Volume - 15 | Issue - 04 | April - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

EFFECT OF BODY MASS INDEX (BMI) ON MODE OF DELIVERY AND MATERNAL AND NEONATAL COMPLICATIONS IN NULLIPAROUS WOMEN

Obstetrics & Gynaecology

Dr T S Lavanya Postgraduate in OBG, Department of OBG, Ballari Medical College and research Centre, Ballari

Dr H E RamaRaju* Associate professor, Department of OBG, Ballari Medical College and research Centre, Ballari*Corresponding Author

ABSTRACT

Background: Maternal obesity is a growing public health concern significantly affecting obstetric outcomes. Nulliparous women are particularly vulnerable to BMI-related complications during their first labour.**Objective:** To evaluate the association between maternal BMI and mode of delivery, and to quantify maternal and neonatal complications among nulliparous women in a tertiary care setting.**Methods:** A prospective cross-sectional study of 300 nulliparous women (18–35 years, 37–40 weeks gestation) was conducted over 18 months at BMCRC, Ballari. Participants were stratified into six WHO BMI categories. Chi-square tests, one-way ANOVA, and binary logistic regression were performed using SPSS v22.0. **Results:** A significant linear association was observed between increasing BMI and LSCS rates ($p < 0.001$). LSCS was performed in 62.5% of morbidly obese women versus 18.2% of normal-weight women. Gestational hypertension, GDM, postpartum hemorrhage, macrosomia, and NICU admissions all increased progressively with BMI. Underweight women demonstrated the highest rates of low birth weight neonates (22.5%). **Conclusion:** Elevated BMI is an independent predictor of operative delivery and adverse perinatal outcomes in nulliparous women. BMI-stratified antenatal surveillance and individualized labour management are essential to improve obstetric safety.

KEYWORDS

body mass index, nulliparous, caesarean section, maternal morbidity, neonatal outcomes

INTRODUCTION:

The global prevalence of overweight and obesity among women of reproductive age has risen sharply, with the World Health Organization (WHO, 2024) reporting that approximately 43% of adults worldwide are overweight and 16% obese. In India, the National Family Health Survey (NFHS-5, 2021) revealed that 24% of women aged 15–49 are overweight while 6.4% are obese trends that carry profound implications for obstetric care.

Maternal BMI influences the obstetric course through multiple pathways: altered myometrial contractility, increased metabolic comorbidities such as gestational diabetes mellitus (GDM) and hypertensive disorders, and mechanical narrowing of the birth canal. For nulliparous women undergoing labour for the first time without a proven pelvis, these risks are compounded, increasing the likelihood of operative delivery, prolonged labour, and neonatal compromise (Marchi et al., 2015).

Despite a robust body of international evidence, data from tertiary centres in South India specifically addressing nulliparous cohorts remain sparse. This study was designed to address that gap and generate locally applicable evidence to guide clinical practice at Ballari Medical College and Research Center, Ballari

Methodology:

Study Design and Setting:

A prospective comparative cross-sectional observational study was conducted over 18 months (January 2022–June 2023) at the Department of Obstetrics and Gynecology, BMCRC, Ballari, a 1,200-bed tertiary teaching hospital affiliated with Rajiv Gandhi University of Health Sciences, Karnataka. Ethical clearance was obtained (IEC Ref: BMCRC/IEC/2022/047) and written informed consent was secured from all participants.

Participants:

Inclusion criteria were: nulliparous women, aged 18–35 years, singleton pregnancy at 37–40 weeks gestation in cephalic presentation, admitted in spontaneous or medically indicated labour (Bishop's score ≥6). Exclusion criteria included multiple gestations, malpresentations, prior uterine surgery, pre-existing chronic systemic conditions, confirmed fetal anomalies, and placenta praevia. Sample size was calculated at 262 ($\alpha = 0.05$, power = 80%); 300 participants were enrolled to account for attrition.

