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## Original Research Article

# Comparison of maternal and fetal outcomes in non-obese and obese women

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## ABSTRACT

**Background:** Maternal obesity is a growing public health problem with negative maternal and perinatal outcomes. The aim of this study was to assess and compare the maternal and foetal outcomes of obese and non-obese pregnant women.

**Methods:** The study was case-control conducted at Department of Obstetrics and Gynecology, ESICMC & PGIMSR, Bengaluru from April 2024 to September 2025. 180 pregnant women were recruited and divided into obese (n=90) and non-obese (n=90) groups. Women who were pregnant with a single foetus and who were aged 19–42 years were included. The participants were followed during the pregnancy, delivery and postpartum period. Data was collected and analysed with SPSS version 26 and  $p < 0.05$  was regarded as statistically significant.

**Results:** Mean BMI was significantly higher in obese than non-obese women ( $33.56 \pm 4.01$  vs.  $22.32 \pm 1.53$  kg/m<sup>2</sup>). Obese women were more likely to have comorbidities than normal weight women (73.3% vs. 41.1%,  $p < 0.001$ ), such as gestational diabetes mellitus (24.4% vs. 8.9%) and preeclampsia (24.4% vs. 6.7%). The rate of preterm birth (24.4% vs. 12.2%) and lower-segment caesarean section (54.4% vs. 36.7%) were higher in obese women. The intrauterine fetal death rate was only in obese women (4.4%). Obese women were more likely to be admitted to NICU (83.7% vs. 43.3%,  $p < 0.001$ ) mainly because of neonatal hypoxia and birth asphyxia.

**Conclusion:** Maternal obesity was significantly linked to greater rates of antenatal comorbidities, operative delivery, and adverse neonatal outcomes, and preterm delivery. Better antenatal monitoring and prompt obstetric intervention is recommended in obese pregnancies.

**Keywords:** Obesity, Pregnancy Complications, Maternal Health, Fetal Outcome, Body Mass Index

## INTRODUCTION

Obesity is now a significant public health problem with over one billion people today identified as obese, including 650 million adults, 340 million adolescents and 39 million children. It is becoming increasingly common in every region, and is now considered by international organizations to be a modern epidemic. The burden is of special concern in the reproductive age group due to the direct impact on maternal and perinatal health.<sup>1,2</sup>

The National Family Health Survey-5 (NFHS-5) reveals that nearly one in four women in India's childbearing age

are overweight or obese, which is a marked increase from previous surveys.<sup>3,4</sup> This increasing burden is at a time when physiological changes may exacerbate the effects of excess adiposity, and obesity in pregnancy is now acknowledged as an important determinant of adverse obstetric outcomes and a focus for public health in both developed and low-middle income countries, including India.<sup>5</sup>

These maternal risks are reflected in fetal and neonatal risks. An excess maternal adiposity is associated with congenital anomalies, especially neural tube defects and cardiac malformations. However, the fetus is also at risk

of macrosomia, associated with alterations of maternal glucose metabolism, with potential complications such as shoulder dystocia and birth trauma; on the other hand, obesity is associated with higher rates of preterm birth and late intrauterine fetal death, which again reflect the complexity of metabolic, placental, and inflammatory mechanisms.<sup>6</sup> The neonates of obese mothers are also at increased risk of needing admission to a NICU and of developing long-term metabolic disorders.<sup>7</sup>

Since obesity is a growing problem among women of reproductive age in India and the consequences of obesity are far-reaching among mothers and their babies, there is a strong need to systematically assess these outcomes in the local context. Knowing the relative risk for complications in obese and non-obese pregnant women will help to better stratify risk, plan appropriate antenatal interventions and optimize labour and delivery management.

The aim of this study was to assess and compare the maternal and foetal outcomes of obese and non-obese pregnant women.

## METHODS

### *Study design, setting and study period*

The case-control study was conducted from April 2024 to September 2025 in the Department of Obstetrics and Gynecology at the ESICMC & PGIMSR, Bengaluru, Karnataka, India.

### *Study population*

The study population consisted of the pregnant women who attended the antenatal outpatient department during the study period. 180 pregnant women who met the criteria for inclusion were recruited.

