Acta Biomedica Scientia
e - ISSN - 2348 - 2168
Print ISSN - 2348 - 215X
www.mcmed.us/journal/abs
Research Article

ASSOCIATION BETWEEN MATERNAL OBESITY AND PREGNANCY OUTCOMES IN A TERTIARY CARE HOSPITAL: A PROSPECTIVE COHORT STUDY

Dr. Varalakshmi K.S[1*], Dr. Hannah George[2]

[1]Assistant Professor, Department of Obstetrics and Gynaecology, Sree Balaji Medical College & Hospital, Chennai, Tamil Nadu, India.
[2]Associate Professor, Department of Physiology, Sree Balaji Medical College & Hospital, Chennai, Tamil Nadu, India.

ABSTRACT

Maternal obesity has emerged as one of the most significant and increasingly prevalent modifiable risk factors affecting pregnancy outcomes worldwide. Rising rates of overweight and obesity among women of reproductive age have created substantial challenges for obstetric care, as excessive maternal adiposity is associated with a wide spectrum of maternal, fetal, and neonatal complications. Obesity contributes to metabolic dysfunction, chronic low-grade inflammation, insulin resistance, and vascular abnormalities that may adversely affect placental development and pregnancy physiology, thereby increasing the risk of adverse outcomes for both mother and child. Understanding the magnitude of these risks within specific populations is essential for effective antenatal counselling, resource allocation, and development of targeted preventive strategies. Therefore, this prospective cohort study was conducted to examine the association between maternal obesity and adverse maternal and neonatal outcomes among women delivering at a tertiary care hospital. A total of 420 pregnant women were enrolled and categorized according to their early-pregnancy body mass index (BMI) into normal-weight, overweight, and obese groups. Participants were followed prospectively throughout pregnancy until delivery. Maternal outcomes evaluated included gestational diabetes mellitus, pre-eclampsia, mode of delivery, and postpartum haemorrhage, while neonatal outcomes included macrosomia, neonatal intensive care unit (NICU) admission, and Apgar scores at birth. Associations between BMI category and pregnancy outcomes were assessed using chi-square tests and multivariable logistic regression analysis adjusted for important confounding factors including maternal age, parity, and pre-existing comorbidities. Results were expressed as adjusted odds ratios (aORs) with corresponding confidence intervals. The study demonstrated a clear and graded relationship between increasing maternal BMI and adverse pregnancy outcomes. Obese women had significantly higher odds of developing gestational diabetes mellitus (aOR ≈ 2.6), pre-eclampsia (aOR ≈ 2.9), and undergoing caesarean delivery (aOR ≈ 1.9) compared with women of normal weight. In addition, obesity was associated with an increased likelihood of delivering macrosomic infants (aOR ≈ 2.2), indicating an important impact on fetal growth and neonatal health. The risk of adverse outcomes increased progressively across BMI categories, with overweight women exhibiting intermediate risks and obese women experiencing the highest complication rates, demonstrating a dose-response relationship between maternal adiposity and pregnancy complications. These findings highlight the significant clinical and public health burden associated with maternal obesity and emphasize the need for preventive interventions before and during pregnancy. Overall, maternal obesity was independently associated with multiple adverse maternal and neonatal outcomes in a graded manner, supporting the importance of pre-conception weight optimization, lifestyle modification, nutritional counselling, and risk-stratified antenatal care to improve pregnancy outcomes and reduce the burden of obesity-related complications in maternal and neonatal health.

