International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Shalini et al. Int J Reprod Contracept Obstet Gynecol. 2026 Aug;15(8):3119-3124
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20262544

Original Research Article

Observational study of effect of body mass index on fetomaternal outcome in pregnancy

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Received: 27 June 2026
Revised: 08 July 2026
Accepted: 10 July 2026

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ABSTRACT

Background: Maternal body mass index (BMI), is a key predictor of pregnancy-related outcomes. Pre-pregnancy BMI and gestational weight gain are closely linked to both maternal and neonatal health. The study was conducted to evaluate the impact of maternal BMI on pregnancy, labour and neonatal outcome.
Methods: This was a cross-sectional observational study. This study was conducted in the Department of Obstetrics and Gynecology at Tertiary Care Institute (Chhatrapati Shivaji Maharaj Hospital, Kalwa) between July 2025 and December 2025. About 400 antenatal women registered in our hospital during the first trimester were enrolled in the study. Their BMI was calculated and each of them were allotted into 4 separate groups based on their BMI. Women are asked for routine antenatal visits in the OPD. At the end obstetric outcomes, perinatal outcome and neonatal outcomes were observed. Data entry was done in Microsoft excel and analysis was done using a software Epi Info 7.
Results: The present study demonstrates that increasing BMI is significantly associated with hypertensive disorders, GDM, postdatism, induction of labour, LSCS, and wound complications. Underweight status is associated with anaemia, preterm labour and IUGR.
Conclusions: Our study points out the numerous maternal and perinatal risks are associated with overweight, obese and underweight pregnant women. Hence these groups of women need to be regarded as 'high risk' when counselling and risk assessment is done in the antenatal clinic.

Keywords: BMI, Maternal outcome, Neonatal outcome

INTRODUCTION

Maternal body mass index (BMI), calculated as weight in kilograms divided by the square of height in meters, is a fundamental measure of nutritional status and a key predictor of pregnancy-related outcomes. Pre-pregnancy BMI and gestational weight gain are closely linked to both maternal and neonatal health, influencing the risk of complications such as gestational diabetes mellitus, hypertensive disorders, cesarean delivery, and adverse neonatal outcomes including macrosomia, small or large for gestational age, preterm birth, and admission to neonatal intensive care units.[1-4] Overweight and obesity before conception are consistently associated with increased odds of gestational diabetes, gestational hypertension, cesarean section, and adverse neonatal conditions compared with women of standard BMI, while underweight status increases risk of low birth weight and preterm delivery. Recommended weight gain in pregnancy: The American College of Obstetricians and Gynecologists (2016) has endorsed these measures.[5]

The worldwide prevalence of elevated BMI among women of reproductive age has risen substantially, making it imperative to systematically characterize the effects of maternal BMI across diverse populations and clinical settings. Patterns of gestational weight gain associated with different BMI categories further modify risks: both inadequate and excessive weight gain relative to

established guidelines have been implicated in increased morbidity for mothers and infants.

Table 1: Recommended weight gain in pregnancy (ACOG 2016).

Pre-conception BMI in kg/m^2	Total gestational weight gain (kg)	Incremental weight gain in 2nd and 3rd trimester (kg/week)
<18.5	12.5-18	0.44-0.58
18.5-24.9	11.5-16	0.35-0.50
25-29.9	7-11.5	0.23-0.33
>30	5-9	0.17-0.27

The study was conducted to evaluate the impact of maternal BMI on overall outcome of pregnancy and labour, aimed towards sensitisation of obstetricians about the modifiable risk factor that can grossly impact the life of mother and baby.

METHODS

This was a cross-sectional observational study. This study was conducted in the Department of Obstetrics and Gynecology at Tertiary Care Institute (Chhatrapati Shivaji Maharaj hospital, Kalwa) between July 2025 and December 2025. About 400 antenatal women who registered in our hospital during the first trimester were enrolled in the study after obtaining proper informed consent. In all the patients a detailed history, examinations and investigations were carried out. Women are asked for routine antenatal visits in the OPD. Their BMI was calculated by the quetelets index and each of them were allotted into 4 separate groups based on their BMI. The BMI is calculated based on the QUETELET'S INDEX BMI = weight in Kg/height in meter square.