### *Selection criteria*

#### *Inclusion criteria*

The inclusion criteria were pregnant women aged 19–42 years, singleton pregnancy confirmed by clinical examination or ultrasonography, attended the antenatal clinic during the study period and gave informed consent in written form to participate.

#### *Exclusion criteria*

Women with multiple gestations, uterine or fetal congenital anomalies, or who refused informed consent were excluded from the study.

The participants were divided into two groups based on their BMI at enrolment:

Cases: BMI  $\geq 25$  kg/m<sup>2</sup>

Controls: BMI  $< 25$  kg/m<sup>2</sup>

### *Sample size estimation*

The sample size for the present case-control study was calculated using G\*Power version 3.1.9.4 based on the effect estimates reported in the study “Maternal Obesity and Pregnancy Outcome: In Perspective of New Asian Indian Guidelines”.<sup>8</sup> The primary outcome for sample size estimation was hypertensive disorders of pregnancy (HDP) which showed a clinically meaningful difference between the BMI groups in the reference study.

The following assumptions were used to determine the sample size for a two-group comparison:

Power (1- $\beta$ ): 80%

The level of significance ( $\alpha$ ) is set at 5% and the test is conducted on both tails.

Effect size: Based on the difference in the percentage of HDP in the BMI categories of the reference study.

From these parameters a minimum sample size of 82 participants per group was calculated. With a possible 10% attrition rate (loss to follow-up, incomplete data, or participant withdrawal), a sample size of about 90 participants per group was calculated. Therefore, the final sample size was 180 pregnant women, with 90 women in each BMI group.

### *Sampling method*

Eligible pregnant women attending the antenatal outpatient department during the study period were used to recruit the participants by simple random sampling. The participants were screened based on the inclusion and exclusion criteria and were recruited until the required number of 180 participants was reached.

### *Study procedure*

The participants were screened and recruited based on the inclusion and exclusion criteria. After enrolment, a pre-designed case record proforma was filled out to collect demographic, clinical, obstetric, anthropometric, laboratory, ultrasonographic, and pregnancy outcome data.

A detailed history was obtained, which included age, gravidity, parity, previous obstetric history, and any maternal risk factors. Gestational age was calculated by Naegele's rule and verified by first trimester ultrasonography if available.

Anthropometric assessment was done by measuring weight and height with calibrated equipment. Body mass index was calculated using the formula:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$$

All participants had standard antenatal investigations as per institutional protocol which included blood grouping and blood typing, complete blood count, urine routine examination, urine microscopy, HIV, VDRL, HBsAg, HCV, thyroid function test and 50g oral glucose challenge test.

During pregnancy, obstetric ultrasonography was done as clinically indicated to evaluate the growth and well-being of the fetus. The subjects were followed up in a prospective manner during pregnancy, labour, delivery and the postpartum period. Maternal and fetal outcomes were recorded and compared between the two BMI groups.

Maternal outcomes evaluated were pregnancy-induced hypertension, gestational diabetes mellitus, and preterm labour. Intrapartum outcomes were mode of delivery (normal vaginal delivery, instrumental delivery, and caesarean delivery), and postpartum complications were postpartum haemorrhage, thromboembolic events, and delayed wound healing.

Fetal outcomes included APGAR scores at 1 and 5 minutes, birth weight (low birth weight, appropriate for gestational age, or macrosomia), and admission to the neonatal intensive care unit (NICU) according to the neonatal condition at birth.

### **Ethical approval**

Before the study was initiated, the study was approved and ethical clearance was obtained from the Institutional ethics committee of ESICMC & PGIMSR, Bengaluru. All eligible participants were provided with an explanation of the purpose of the study, the procedures, possible risks and benefits, confidentiality and the voluntary nature of participation. All participants signed an informed consent form prior to enrollment.