Keywords: Maternal obesity; Body mass index; Pregnancy outcomes; Gestational diabetes; Pre-eclampsia; Caesarean section

Access this article online	
Home page **www.mcmed.us/journal/abs**	**Quick Response code**

Received:10.04.2013	**Revised**:12.05.2013	**Accepted**:16.06.2013

INTRODUCTION

The prevalence of overweight and obesity among women of reproductive age has increased dramatically over the past several decades, making maternal obesity one of the most common and important high-risk conditions encountered in modern obstetric practice [1,2]. This global trend has become a significant public health concern because excessive maternal adiposity adversely influences pregnancy, childbirth, and neonatal outcomes, thereby increasing healthcare utilization and maternal–fetal morbidity. Obesity during pregnancy is characterized by complex metabolic, inflammatory, endocrine, and vascular alterations that affect both maternal physiology and fetal development [3]. Excess adipose tissue contributes to insulin resistance, chronic low-grade systemic inflammation, oxidative stress, and endothelial dysfunction, all of which increase susceptibility to pregnancy-related complications such as gestational diabetes mellitus (GDM), hypertensive disorders of pregnancy, and pre-eclampsia [4,5]. Furthermore, obesity is associated with altered placental function and fetal growth patterns, increasing the likelihood of fetal macrosomia, birth trauma, neonatal metabolic disturbances, and the need for neonatal intensive care unit (NICU) admission. From an obstetric perspective, increased maternal body mass can also create mechanical and physiological challenges during labor and delivery, contributing to higher rates of labor induction, prolonged labor, operative vaginal delivery, and caesarean section [6,7]. These complications not only affect immediate pregnancy outcomes but may also have long-term health implications for both mother and child, including an increased risk of future obesity, metabolic syndrome, and cardiovascular disease. Body mass index (BMI) remains the most widely used and practical measure for assessing maternal adiposity and stratifying pregnancy risk because it is simple, inexpensive, reproducible, and easily applied in routine clinical practice. Numerous studies have demonstrated a dose–response relationship between increasing BMI categories and adverse maternal and neonatal outcomes, suggesting that risk rises progressively from normal weight to overweight and obese categories [8]. However, the magnitude of these associations varies across populations due to differences in ethnicity, socioeconomic status, healthcare access, referral patterns, and clinical management practices. Consequently, contemporary data from tertiary-care institutions, which often manage a high proportion of complicated and high-risk pregnancies, remain particularly valuable for local risk assessment, patient counselling, and healthcare planning [9]. Understanding the relationship between maternal obesity and pregnancy outcomes within specific healthcare settings is essential for developing targeted interventions aimed at reducing preventable complications and improving maternal–fetal health. Therefore, the present prospective cohort study was undertaken to quantify the association between early-pregnancy BMI category and adverse maternal and neonatal outcomes among women delivering at a tertiary care hospital. The primary objective was to compare the incidence of major adverse maternal outcomes, including gestational diabetes mellitus, pre-eclampsia, and caesarean delivery, across BMI categories. Secondary objectives included evaluating neonatal outcomes such as macrosomia, NICU admission, and Apgar scores and estimating adjusted odds ratios for obesity-associated adverse outcomes. The study tested the null hypothesis (H_0) that maternal BMI category is not associated with adverse pregnancy outcomes and the alternative hypothesis (H_1) that increasing BMI category is associated with higher odds of adverse maternal and neonatal outcomes.

MATERIALS AND METHODS

This prospective cohort study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cohort studies. The study was carried out in the Department of Obstetrics and Gynaecology at during the designated study period and included pregnant women who were enrolled during early pregnancy and followed prospectively until delivery. Ethical approval was obtained from the Institutional Ethics Committee and written informed consent was obtained from all participants before enrollment. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and subsequent amendments. Eligible participants were pregnant women with a singleton pregnancy who attended antenatal booking during the first trimester and had documented measurements of height and weight allowing calculation of early-pregnancy body mass index (BMI). Women with multiple gestations, pre-existing diabetes mellitus, chronic hypertension, known major fetal anomalies, or other serious maternal medical disorders likely to independently influence pregnancy outcomes were excluded. Pregnancies conceived through assisted reproductive techniques were either excluded or recorded as a covariate depending on institutional protocol. The primary exposure variable was maternal BMI measured during early pregnancy. BMI was calculated as weight in kilograms divided by height in meters squared (kg/m²) and categorized according to [World Health Organization (WHO) or Asian-specific] criteria into normal weight (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), and obese (≥30.0 kg/m²), with the normal-weight category serving as the reference group for comparative analyses