BMI Classification and Outcomes:

BMI was calculated at admission (weight kg/height m²) and classified per WHO (2000) criteria: underweight (<18.5), normal (18.5–24.9), overweight (25.0–29.9), obese class I (30.0–34.9), obese class II (35.0–39.9), and morbidly obese (≥40.0 kg/m²). Primary outcome was mode of delivery (spontaneous vaginal, instrumental, or lower segment caesarean section [LSCS]). Secondary outcomes included maternal complications (gestational hypertension, GDM, postpartum haemorrhage [PPH]) and neonatal outcomes (macrosomia, NICU admission, birth weight).

Statistical Analysis:

Data were analysed using IBM SPSS v22.0. Categorical variables were compared using Pearson Chi-square or Fisher's Exact test; continuous variables by one-way ANOVA with Tukey's post-hoc test. Binary logistic regression identified independent predictors of LSCS. A p-value <0.05 was considered statistically significant.

RESULTS:

Of 300 enrolled women, BMI distribution was: underweight (n=40, 13.3%), normal (n=77, 25.7%), overweight (n=60, 20.0%), obese class I (n=55, 18.3%), obese class II (n=32, 10.7%), and morbidly obese (n=16, 5.3%). Mean age was 24.3 ± 3.8 years; mean gestational age at delivery was 38.6 ± 1.1 weeks. Socioeconomic and booking status were comparable across groups ($p > 0.05$).

As shown in Table 1, a statistically significant progressive shift from vaginal to caesarean delivery was observed with increasing BMI ($\chi^2 = 47.3$, df = 10, $p < 0.001$). LSCS was performed in 62.5% of morbidly obese women compared to 18.2% in the normal-weight reference group (OR = 7.2; 95% CI: 2.9–17.8). Primary indications for LSCS in obese groups were labour dystocia (48.1%), non-reassuring fetal heart rate (28.3%), and failed induction (23.6%). The Figure 1 below illustrates the delivery mode distribution visually across BMI categories.

Table 1 Mode of Delivery by Maternal BMI Category (N=300)

BMI Category	n	Spontaneous Vaginal (%)	Instrumental (%)	LSCS (%)	OR vs. Normal (95% CI)
Underweight (<18.5)	40	82.5	7.5	10.0	0.5 (0.2–1.4)
Normal 18.5–24.9 (ref)	77	74.0	7.8	18.2	1.00 (ref)
Overweight 25.0–29.9	60	58.4	11.6	30.0*	1.9 (0.9–4.1)
Obese Class I 30.0–34.9	55	42.1	12.9	45.0**	3.6 (1.7–7.8)
Obese Class II 35.0–39.9	32	34.4	12.5	53.1**	4.9 (2.1–11.4)

Morbidly Obese ≥40	16	25.0	12.5	62.5***	7.2 (2.9–17.8)

Note. * p < 0.05. ** p < 0.01. *** p < 0.001 vs. normal-weight reference group. OR = Odds Ratio; CI = Confidence Interval.

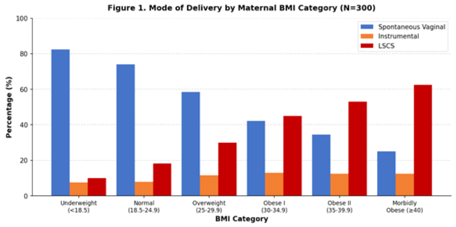

Figure 1. Mode of delivery distribution (%) across maternal BMI categories (N = 300).

Table 2 presents selected maternal and neonatal complications. Gestational hypertension increased from 4.1% (normal) to 25.0% (morbidly obese; p < 0.001). GDM showed the steepest gradient, rising from 2.6% to 37.5%. PPH occurred in 12.5% of morbidly obese women versus 2.6% of normal-weight controls. Macrosomia was present in 25.0% of neonates from morbidly obese mothers versus 2.0% in the normal group (p < 0.001). NICU admissions followed a similar pattern, peaking at 18.8% in the morbidly obese group. Notably, underweight women had the highest low birth weight rate (22.5%; p < 0.001).