### **Statistical analysis**

The data was entered into a Microsoft Excel spreadsheet and analyzed using IBM SPSS Statistics version 26 (IBM Corp., Armonk, NY, USA). Frequencies and percentages were used to present categorical variables. The normality of continuous variables was tested by Kolmogorov–Smirnov and Shapiro–Wilk tests. Continuous variables were normally distributed and expressed as mean  $\pm$  SD, and were compared using the independent-samples t-test. Continuous variables that were skewed were summarized with appropriate measures and compared by the Mann–Whitney U test. The Chi-square test was used to compare categorical variables. Fisher's exact test or Yates' continuity correction was used for categorical data in situations where the assumptions of the chi-square test were not met, especially for 2 $\times$ 2 contingency tables. A

two-sided p-value <0.05 was considered statistically significant

## **RESULTS**

The non-obese group shows a narrow BMI range with a mean of 22.32 $\pm$ 1.53 kg/m<sup>2</sup>, and values clustering tightly around the median of 22.7 kg/m<sup>2</sup>. The obese group exhibits a substantially higher mean BMI of 33.56 $\pm$ 4.01 kg/m<sup>2</sup>, with a wider spread extending up to 44.20 kg/m<sup>2</sup>. The majority of participants in both groups were between 21–30 years depicted in Table 1. The Chi-square p-value of 0.107 indicates that the distribution was not statistically different between groups.

**Table 1: Comparison of BMI and age distribution between non-obese and obese groups.**

| Parameters                                | Non-obese (n=90) | Obese (n=90)     |
|-------------------------------------------|------------------|------------------|
| <b>Body mass index (kg/m<sup>2</sup>)</b> |                  |                  |
| Mean $\pm$ SD                             | 22.32 $\pm$ 1.53 | 33.56 $\pm$ 4.01 |
| Minimum                                   | 18.9             | 25.6             |
| Median                                    | 22.7             | 33.8             |
| Maximum                                   | 24.6             | 44.2             |
| <b>Age distribution, N (%) (years)</b>    |                  |                  |
| 18–20                                     | 5 (5.6)          | 3 (3.3)          |
| 21–25                                     | 27 (30.0)        | 22 (24.4)        |
| 26–30                                     | 29 (32.2)        | 29 (32.2)        |
| 31–35                                     | 23 (25.6)        | 18 (20.0)        |
| 36–40                                     | 6 (6.7)          | 18 (20.0)        |
| <b>Chi-square test</b>                    | 0.107            |                  |
| <b>P value</b>                            |                  |                  |

Values are presented as mean  $\pm$  SD or N (%), as appropriate. BMI = body mass index; SD = standard deviation. Age distribution was compared using the chi-square test

**Table 2: Comparison of BMI and age distribution between non-obese and obese groups.**

| Parameters                                | Non-obese (n=90) | Obese (n=90)     |
|-------------------------------------------|------------------|------------------|
| <b>Body mass index (kg/m<sup>2</sup>)</b> |                  |                  |
| Mean $\pm$ SD                             | 22.32 $\pm$ 1.53 | 33.56 $\pm$ 4.01 |
| Minimum                                   | 18.9             | 25.6             |
| Median                                    | 22.7             | 33.8             |
| Maximum                                   | 24.6             | 44.2             |
| <b>Age distribution, N (%) (years)</b>    |                  |                  |
| 18–20                                     | 5 (5.6)          | 3 (3.3)          |
| 21–25                                     | 27 (30.0)        | 22 (24.4)        |
| 26–30                                     | 29 (32.2)        | 29 (32.2)        |

Nearly three-quarters of obese participants experienced at least one medical complication. Gestational diabetes mellitus (24.4%) and preeclampsia (24.4%) were remarkably more common among obese women, compared to 8.9% and 6.7% respectively in the non-obese group. Hypothyroidism also showed higher prevalence in

the obese group (18.9% vs. 11.1%) depicted in Table 2. The highly significant p-value ( $<0.001$ ) confirms that comorbid conditions clustered disproportionately among obese women.

**Table 3: Comparison of gravida between the groups.**

| Gravida status                      | Non-obese<br>(n=90), N<br>(%) | Obese<br>(n=90), N<br>(%) |
|-------------------------------------|-------------------------------|---------------------------|
| <b>Primigravida</b>                 | 43 (47.8)                     | 25 (27.8)                 |
| <b>Multigravida</b>                 | 47 (52.2)                     | 65 (72.2)                 |
| <b>Chi-square test,<br/>P value</b> | 0.006                         |                           |

Values are presented as N (%). Gravida status was compared using the chi-square test.  $p=0.006$  indicates a statistically significant difference between the groups.