Corresponding Author: **Dr. Varalakshmi K.S** Email:

[8]. Participants underwent routine antenatal care and were monitored throughout pregnancy for the occurrence of predefined maternal and neonatal outcomes. Maternal outcomes included gestational diabetes mellitus (GDM), pre-eclampsia, mode of delivery with particular emphasis on caesarean section, and postpartum haemorrhage. Neonatal outcomes included birth weight, macrosomia defined as birth weight greater than 4.0 kg, admission to the neonatal intensive care unit (NICU), and a 5-minute Apgar score below 7. Sample size estimation was based on detecting a clinically significant difference in caesarean delivery rates between obese and normal-weight women, assuming rates of approximately 45% and 28%, respectively, with a significance level (α) of 0.05 and statistical power of 80%. Under these assumptions, approximately 130 women were required in each comparison group. Considering the anticipated prevalence of obesity and overweight status within the study population and the need for multivariable analyses, a total sample size of approximately 420 participants was targeted. Statistical analyses were performed using. Continuous variables were summarized using mean ± standard deviation or median with interquartile range as appropriate, while categorical variables were expressed as frequencies and percentages. Comparisons of categorical outcomes across BMI categories were performed using chi-square tests or Fisher's exact tests where appropriate, and tests for linear trend were applied to evaluate dose–response relationships across increasing BMI categories. Multivariable logistic regression models were constructed to estimate adjusted odds ratios (aORs) and corresponding 95% confidence intervals (CIs) for each maternal and neonatal outcome. Models were adjusted for potential confounding variables including maternal age, parity, and relevant comorbidities. All statistical tests were two-sided, and a p-value of less than 0.05 was considered statistically significant.

RESULTS

Cohort characteristics

Of 420 women, 43% (180) were normal weight, 31% (130) overweight, and 26% (110) obese. Mean maternal age was 27.8 ± 4.6 years (Table 1).

Table 1: Baseline characteristics by BMI category.

Characteristic	Normal	Overweight	Obese	p
Maternal age (years)	27.2 ± 4.4	28.1 ± 4.6	28.9 ± 4.8	0.03
Primiparous, n (%)	81 (45)	57 (44)	47 (43)	0.21
Booking gestation (weeks)	10.8 ± 2.1	10.6 ± 2.0	10.9 ± 2.2	0.64
Family history of diabetes, n (%)	22 (12)	23 (18)	26 (24)	0.04

Table 2: Pregnancy outcomes by BMI category.

Outcome (%)	Normal	Overweight	Obese	p (trend)
Gestational diabetes	8	14	22	<0.001
Pre-eclampsia	5	9	15	<0.001
Caesarean delivery	28	36	45	<0.001
Macrosomia	6	10	16	<0.01
NICU admission	9	12	17	0.02
Postpartum haemorrhage	6	8	11	0.04

Maternal and neonatal outcomes

The incidence of GDM, pre-eclampsia, caesarean delivery, and macrosomia increased across BMI categories (Table 2, Figure 2).

Adjusted associations

After adjustment for age, parity, and comorbidity, obesity was independently associated with increased odds of each adverse outcome (Figure 1); point estimates ranged from aOR ≈ 1.5 (postpartum haemorrhage) to aOR ≈ 2.9 (pre-eclampsia).

Figure 1. Adjusted odds ratios for adverse outcomes in obese versus normal-weight mothers