Based on this, index patients were divided into 4 groups: Group 1=Underweight = patients with BMI <=18.5kg/m^2, Group 2 = Normal=patients with BMI 18.5-24.9 kg /m^2, Group 3 = Overweight = patients with BMI 25-29.9kg /m^2, Group 4 = Obese = patients with BMI 30-34.9 kg /m^2.

Inclusion criteria

Pregnant women who are booked in 1st trimester and delivered at Chhatrapati Shivaji Maharaj Hospital, Kalwa, Maharashtra, India.

Exclusion criteria

Pregnant women who are unbooked, pregnant women who are registered in second trimester, multifetal pregnancy were excluded.

Statistical analysis

At the end obstetric outcomes, perinatal outcome and neonatal outcomes were observed. Data entry was done in Microsoft excel and analysis was done using a software Epi Info 7.

RESULTS

In our study, 48 women belong to underweight category, 184 women had normal BMI. 112 women were overweight and 56 were obese (Table 2).

Table 2: Categorization of patient according to BMI.

BMI in kg/m^2	Category	Total	Percentage
<18.5	Underweight	48	12
18.5-24.9	Normal	184	46
25-29.9	Overweight	112	28
30-34.9	Obese	56	14

In this study, 87.3% of women belonged to age under 30 years and 12.7% were of age 30 years or more (Table 3).

Table 3: Age distribution among different groups.

Age (years)	Underweight (n=48), N (%)	Normal (n=184), N (%)	Overweight (n=112), N (%)	Obese (n=56), N (%)	Total, N (%)
18-22	9 (18.8)	36 (19.6)	26 (23.2)	11 (19.6)	82 (20.5)
23-29	27 (56.3)	132 (71.7)	74 (66.1)	34 (60.7)	267 (66.8)
30-35	12 (25.0)	16 (8.7)	12 (10.7)	11 (19.6)	51 (12.7)
Total	48 (100)	184 (100)	112 (100)	56 (100)	400 (100)

The incidence of preeclampsia and gestational diabetes milletus were more among obese and overweight as compared to other groups. The incidence of preeclampsia is 16.1% among overweight and in obese were 35.7%. Similarly, the incidence of GDM is more among obese (39.3%) and overweight (17.9%) women. The result was statistically significant ($p<0.001$). Women belonged to underweight category were more anaemic (37.5%) as compared to another group (Table 4).

The incidence of postdatism were more common among overweight (37.5%) and obese women (42.95%). The difference was statistically significant. Similarly, incidence of preterm labour was more among women in underweight group. There was not statistically significant difference among four groups with complications like oligohydramnios, PROM, abruption, abortions (Table 5).

Table 4: Maternal complications.

Complications	Underweight (n=48), N (%)	Normal (n=184), N (%)	Overweight (n=112), N (%)	Obese (n=56), N (%)	Total, N (%)
Preeclampsia	1 (2.1)	6 (3.3)	18 (16.1)	20 (35.7)	<0.001
Gestational diabetes mellitus	0 (0)	5 (2.7)	20 (17.9)	22 (39.3)	<0.001
Anaemia	18 (37.5)	42 (22.8)	16 (14.3)	6 (10.7)	<0.001

Table 5: Obstetrical complications.

Complications	Underweight (n=48), N (%)	Normal (n=184), N (%)	Overweight (n=112), N (%)	Obese (n=56), N (%)	Total, N (%)
Oligohydraminos	6 (12.5)	10 (5.4)	14 (12.5)	11 (19.6)	0.132
Postdatism	3 (6.3)	28 (15.2)	42 (37.5)	24 (42.9)	<0.001
Preterm	14 (29.2)	8 (4.3)	4 (3.6)	5 (8.9)	<0.001
PROM	5 (10.4)	14 (7.6)	9 (8.0)	2 (3.6)	0.566
Abruption	1 (2.1)	0 (0)	2 (1.8)	1 (1.8)	0.492
Abortions	2 (4.2)	0 (0)	1 (0.9)	1 (1.8)	0.665

Table 6: Delivery outcome.

