessive weight gain. These results suggest that nearly one-third of participants gained weight excessively during pregnancy, and a significant portion did not meet the recommended weight gain levels. This emphasizes the potential impact of both inadequate and excessive gestational weight gain on maternal and fetal outcomes, as it can raise the risk of complications like cesarean delivery and fetal macrosomia. These trends are consistent with the observations noted in this study. Regarding gestational age, the majority of participants across different BMI categories delivered between 37 to <42 weeks: 95.47% of those with a normal BMI (n=232), 94.04% of overweight women (n=442), and 93.38% of obese women (n=268). Preterm deliveries ( $\geq 25$  to <37 weeks) were more common among obese women, occurring in 6.62% (n=19) of cases, compared to 4.12% (n=10) in those with normal BMI and 5.96% (n=28) in overweight participants. Notably, only one participant with normal BMI (0.41%, n=1) experienced a post-term delivery ( $\geq 42$  weeks). These findings emphasize that obesity is a significant predictor of preterm birth, likely due to placental dysfunction, which aligns with the trends observed in our study. The mode of delivery showed a significant association with BMI ( $P < 0.001$ ). Vaginal delivery was most common among women with normal BMI (87.24%, n=212) and overweight women (81.91%, n=385) but occurred less frequently in obese women (59.93%, n=172). Conversely, cesarean deliveries were highest among obese women (40.07%, n=115), followed by overweight women (18.09%, n=85) and those with normal BMI (12.76%, n=31). These findings further link maternal obesity with a higher risk of labor complications and increased cesarean delivery rates, consistent with the outcomes of this study. Additionally, the relationship between BMI and fetal outcomes is reflected in the variation in birth weight ( $P < 0.001$ ). Low birth weight was observed slightly more frequently among obese women (4.88%, n=14) compared to those with normal BMI (3.29%, n=8) and overweight BMI (2.55%, n=12). Most participants had normal birth weight; however, this proportion decreased with increasing BMI: 90.53% (n=220) in the normal group, 84.04% (n=395) in the overweight group, and 79.79% (n=229)

in the obese group. Macrosomia, or excessive birth weight, was most prevalent among obese women (15.33%, n=44), followed by those in the overweight group (13.40%, n=63) and the normal BMI group (6.17%, n=15). Additionally, Apgar scores at both 1 and 5 minutes were significantly lower in the overweight and obese groups compared to the normal group ( $P = 0.001$ ). Khan et al. (2020) explored the effect of lifestyle interventions on the mode of delivery in overweight pregnant women. Their findings support these observations by highlighting that adverse intrauterine environments associated with elevated BMI can detrimentally affect neonatal vitality [31]. NICU admissions were more frequent among obese women (9.76%, n=28) compared to the overweight (6.81%, n=32) and normal BMI groups (5.35%, n=13), though this difference was not statistically significant ( $P = 0.321$ ). Neonatal mortality rates were low across all groups, with slightly higher rates in the obese group (1.05%, n=3) compared to the overweight (0.43%, n=2) and normal BMI groups (0.41%, n=1). Although these differences were not statistically significant ( $P = 0.405$ ), Khan et al.'s study highlights that maternal obesity increases the risk of adverse neonatal outcomes, consistent with these findings [26].

**Limitations of the study:** This study has several limitations. As a retrospective observational study, it is inherently prone to potential biases in data recording and availability. Conducting the study at a single hospital may restrict the generalizability of the results to other populations. Additionally, the exclusion of women with specific risk factors, such as smoking or drug use, further limits the applicability of the findings to the broader population.

### Conclusion and Recommendations

This study highlights a clear link between maternal weight gain during pregnancy and the mode of delivery. Excessive gestational weight gain and elevated pre-pregnancy BMI are significantly associated with a higher likelihood of cesarean deliveries, with obese women showing the highest cesarean rates. Furthermore, maternal obesity is connected to adverse fetal outcomes, including fetal macrosomia, lower Apgar scores, and increased NICU admissions. These findings emphasize the importance of effective weight management during pregnancy to minimize delivery complications and enhance maternal and neonatal health outcomes.

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