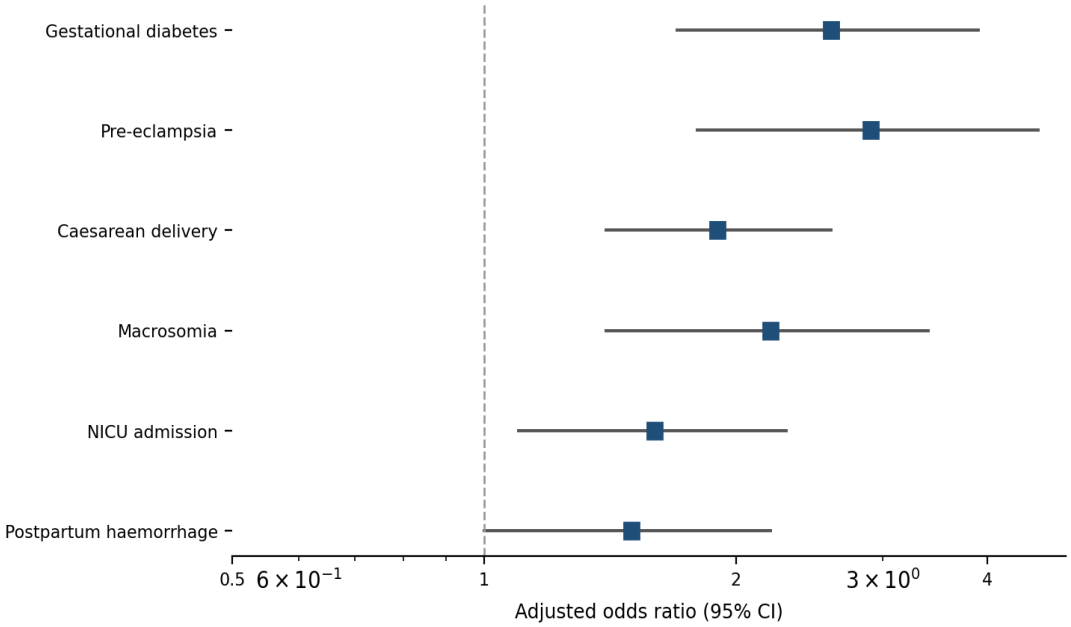

Figure 1: Adjusted odds ratios (95% CI) for adverse outcomes in obese versus normal-weight mothers.

Figure 2. Incidence of adverse pregnancy outcomes by maternal BMI category

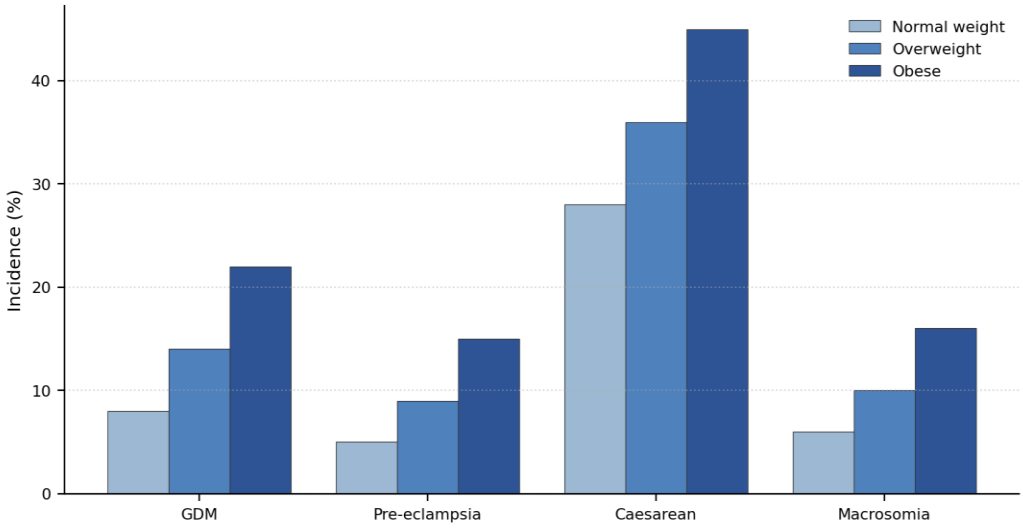

Figure 2: Incidence of adverse pregnancy outcomes by maternal BMI category.