Delivery outcomes	Underweight (n=48), N (%)	Normal (n=184), N (%)	Overweight (n=112), N (%)	Obese (n=56), N (%)	Total, N (%)
Induction of labour	10 (20.8)	36 (19.6)	45 (40.2)	18 (32.1)	Induction of labour
Vaginal delivery	34 (70.8)	143 (77.7)	61 (54.5)	26 (46.4)	Vaginal delivery
LSCS	12 (25.0)	41 (22.3)	49 (43.8)	29 (51.8)	LSCS
Operative vaginal delivery	0 (0)	0 (0)	1 (0.9)	0 (0)	Operative vaginal delivery

The women with normal BMI had more vaginal deliveries as compared to other groups. The induction of labour is done maximum in the women belong to overweight group {odd's ratio 2.76, p value <0.001}. Thus, the odds of induction of labour increases with increasing BMI. Underweight shows no significant association (Table 6).

The rate of LSCS is more with women with high BMI. Overweight women have 2.7 times higher odds of LSCS (p<0.001). Obese women have 3.7 times higher odds of LSCS (p<0.001). Underweight women do not show a statistically significant difference in LSCS rates compared to normal BMI.

The incidence of wound gap is more among overweight and obese women as compared to the other groups. However, the incidence of PPH and pyrexia were similar among all the groups (Table 7).

Table 7: Postpartum complications.

Postpartum complications	Underweight (n=48), N (%)	Normal (n=184), N (%)	Overweight (n=112), N (%)	Obese (n=56), N (%)	Total, N (%)
PPH	1 (2.1)	3 (1.6)	2 (1.8)	1 (1.8)	0.998
Pyrexia	2 (4.2)	2 (1.1)	6 (1.8)	1 (1.8)	0.236
Wound gap	1 (2.1)	2 (1.1)	13 (7.1)	4 (7.1)	0.003

Table 8: Neonatal complications.

Neonatal complications	Underweight (n=48), N (%)	Normal (n=184), N (%)	Overweight (n=112), N (%)	Obese (n=56), N (%)	Total, N (%)
IUGR	13 (27.1)	16 (8.7)	22 (19.6)	6 (10.7)	0.004
Macrosomia	0 (0)	2 (1.1)	5 (4.5)	3 (5.4)	0.12
Stillbirth	0 (0)	0 (0)	1 (0.9)	1 (1.8)	0.39
Intubation	2 (4.2)	4 (2.2)	3 (2.7)	2 (3.6)	0.87

The incidence of IUGR is more common among underweight as compared to overweight and obese. Other complications like macrosomia, Stillbirth and need for intubation were comparable among four groups (Table 8).

DISCUSSION

The present study was conducted to evaluate the impact of maternal BMI on maternal, obstetrical, and neonatal outcomes among 400 pregnant women. The findings clearly demonstrate that both extremes of BMI are associated with adverse pregnancy outcomes.

BMI distribution

In the present study, 12% women were underweight, 46% had normal BMI, 28% were overweight, and 14% were obese. A study by Sebire et al (2001) reported 28% overweight and 11% obese women, which is similar to our findings.[8] The rising prevalence of overweight and obesity reflects changing lifestyle patterns and urbanization.

Maternal complications

Preeclampsia

In our study, the incidence of preeclampsia increased significantly with BMI, overweight: 16.1%, obese: 35.7% (p<0.001). This finding is consistent with the landmark study by O'Brien et al, which showed that obese women had approximately 3-4 times higher risk of preeclampsia compared to women with normal BMI.[3] Relph et al observed that, although only 2.6% of normal weight women developed the condition, the prevalence was 4.7% in overweight women, 7.8% in obese and greater than 10% in severely obese women.[23] The pathophysiology may be related to insulin resistance, endothelial dysfunction, and chronic inflammatory state associated with obesity.