**Table 4: Comparison of gestational age and mode of delivery between non-obese and obese groups**

| Parameters                                 | Non-obese<br>(n=90), N<br>(%) | Obese<br>(n=90), N<br>(%) |
|--------------------------------------------|-------------------------------|---------------------------|
| <b>Gestational age at delivery (weeks)</b> |                               |                           |
| Preterm ( $<37$ )                          | 11 (12.2)                     | 22 (24.4)                 |
| Term (37–40)                               | 79 (87.8)                     | 65 (72.2)                 |
| Post-term ( $>40$ )                        | 0 (0.0)                       | 3 (3.3)                   |
| <b>Mode of delivery</b>                    |                               |                           |
| Normal vaginal delivery                    | 56 (62.2)                     | 34 (37.8)                 |
| Assisted vaginal delivery                  | 1 (1.1)                       | 7 (7.8)                   |
| LSCS                                       | 33 (36.7)                     | 49 (54.4)                 |
| <b>Chi-square test<br/>P value</b>         | 0.018†                        | 0.002‡                    |

Values are presented as N (%). †Chi-square test for gestational age at delivery; ‡Chi-square test for mode of delivery. Both comparisons showed statistically significant differences between the groups ( $p<0.05$ ).

In the non-obese category, the distribution was nearly balanced, with primigravidae constituting 47.8% and multigravidae 52.2%. However, among obese women, a majority (72.2%) were multigravidae, while only 27.8% were primigravidae depicted in Table 3. This substantial difference is statistically significant ( $p=0.006$ ) and clinically relevant.

Preterm birth ( $<37$  weeks) was twice as common among obese mothers (24.4%) compared to non-obese mothers (12.2%), indicating a significantly elevated predisposition to early delivery in the obese group depicted in Table 4. The statistically significant p-value (0.018) reinforces that these differences are unlikely due to chance. A majority of non-obese women (62.2%) delivered vaginally, whereas only 37.8% of obese women achieved normal vaginal delivery. Assisted vaginal delivery was also more frequent in the obese group (7.8%) compared to the non-obese group (1.1). Most notably, caesarean section (LSCS) rates

were significantly higher in obese women (54.4%) than in non-obese women (36.7%) depicted in Table 4. The statistically significant p-value (0.002) confirms that mode-of-delivery differences are meaningful and not incidental

Among non-obese women undergoing LSCS, fetal distress was the predominant reason (45.5%), followed by cephalopelvic disproportion (15.2%) and failed induction (9.1%). In contrast, obese women requiring LSCS exhibited a different pattern: failed induction (22.4%) and eclampsia (20.4%) emerged as major indications, with fetal distress still present but comparatively lower (24.5%) depicted in Table 5. Despite these clinically important differences, the p-value of 0.218 suggests that the variation in indications was not statistically significant.

**Table 5: Comparison of indications for LSCS between the groups**

| Indication for LSCS                | Non-obese<br>(n=33), N<br>(%) | Obese<br>(n=49), N<br>(%) |
|------------------------------------|-------------------------------|---------------------------|
| <b>Abruptio placentae</b>          | 2 (6.1)                       | 4 (8.2)                   |
| <b>Breech presentation</b>         | 2 (6.1)                       | 2 (4.1)                   |
| <b>Contracted pelvis</b>           | 1 (3.0)                       | 0 (0.0)                   |
| <b>Cephalopelvic disproportion</b> | 5 (15.2)                      | 7 (14.3)                  |
| <b>Deep transverse arrest</b>      | 1 (3.0)                       | 0 (0.0)                   |
| <b>Eclampsia</b>                   | 2 (6.1)                       | 10 (20.4)                 |
| <b>Failed induction</b>            | 3 (9.1)                       | 11 (22.4)                 |
| <b>Fetal distress</b>              | 15 (45.5)                     | 12 (24.5)                 |
| <b>Non-progression of labour</b>   | 2 (6.1)                       | 3 (6.1)                   |
| <b>Chi-square test<br/>P value</b> | 0.218                         |                           |