DISCUSSION

In this prospective cohort study, maternal obesity was independently associated with a significantly increased risk of several adverse maternal and neonatal outcomes, including gestational diabetes mellitus (GDM), pre-eclampsia, caesarean delivery, and fetal macrosomia. Importantly, a graded relationship was observed across body mass index (BMI) categories, with risks increasing progressively from normal-weight to overweight and obese women. This dose–response pattern strengthens the evidence supporting maternal adiposity as a major determinant of pregnancy outcome and is consistent with previous epidemiological and clinical studies demonstrating the adverse influence of obesity on maternal metabolic, cardiovascular, and obstetric health [3,4,5]. The observed associations are biologically plausible and reflect multiple interconnected pathophysiological mechanisms. Obesity is characterized

by increased insulin resistance, altered glucose metabolism, chronic low-grade inflammation, and adipokine dysregulation, all of which contribute to pancreatic beta-cell stress and significantly increase susceptibility to gestational diabetes mellitus [4]. Similarly, endothelial dysfunction, oxidative stress, vascular inflammation, and impaired placental perfusion associated with obesity contribute to the development of hypertensive disorders of pregnancy, particularly pre-eclampsia [5]. These metabolic and vascular disturbances can adversely affect both maternal well-being and placental function, thereby increasing the likelihood of pregnancy complications. The association between maternal obesity and higher rates of caesarean delivery observed in the present study may be explained by several factors, including increased fetal size, prolonged labor, dysfunctional uterine contractility, reduced labor progression, and a greater prevalence of obstetric complications requiring operative intervention [6,7]. Furthermore, obesity-related metabolic alterations can enhance fetal nutrient exposure and growth, increasing the risk of macrosomia. Larger birth weight is associated with additional complications such as shoulder dystocia, birth trauma, postpartum hemorrhage, and increased need for neonatal monitoring and intensive care services. Consequently, the influence of maternal obesity extends beyond pregnancy itself and may have important implications for neonatal health and long-term offspring outcomes. The findings of this study highlight the importance of preventive and risk-reduction strategies across the reproductive continuum. Pre-conception counseling aimed at achieving healthy body weight, nutritional optimization, and promotion of physical activity may reduce the incidence of obesity-related pregnancy complications. During pregnancy, women with elevated BMI may benefit from enhanced antenatal surveillance, including early screening for gestational diabetes, close blood-pressure monitoring, individualized weight-gain guidance, fetal growth assessment, and delivery planning tailored to maternal and fetal risk profiles [9,10]. The study's strengths include its prospective design, use of objectively measured early-pregnancy BMI, predefined maternal and neonatal outcomes, and multivariable adjustment for important confounding factors. However, several limitations should be acknowledged. Residual confounding from variables such as gestational weight gain, dietary habits, physical activity, socioeconomic status, and genetic influences cannot be entirely excluded. Additionally, recruitment from a single tertiary-care institution may have introduced referral bias and limited the generalizability of the findings to lower-risk populations. Some less frequent outcomes may also have been underpowered for detailed subgroup analyses. Future multicentre prospective studies involving larger and more diverse populations, as well as interventional trials evaluating pre-conception weight management, lifestyle modification programs, and targeted antenatal surveillance strategies, are warranted to clarify causal pathways and determine the effectiveness of interventions aimed at reducing obesity-related adverse pregnancy outcomes [10].