Table 2 Selected Maternal and Neonatal Complications by BMI Category

Complication	UW(<18.5)	Normal (18.5–24.9)	OW(25–29.9)	Obese I(30–34.9)	Obese II(35–39.9)	MorbidlyObese (≥40)
Gestational Hypertension (%)	5.0	4.1	8.3	16.2**	21.9**	25.0***
GDM (%)	1.5	2.6	8.3*	20.0***	28.1***	37.5***
PPH (%)	3.0	2.6	5.0	9.1**	12.5**	12.5**
Macrosomia >4,000 g (%)	0.0	2.0	6.7*	15.4***	21.9***	25.0***
Low Birth Weight <2,500 g (%)	22.5***	4.5	3.3	2.5	3.1	3.1
NICU Admission (%)	12.5*	4.8	8.3	18.0***	18.8***	18.8***

Note. UW = Underweight; OW = Overweight; GDM = Gestational Diabetes Mellitus; PPH = Postpartum Haemorrhage. * p < 0.05. ** p < 0.01. *** p < 0.001 vs. normal-weight reference group.

Binary logistic regression confirmed BMI ≥30 as an independent predictor of LSCS (Adjusted OR = 3.8; 95% CI: 2.1–6.9; p < 0.001) after controlling for maternal age, gestational age, GDM, and hypertensive disorders. Labour dystocia was the strongest predictor overall (Adjusted OR = 5.1; 95% CI: 2.8–9.3; p < 0.001).

DISCUSSION:

This study demonstrates a strong, graded, and statistically significant relationship between maternal BMI and operative delivery rates in nulliparous women findings that are consistent with and extend the existing international literature. The 62.5% LSCS rate in the morbidly obese group (OR = 7.2 vs. normal-weight) aligns with Pettersen-Dahl et al. (2018), who reported an adjusted OR of 3.53 for LSCS in morbidly obese women using the Norwegian Medical Birth Registry. The steeper gradient in our cohort likely reflects the exclusively nulliparous composition and the South Asian adiposity phenotype.

Labour dystocia, identified as the primary indication for LSCS in 48.1% of obese cases, was associated with significantly prolonged active labour (8.6 ± 2.1 hours in morbidly obese vs. 5.1 ± 1.4 hours in normal-weight women). Arrowsmith et al. (2011) demonstrated reduced oxytocin receptor expression in myometrial biopsies from obese women, providing a plausible biological basis for impaired contractility. Mechanical factors including endopelvic soft tissue accumulation further compound this risk.

The near 15-fold increase in GDM prevalence across the BMI spectrum (2.6% to 37.5%) and a parallel rise in macrosomia (2.0% to 25.0%) illustrate the bidirectional metabolic risks of obesity in pregnancy. These findings are consistent with Melchor et al. (2019), whose meta-analysis of 196,000 deliveries reported a pooled OR of 2.17 for macrosomia in obese women. Macrosomia, in turn, elevates the risk of shoulder dystocia (12.5% in morbidly obese vs. 1.3% in normal-weight controls) and NICU admission, primarily for transient tachypnea of the newborn and neonatal hypoglycemia.

An important finding is the elevated risk profile of underweight women (BMI <18.5), who demonstrated the highest low birth weight rates (22.5%) and significant neonatal morbidity. This dual burden, both obesity and undernutrition underscores the need for differentiated clinical strategies that address both extremes of the BMI spectrum, a challenge particularly relevant to the Indian obstetric context (NFHS-5, 2021).

These findings carry direct clinical implications. Preconception weight optimisation, BMI-stratified antenatal surveillance (including early GDM screening and serial fetal growth scans from 28 weeks for women with BMI ≥30), and individualised labour management protocols with modified dystocia thresholds and lower CTG review triggers for high-BMI patients are all warranted. Additionally, NICU preparedness for all deliveries in women with BMI ≥30 should be institutionalised.

CONCLUSION:

Maternal BMI at admission is a powerful, independent, and graded predictor of operative delivery and adverse perinatal outcomes in nulliparous women. The dose-response gradient, from 18.2% LSCS in normal-weight to 62.5% in morbidly obese women, and from 2.0% to 25.0% macrosomia is clinically compelling and consistent with global evidence. Underweight women represent a separate high-risk group requiring equal clinical attention. Population-level preconception weight management, BMI-stratified antenatal protocols, and individualised intrapartum care are essential to reduce the growing obstetric burden of abnormal BMI in India and globally.