Values are presented as N (%). The indications for LSCS were compared using the chi-square test.  $p=0.218$  indicates no statistically significant difference between the groups

**Table 6: Comparison of fetal outcome between the groups.**

| Fetal outcomes                     | Non-obese<br>(n=90), N<br>(%) | Obese<br>(n=90), N<br>(%) |
|------------------------------------|-------------------------------|---------------------------|
| <b>Intrauterine death</b>          | 0 (0.0)                       | 4 (4.4)                   |
| <b>Live birth</b>                  | 90 (100.0)                    | 86 (95.6)                 |
| <b>Chi-square test<br/>P value</b> | 0.043                         |                           |

Values are presented as N (%). Fetal outcomes were compared using the chi-square test.  $p=0.043$  indicates a statistically significant difference between the groups.

In the non-obese group, all pregnancies resulted in live births (100%), indicating favourable fetal survival outcomes depicted in Table 6. However, in the obese group, 4 out of 90 pregnancies (4.4%) resulted in

intrauterine fetal demise (IUFD), a significant and clinically concerning difference supported by a p-value of 0.043.

In the non-obese group, 85.6% of neonates had normal birth weight ( $\geq 2.5$  kg), and 14.4% were low birth weight (LBW). In the obese group, a slightly lower proportion of normal-weight infants (80.2%) was observed, with LBW neonates representing 19.8% depicted in Table 7. The findings were not statistically significant (0.348).

**Table 7: Comparison of birth weight of the neonates between the groups.**

| Birth weight            | Non-obese (n=90), N (%) | Obese (n=86), N (%) |
|-------------------------|-------------------------|---------------------|
| Low (<2.5 kg)           | 13 (14.4)               | 17 (19.8)           |
| Normal ( $\geq 2.5$ kg) | 77 (85.6)               | 69 (80.2)           |
| Chi-square test         | 0.348                   |                     |
| P value                 |                         |                     |

Values are presented as N (%). APGAR score distribution was compared using the chi-square test.  $p = 0.074$  indicates no statistically significant difference between the groups

**Table 8: Comparison of APGAR score of the neonates between the groups.**

| APGAR score              | Non-obese (n=90), N (%) | Obese (n=86), N (%) |
|--------------------------|-------------------------|---------------------|
| 6                        | 2 (2.2)                 | 4 (4.7)             |
| 7                        | 16 (17.8)               | 18 (20.9)           |
| 8                        | 11 (12.2)               | 21 (24.4)           |
| 9                        | 61 (67.8)               | 43 (50.0)           |
| Chi-square test, P value | 0.074                   |                     |
| APGAR score              | Non-obese (n=90), N (%) | Obese (n=86), N (%) |

Values are presented as N (%). APGAR score distribution was compared using the chi-square test.  $p = 0.074$  indicates no statistically significant difference between the groups.

**Table 9: Comparison of APGAR score of the neonates between the groups.**

| NICU admission  | Non-obese (n=90), N (%) | Obese (n=86), N (%) |
|-----------------|-------------------------|---------------------|
| Yes             | 39 (43.3)               | 72 (83.7)           |
| No              | 51 (56.7)               | 14 (16.3)           |
| Chi-square test | <0.001                  |                     |
| P value         |                         |                     |

Values are presented as N (%). NICU admission was compared using the chi-square test.  $p < 0.001$  indicates a statistically significant difference between the groups.

In the non-obese group, the majority of neonates (67.8%) achieved an APGAR score of 9, indicating excellent neonatal adaptation. Comparatively, only 50% of obese-group neonates achieved an APGAR of 9, reflecting comparatively lower immediate postnatal vigor depicted in Table 8. The statistical p-value (0.074) did not reach significance.

In the non-obese category, 43.3% of newborns required NICU care, already a considerable proportion. However, in the obese group, a remarkable 83.7% of newborns were admitted to the NICU, almost doubling the requirement for advanced neonatal support depicted in Table 9. This highly significant difference ( $p < 0.001$ ) reflects profound fetal compromise associated with maternal obesity. In the non-obese group, neonatal hypoxia (46.2%) and respiratory distress (33.3%) were the leading indications, while meconium aspiration accounted for 20.5%. However, among neonates born to obese mothers, neonatal hypoxia was even more prominent (61.1%) depicted in Table 10. The statistically significant p-value (0.033) confirms real differences in the clinical spectrum of neonatal compromise.