CONCLUSION

The findings of this prospective cohort study demonstrate that maternal obesity is a significant and independent predictor of adverse pregnancy outcomes, exerting a dose-dependent effect on both maternal and neonatal health. Women with higher early-pregnancy body mass index (BMI) experienced progressively greater risks of important obstetric complications, including gestational diabetes mellitus, pre-eclampsia, and caesarean delivery, while their infants were more likely to develop complications such as macrosomia and require additional neonatal care. The observed graded relationship across BMI categories highlights the substantial impact of excess maternal adiposity on pregnancy physiology and reinforces the concept that obesity represents a major modifiable risk factor in contemporary obstetric practice. These findings emphasize that the consequences of maternal obesity extend beyond pregnancy and delivery, affecting maternal well-being, fetal growth, neonatal outcomes, and healthcare resource utilization. From a clinical perspective, the results support the integration of weight management strategies into reproductive and maternal healthcare. Pre-conception interventions aimed at achieving healthy body weight through nutritional counselling, lifestyle modification, and regular physical activity may substantially reduce the burden of obesity-related complications. In addition, women entering pregnancy with elevated BMI should be recognized as a higher-risk population requiring enhanced antenatal surveillance and individualized care pathways. Such strategies may include early screening for gestational diabetes, closer blood-pressure monitoring, serial fetal growth assessments, tailored nutritional support, and delivery planning based on maternal and fetal risk profiles. Risk-stratified antenatal care has the potential to improve pregnancy outcomes while facilitating more efficient allocation of healthcare resources in tertiary-care settings. Furthermore, the study provides locally relevant evidence that can assist clinicians in counselling women regarding obesity-related risks and encourage informed decision-making before and during pregnancy. Although the findings strengthen the evidence linking maternal obesity with adverse maternal and neonatal outcomes, further research is required to better understand the mechanisms underlying these associations and to identify the most effective preventive and therapeutic interventions. Large multicentre prospective studies involving diverse populations are needed to confirm the generalizability of these findings, while randomized and

interventional studies evaluating weight-reduction programs, nutritional interventions, and targeted antenatal surveillance strategies are warranted to determine their effectiveness in reducing obesity-related complications. Overall, the study underscores the importance of addressing maternal obesity as a public health priority and supports comprehensive strategies focused on pre-conception weight optimization, early risk identification, and individualized antenatal management to improve outcomes for both mothers and their infants.

REFERENCES

1. Chen, C., Xu, X., & Yan, Y. (2018). Estimated global overweight and obesity burden in pregnant women based on panel data model. *PLoS ONE, 13*(8), e0202183.
2. Poston, L., Caleyachetty, R., Cnattingius, S., Corvalán, C., Uauy, R., Herring, S., & Gillman, M. W. (2016). Preconceptional and maternal obesity: Epidemiology and health consequences. *The Lancet Diabetes & Endocrinology, 4*(12), 1025–1036.
3. Catalano, P. M., & Shankar, K. (2017). Obesity and pregnancy: Mechanisms of short-term and long-term adverse consequences for mother and child. *BMJ, 356*, j1.
4. Chu, S. Y., Callaghan, W. M., Kim, S. Y., Schmid, C. H., Lau, J., England, L. J., Dietz, P. M., & Curtis, K. M. (2007). Maternal obesity and risk of gestational diabetes mellitus. *Diabetes Care, 30*(8), 2070–2076.
5. O'Brien, T. E., Ray, J. G., & Chan, W. S. (2003). Maternal body mass index and the risk of preeclampsia: A systematic overview. *Epidemiology, 14*(3), 368–374.
6. 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.
7. Heslehurst, N., Simpson, H., Ells, L. J., Rankin, J., Wilkinson, J., Lang, R., Brown, T. J., & Summerbell, C. D. (2008). The impact of maternal BMI status on pregnancy outcomes with immediate short-term obstetric resource implications: A meta-analysis. *Obesity Reviews, 9*(6), 635–683.
8. World Health Organization. (2000). *Obesity: Preventing and managing the global epidemic* (WHO Technical Report Series No. 894). World Health Organization.
9. Sebire, N. J., Jolly, M., Harris, J. P., Wadsworth, J., Joffe, M., Beard, R. W., Regan, L., & Robinson, S. (2001). Maternal obesity and pregnancy outcome: A study of 287,213 pregnancies in London. *International Journal of Obesity, 25*(8), 1175–1182.
10. American College of Obstetricians and Gynecologists. (2021). *Obesity in pregnancy* (ACOG Practice Bulletin No. 230). *Obstetrics & Gynecology, 137*(6), e128–e144.

Cite this article:
Dr. Varalakshmi K.S and Dr. Hannah George. (2013). Association Between Maternal Obesity and Pregnancy Outcomes in a Tertiary Care Hospital: A Prospective Cohort Study. *Acta Biomedica Scientia,*1(2):133-138