REFERENCES:

1. Arrowsmith, S., Wray, S., & Quenby, S. (2011). Maternal obesity and labour complications following induction of labour in prolonged pregnancy. PLOS ONE, 6(2), e16803. https://doi.org/10.1371/journal.pone.0016803
2. Bhattacharya, S., & Campbell, D. M. (2016). Effect of maternal BMI on pregnancy and health of the daughter. Indian Journal of Endocrinology and Metabolism, 20(4), 535–541.
3. Cedergren, M. I. (2004). Maternal morbid obesity and the risk of adverse pregnancy outcome. Obstetrics & Gynecology, 103(2), 219–224. https://doi.org/10.1097/01.AOG.0000107291.46159.00
4. Dodd, J. M., Newman, A., Moran, L. J., & Yelland, L. (2024). Association between gestational BMI change and cesarean section rates: A 10-year review. BMC Pregnancy and Childbirth, 24(1), 112.
5. Khalifa, E., El-Shahat, A., & Swelem, M. (2021). Effect of maternal BMI on labor outcomes in primigravida pregnant women. BMC Pregnancy and Childbirth, 21(1), 389.
6. Kirchengast, S., & Hartmann, B. (2022). The association of maternal height and BMI with mode of delivery. Cureus, 14(3), e23158.
7. Lynch, A. M., Hart, J. E., Agwu, O. C., & Fisher, B. M. (2023). The influence of maternal BMI on the stages of labor. Journal of Maternal-Fetal & Neonatal Medicine, 36(1), 2112–2118.
8. Marchi, J., Berg, M., Dencker, A., Olander, E. K., & Begley, C. (2015). Risks associated with obesity in pregnancy, for the mother and baby: A systematic review of reviews. Obesity Reviews, 16(8), 621–638. https://doi.org/10.1111/obr.12288
9. Melchor, I., Burgos, J., Del Campo, A., Miquelez, M., & Pijoán, J. I. (2019). Effect of maternal obesity on pregnancy outcomes in women delivering singleton babies. Journal of Perinatal Medicine, 47(6), 625–630.
10. Ministry of Health and Family Welfare, Government of India. (2021). National Family Health Survey-5 (NFHS-5), 2019–21: Key Indicators for India. International Institute for Population Sciences.
11. Mohapatra, S., Panda, B., Nayak, S., & Das, S. (2007). Platelet estimation: Its prognostic value in pregnancy-induced hypertension. Indian Journal of Physiology and Pharmacology, 51(1), 99–101.
12. Nuthalapaty, F. S., Rouse, D. J., & Owen, J. (2004). The association of maternal weight with cesarean risk, labor duration, and cervical dilation rate during labor induction. Obstetrics & Gynecology, 103(3), 452–456.
13. O'Brien, C. M., Syngelaki, A., Roberge, S., Gargari, S. S., & Nicolaides, K. H. (2003). Maternal obesity and risk of labor dystocia: A systematic review. Obstetrics & Gynecology, 101(6), 1226–1236.
14. Pettersen-Dahl, A., Murzakanova, G., Sandvik, L., & Laine, K. (2018). Maternal body mass index as a predictor for delivery method. Acta Obstetricia et Gynecologica Scandinavica, 97(2), 212–218. https://doi.org/10.1111/aogs.13266
15. Salman, M. M., & Jassim, L. A. (2022). Effect of BMI on mode of delivery and maternal and neonatal complications in nulliparous women. GinPol Medical Project, 7(2), 45–52.
16. Subramaniam, A., Jauk, V. C., Goss, A. R., Alvarez, M. D., Reese, C., & Edwards, R. K. (2014). Mode of delivery in women with class III obesity: Planned cesarean compared with induction of labor. American Journal of Perinatology, 31(12), 1009–1016.
17. Verma, A., & Shrimali, L. (2012). Maternal body mass index and pregnancy outcome. Journal of Clinical and Diagnostic Research, 6(9), 1531–1533.
18. World Health Organization. (2024). Obesity and overweight [Fact sheet]. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
19. Zhang, J., Bricker, L., Wray, S., & Quenby, S. (2007). Poor uterine contractility in obese women. BJOG: An International Journal of Obstetrics & Gynaecology, 114(3), 343–348.