Gestational diabetes mellitus

In our study, GDM was significantly higher among obese women which was about 39.3% and among overweight women which is around 17.9%. Systematic reviews and meta-analyses of case-control and cohort studies indicate that obesity increases risk by more than threefold (study by Chu et al) and that excess visceral and central adiposity are greater risk factors than general obesity.[24] Alwash et al also reported that obese women have nearly 3-5 times increased risk of GDM, supporting our findings.[2]

Anaemia

In our study, anaemia was most common among underweight women (37.5%) (p<0.001). This observation aligns with findings from developing countries where undernutrition is strongly associated with micronutrient deficiencies. Studies from South Asia have consistently shown higher anaemia rates among underweight pregnant women due to poor nutritional reserves.[7]

Obstetrical complications

Postdatism

In our study, the postdatism was significantly higher among the women belonging to categories of Overweight (37.5%) and Obese (42.9%). This is comparable to findings by Cedergren et al, who reported increased incidence of prolonged pregnancy among obese women.[11] Delayed onset of spontaneous labour in obese women may be due to altered myometrial contractility and hormonal dysregulation. However, for post-date delivery there was no difference between cases and control groups in this study like Seligman et al.[25]

Preterm labour

In our study preterm labour was highest among underweight women (29.2%) (p<0.001). Similar results were reported by Han et al, who demonstrated that underweight women have increased risk of spontaneous preterm birth, possibly due to poor nutritional status and reduced placental perfusion.[10] But other studies like Bhattacharya et al suggested that there is higher percentage of preterm labour among the women with higher BMI.[26]

Mode of delivery

Induction of labour

In our study, the odds of induction of labour increased with BMI; overweight: OR 2.76 (p<0.001) and Obese: OR 1.95 (p=0.048). This is consistent with studies by Arrowsmith et al and Ushakiran et al, which showed higher induction rates among obese women due to increased postdatism and hypertensive disorders.[13,27]

LSCS (Lower Segment Caesarean Section)

In our study, LSCS rates increased progressively with BMI. This strong association has been widely reported. O'Dwyer et al reported increased risk of caesarean delivery in obese women.[9] The result is similar to that of study of Berghof et al.[28] The increased LSCS rate may be due to failed induction, and cephalopelvic disproportion etc.

Postpartum complications

Wound gap was significantly higher in overweight and obese women (p=0.003). This finding is consistent with the study by Leth et al, which showed increased postoperative wound complications in obese women due to poor vascularity and increased adipose tissue thickness.[10]

In our study there was no significant association between postpartum haemorrage, puerperal pyrexia with BMI. However, risk of post-partum haemorrhage was found to

be more than doubled in obese women in a study by Dalbye et al.[29]

Neonatal outcomes

IUGR

IUGR was highest among underweight women (27.1%) (p=0.004). This finding correlates with studies by Kramer et al, who demonstrated that low maternal BMI is an independent risk factor for fetal growth restriction.[14]

Macrosomia

In our study, macrosomia was more common in overweight and obese groups but did not reach statistical significance. Several studies including those by Weiss et al have shown strong association between maternal obesity and macrosomia.[15]

The major limitation of the study is that study department is a tertiary referral centre. High-risk pregnancy cases consist almost two-thirds of our patients. Thus, the rates of complicated obstetric outcomes related to obesity maybe higher in our study population and this could be a potentially confounding factor that may have influenced the results. The other limitation is small sample size and BMI measurement done in first trimester where some women will lose the weight because of excessive vomiting.

CONCLUSION

The present study demonstrates that increasing BMI is significantly associated with hypertensive disorders, GDM, postdatism, induction of labour, LSCS, and wound complications. Underweight status is associated with anaemia, preterm labour, and IUGR.

Our study points out the numerous maternal and perinatal risks in overweight and obese pregnant women shows that this group of women need to be regarded as 'high risk' when counselling and risk assessment is done in the antenatal clinic. Same is applied to underweight group. So, all mother in underweight group should be encouraged for proper nutrition and risk should be explained to them. It has been recommended that all mothers should have their BMI calculated at booking as a part of the full risk assessment and should be offered advice about sensible weight reduction, including diet and exercise and referral to a dietician where appropriate.

In addition, massive obesity among women of child bearing age is associated with a number of health risks later in life. This stresses the importance of concentrating on trying to reduce the increasing incidence of obesity in fertile women. The best time of intervention may be before a woman considers a pregnancy, because it is not recommended that obese women lose weight during pregnancy.

This implicates the need of pre-pregnancy advice and counselling to young women. Obese women considering pregnancy should be informed of the risk that maternal obesity confers on a pregnancy.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Shalini, Anand M, Ashar T, More P, Senapati JB. Observational study of effect of body mass index on fetomaternal outcome in pregnancy. Int J Reprod Contracept Obstet Gynecol 2026;15:3119-24.