**Table 10: Comparison of APGAR score of the neonates between the groups.**

| Indication for NICU admission | Non-obese (n=39), N (%) | Obese (n=72), N (%) |
|-------------------------------|-------------------------|---------------------|
| Birth asphyxia                | 0 (0.0)                 | 6 (8.3)             |
| Collar bone injury            | 0 (0.0)                 | 1 (1.4)             |
| Erb's palsy                   | 0 (0.0)                 | 1 (1.4)             |
| Meconium aspiration           | 8 (20.5)                | 4 (5.6)             |
| Neonatal hypoxia              | 18 (46.2)               | 44 (61.1)           |
| Respiratory distress          | 13 (33.3)               | 14 (19.4)           |
| Shoulder dystocia             | 0 (0.0)                 | 2 (2.8)             |
| Chi-square test               | 0.033                   |                     |
| P value                       |                         |                     |

Values are presented as N (%). The indications for NICU admission were compared using the chi-square test.  $p = 0.033$  indicates a statistically significant difference between

## DISCUSSION

Obesity is an increasing global public health concern and has important implications during pregnancy. Maternal obesity is linked to insulin resistance, chronic low-grade inflammation, endothelial dysfunction and altered metabolic and cardiovascular physiology, all of which can lead to adverse maternal and fetal outcomes. Most of the participants were in the age group of 21-30 years, and there was no significant difference in age distribution between the non-obese and obese groups ( $p = 0.107$ ), although there were more women in the age group of 36-40 years in the obese group. There was a significant difference between gravida status, with 72.2% of the obese women being multigravida compared to 52.2% of the non-obese women ( $p = 0.006$ ). This finding is consistent with an Indian tertiary-care study in which 67.7% of obese women were

multigravida, suggesting that higher BMI may be more commonly encountered among women with previous pregnancies.<sup>9</sup> The present study revealed that obese women had significantly higher prevalence of maternal comorbidities, such as gestational diabetes mellitus (24.4% vs. 8.9%) and preeclampsia (24.4% vs. 6.7%). A higher frequency of GDM and preeclampsia was also observed in obese women in the present study (18.9% vs. 11.1%), which is consistent with recent Indian observational studies reporting increased frequencies of GDM and preeclampsia among women with increased BMI.<sup>10,11</sup> Similarly, a prospective Indian cohort showed an increased risk of early GDM with higher pre-pregnancy weight.<sup>12</sup> Hypothyroidism was also more frequent among obese women in the present study (18.9% vs. 11.1%), supporting the need for careful metabolic and thyroid assessment in obese pregnant women.<sup>13</sup>

There was a significant difference in the gestational age at delivery between the two groups ( $p=0.018$ ). The rates of preterm delivery were 24.4% in obese women and 12.2% in non-obese women, while post-term delivery was seen only in the obese group (3.3%). This relationship between maternal obesity and altered timing of delivery has been reported in previous studies, which may be due to metabolic dysregulation, systemic inflammation, hypertensive disorders, and pregnancy complications that necessitate early delivery.<sup>14,15</sup> Furthermore, obesity has been linked with premature rupture of membranes and medically indicated preterm delivery. There was also a significant difference in mode of delivery between the groups ( $p=0.002$ ). Obese women were less likely to have a normal vaginal delivery (37.8%) and more likely to have LSCS (54.4%) than non-obese women (62.2% and 36.7%, respectively). The rate of assisted vaginal delivery was also higher among the obese group (7.8% vs. 1.1%). John et al and Zhang et al reported similar results, which could be linked to dysfunctional labour, poor uterine contractility, cephalopelvic disproportion, macrosomia, failed induction and pregnancy complications like preeclampsia and gestational diabetes.<sup>16,17</sup> The distribution of indications for LSCS was not significantly different between groups ( $p=0.218$ ), but failed induction and eclampsia were more common in obese women. Previous studies have also demonstrated increasing caesarean delivery rates with increasing maternal BMI.<sup>18,19</sup>

The groups also showed significant differences in fetal outcomes. There was no intrauterine death in the non-obese group, while 4.4% of the obese women had intrauterine death, which was statistically significant ( $p=0.043$ ). The absolute number of events was low, but the finding is consistent with previous studies that have shown that women with obesity have an increased risk of stillbirth or intrauterine death, which may be due to placental dysfunction, altered placental vascularization, chronic fetal hypoxia, and increased risk of maternal complications (such as hypertension and diabetes).<sup>20,21</sup> Low birth weight was seen in 19.8% of live-born neonates born to obese women, and 14.4% of live-born neonates born to non-

obese women, but this difference was not statistically significant ( $p=0.348$ ). Low birth weight in obese pregnancies could be linked to pre-term delivery or placental dysfunction due to hypertensive disorders. Previous studies have found similar correlations between maternal BMI and birth weight, but did not specifically examine macrosomia or LGA infants, which are significant neonatal outcomes linked to maternal obesity.<sup>22</sup> Neonates born to obese women also tended to have lower APGAR scores, but this was not statistically significant ( $p=0.074$ ). The APGAR score of 9 was less common in the obese-group neonates than in the non-obese group, and the scores of 6–8 were more common. These differences have been reported in other studies, but the present study does not provide a specific causal mechanism.<sup>20</sup>

The greatest difference between neonates and adults was seen in NICU admission. The rate of admission to the NICU for neonates born to obese women was 83.7% versus 43.3% for those born to non-obese women, which was statistically significantly different ( $p<0.001$ ). Neonatal hypoxia was the most common indication in neonates admitted to the NICU, with 61.1% of obese-group neonates and 46.2% of non-obese-group neonates having this diagnosis. Respiratory distress was seen in 19.4% and 33.3% respectively, and birth asphyxia, shoulder dystocia, Erb's palsy and collar bone injury were mainly seen in neonates born to obese women. This increased rate of NICU admission may be due to the interaction of preterm delivery, maternal metabolic and hypertensive complications, operative delivery, intrapartum fetal compromise, and birth trauma. Previous studies have also found that the children of obese mothers have a higher incidence of neonatal morbidity and NICU admissions, which could be related to excessive fetal growth and difficult delivery, though fetal birth weight does not account for all of these outcomes.<sup>9</sup>

There are some limitations in the present study. The findings may not be generalizable due to its single-center observational design and relatively small sample size, and may not allow causal relationships to be drawn. The findings may have been affected by other factors that could have confounded the results, such as maternal age, parity, socioeconomic status, lifestyle and preexisting medical conditions. The classification of obesity could also have been influenced by variations in the availability or accuracy of pre-pregnancy weight data. Furthermore, maternal and neonatal outcomes were not evaluated in the long-term. These results should be confirmed with larger multicenter prospective studies with longer follow-up.

## CONCLUSIONS

In conclusion, the present study shows that maternal obesity is linked to a number of maternal and fetal complications such as increased rates of gestational diabetes mellitus, preeclampsia, preterm delivery, operative delivery, intrauterine death, and admission to the NICU. Birth weight and APGAR scores were not

significantly different between groups, however. The results of this study emphasize the need for preconception counseling, proper weight management, early detection of diabetes and hypertensive disorders, routine antepartum monitoring, and careful planning of the intrapartum and neonatal period. A multidisciplinary approach can also help to minimize pregnancy-related complications and optimize maternal and neonatal outcomes, especially in obese women with concurrent metabolic and/or hypertensive disorders.

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## REFERENCES

- World Obesity Federation. Prevalence of obesity. Available at: <https://www.worldobesity.org/about/about-obesity/prevalence-of-obesity>. Accessed on 10 January 2026.
- World Health Organization. Obesity and overweight. WHO fact sheet. 2025 Dec. Available from: World Health Organization website. Accessed on 10 January 2026.
- Chakrabarty M, Let S. Spatial clustering of overweight/obesity among women in India: insights from the latest National Family Health Survey. PLoS One. 2024;19(7).
- Press Information Bureau. Towards a fit and healthy India: combating obesity through NFHS-5 data. Government of India; 2025. Available from: Press Information Bureau website. Accessed 2025 May 17.
- Haq N, Chamarthi VS, Ayabe A. Obesity in pregnancy. In: StatPearls Treasure Island (FL): StatPearls Publishing; 2025. Available from: NCBI Bookshelf. Accessed on 4 January 2026.
- Persson M, Cnattingius S, Villamor E, Söderling J, Pasternak B, Stephansson O, et al Risk of major congenital malformations in relation to maternal overweight and obesity severity: cohort study of 1.2 million singletons. BMJ. 2017;357.
- D'Souza R, Horyn I, Pavalagantharajah S, Zaffar N, Jacob CE. Maternal body mass index and pregnancy outcomes: a systematic review and meta-analysis. Am J Obstet Gynecol MFM. 2019;1(4):100041.
- Kutchi I, Chellammal P, Akila A. Maternal obesity and pregnancy outcome: in perspective of new Asian Indian guidelines. J Obstet Gynaecol India. 2020;70(2):138-44.
- Naik R, Karmali D, Nagarsenkar A, Mainath S, Pednekar G. Effect of pre-pregnancy maternal body mass index on obstetric outcomes in a tertiary care hospital in Goa, India. J Obstet Gynaecol India. 2022;72(2):141-6.
- Gandhi S, Chauhan K, Rajan P, Wanjari M, Sangoi L, Sangoi R. Impact of maternal body mass index on pregnancy outcomes among Indian women. Bioinformation. 2024;20(10):1257.
- Inian S, Nadar SR, Marconi S, Sukumar A, Cherian AG. Weight gain in pregnancy and impact of obesity on the obstetric outcome: a retrospective study in a secondary care hospital in South India. J Family Med Prim Care. 2024;13(10):4293.
- Deshpande S, Kinnunen TI, Khadilkar A, Unni J, Khanijo V, Donga N, et al Pre-pregnancy weight, the rate of gestational weight gain, and the risk of early gestational diabetes mellitus among women registered in a tertiary care hospital in India. BMC Pregnancy Childbirth. 2023;23(1):586.
- Dhabhai N, Chowdhury R, Virmani A, Chaudhary R, Taneja S, Mittal P, et al. Burden, risk factors and outcomes associated with adequately treated hypothyroidism in a population-based cohort of pregnant women from North India. PLoS One. 2023;18(9).
- Sangeetha TM, Tamilarasi S. Maternal and fetal outcome in obesity complicating pregnancy. Int J Acad Med Pharm. 2024;6(5):223-8.
- Bhattacharya S, Campbell DM, Liston WA, Bhattacharya S. Effect of body mass index on pregnancy outcomes in nulliparous women delivering singleton babies. BMC Public Health. 2007;7(1):168.
- John J, Mahendran M. Maternal and fetal outcomes of obese pregnant women: a prospective cohort study. Int J Reprod Contracept Obstet Gynecol. 2017;6(2):725-30.
- Zhang Y, Lu M, Yi Y, Xia L, Zhang R, Li C, et al. Influence of maternal body mass index on pregnancy complications and outcomes: a systematic review and meta-analysis. Front Endocrinol (Lausanne). 2024;15:1280692.
- Vahratian A, Siega-Riz AM, Savitz DA, Zhang J. Maternal pre-pregnancy overweight and obesity and the risk of cesarean delivery in nulliparous women. Ann Epidemiol. 2005;15(7):467-74.
- Stepan H, Scheithauer S, Dornhöfer N, Krämer T, Faber R. Obesity as an obstetric risk factor: does it matter in a perinatal center? Obesity (Silver Spring). 2006;14(5):770-3.
- Salihu HM, Dunlop AL, Hedayatzadeh M, Alio AP, Kirby RS, Alexander GR. Extreme obesity and risk of stillbirth among black and white gravidas. Obstet Gynecol. 2007;110(3):552-7.
- Yao R, Ananth CV, Park BY, Pereira L, Plante LA. Obesity and the risk of stillbirth: a population-based cohort study. Am J Obstet Gynecol. 2014;210(5):457.e1.
- Tayade S, Singh R, Kore J, Gangane N. Maternal anthropometric measurements, pre-pregnancy body mass index, and fetal growth parameters: a rural experience. Obstet Gynecol Res. 2018;1(2):51-6.

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