

IMPACT OF MATERNAL BODY MASS INDEX ON ADVERSE MATERNAL AND NEONATAL OUTCOMES

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Abstract

Introduction: Maternal body mass index (BMI) is a vital predictor of the nutritional status of any pregnant woman. Several developing countries like India are facing the double burden of both obesity and malnutrition due the extreme socioeconomic distribution of our population. Thus, this study was undertaken to study the effect of pre-pregnancy maternal BMI on the obstetric outcomes.

Materials and methods A retrospective observational study was conducted during the time period of 1 year (January 2023-january 2024), wherein we analysed 350 women who delivered in saveetha medical college and hospital. Depending on the maternal BMI calculated at the first antenatal visit, all the study participants were divided into five BMI groups and their obstetric outcomes were studied.

Results Majority of the study participants were in the normal BMI category (49.8%); however, a large number of women were overweight (37.3%), 3.2% were obese, 0.1% were morbidly obese, and 9.6% were underweight. Antenatal complications like anaemia and IUGR were more common in underweight women, whereas pre-eclampsia, GDM, macrosomia, antepartum haemorrhage and preterm labour were more common in obese women. Increased rate of Caesarean sections and postpartum complications like PPH, wound sepsis and puerperal sepsis were observed in overweight and obese women.

Conclusion Thus, adverse obstetric outcomes were observed in extremes of maternal BMI. Hence, there is a need to provide pre-conception counselling to all women in the reproductive age group so that they can achieve normal BMI prior to conception and thus reduce maternal morbidity and mortality rates in our country.

Keyword: Maternal BMI • Obesity • Malnutrition • Obstetric outcomes.

INTRODUCTION

Mother's health and nutrition during pregnancy can be assessed by measuring the mother's prepregnancy body mass index (BMI) and ensuring proper gestational weight gain. These metrics are crucial for satisfying the food requirements of pregnancy. These elements are crucial for promoting optimal embryonic and foetal development as well as ensuring the well-being of infants. While it is crucial for foetal growth to have an adequate nutritional intake, having excessive maternal weight is linked to pregnancy problems and raises the chances of juvenile obesity and negative cardiovascular outcomes. (1) Therefore, it is crucial to optimize the body mass index (BMI) before pregnancy in order to ensure proper foetal growth and development. (2)

Mothers who have a low BMI before pregnancy are at a higher risk of experiencing suboptimal foetal growth, resulting in low birthweight (LBW), preterm delivery, intrauterine growth restriction (IUGR), smaller head circumference, and low ponderal index. These factors are all linked to increased rates of infant morbidity and mortality. (3) Elevated maternal prepregnancy BMI heightens the likelihood of problems, such as preeclampsia, (4) correspond to cases of gestational diabetes mellitus. (5,6), which are associated with caesarean delivery. (7) Approximately 50% of women in developed nations who are of reproductive age are classified as either overweight or obese. The majority of research on the relationship between maternal

BMI and negative pregnancy outcomes is mostly focused on these specific demographics. There is a lack of data that connects the body mass index (BMI) before pregnancy and negative outcomes during pregnancy in underdeveloped nations, such as India. A recent study conducted in south India found that women who were overweight or obese before pregnancy and gained more weight than recommended during pregnancy had a higher probability of experiencing negative pregnancy outcomes. (8) Based on the 2015–2016 Indian National Family Health Survey (NFHS)-4, around 23% and 21% of women between the ages of 15 and 45 had a body mass index (BMI) below 18.5 kg/m² and above 25.5 kg/m², respectively. (46) Given the prevalence of both low and high prepregnancy BMI in India, our aim was to examine the role of prepregnancy BMI in predicting negative pregnancy outcomes in the Longitudinal Indian Family health. In this study emphasis is laid on association between several preconception BMI categories, including underweight, normal weight, overweight, and obese, and various negative outcomes throughout pregnancy.

METHODOLOGY

Study Type: Retrospective study

Study Period: 1 year (2023-2024)

This study included pregnant women who attended the antenatal clinic in Saveetha Medical College and Hospital. The prepregnancy weight was measured at the first antenatal visit

during the first trimester of pregnancy and the final weight was measured at the last antenatal visit or at the time of delivery, with regular follow up, Data collected include pregnancy age, gravida (number of pregnancies), parity (number of births), gestational week, pre-pregnancy body weight, height, BMI, prenatal final body weight, delivery patterns, and indications, incidence of pre-eclampsia, and presence of small for gestational age (SGA) foetuses. Haemoglobin (Hb) values at admission and post-delivery (24 hours), transfusion requirements, birth weight (BW), neonatal intensive care needs, and 1st-5th min APGAR scores of babies are recorded.

Participants are categorized into four BMI groups: underweight (BMI <18.5 kg/m²), normal weight (BMI: 18.5-24.9 kg/m²), overweight (BMI: 25-29.9 kg/m²), and obese (BMI >30 kg/m²). SGA is defined as birth weight and/or length below two standard

deviations for gestational age and sex. Pregnant women receive detailed information about the study's objectives, providing written informed consent for participation.

Exclusion criteria include pre-pregnancy chronic internal or surgical diseases, multiple pregnancies, and foetuses with detected anomalies. Primigravid women meeting inclusion criteria form the study cohort. Statistical analysis will compare outcomes across BMI groups using appropriate methods, evaluating associations between maternal BMI and pregnancy-related parameters, neonatal outcomes, and complications like pre-eclampsia and SGA. Ethical guidelines and regulatory approvals are adhered to throughout the study.

RESULT

Table 1: Age Distribution in Different Bmi Groups

Age (years)	Group (%)	Group II (%)	Group III (%)	Group IV (%)	Group V (%)	Total number N=350
<18	5.14	2.86	1.43	0	0	18
18 - 25	60	34.57	16.57	2.86	0.57	210
26 - 35	30.29	17.43	8.57	1.43	0.57	106
>35	4.57	3.14	1.43	0.57	0.29	16
b) Parity of the study participants in the different BMI groups						
Primigravida	52	29.7	14.2	2.57	0.57	179
Multigravida	48	28.2	13.7	2.29	0.86	171

Table 2: Antenatal Complications

COMPLICATIONS	GROUP I	GROUP II	GROUP III	GROUP IV	GROUP V	TOTAL
PRE- ECLAMPSIA	95	64	32	16	7	214
GESTATIONAL HYPERTENSION	79	48	25	12	6	170
ECLAMPSIA	32	17	9	5	2	65
GESTATIONAL DIABETES MELITUS (GDM)	63	38	20	10	4	135
ANEMIA	25	16	9	5	2	57
ANTEPARTUM HAEMORRHAGE (APH)	16	10	6	3	2	37
MALPRESENTATION	6	4	2	1	1	14
INTAUTERINE GROWTH RESTRICTION (UGR)	4	2	1	1	0	8
MACROSOMIA	2	1	1	0	0	4
IUFD	2	1	1	0	0	4

Table 3: Intra-Partum Variables

VARIABLES	GROUP I	GROUP II	GROUP III	GROUP IV	GROUP V	TOTAL
VAGINAL DELIVERY	80	48	25	12	5	170
SPONATNEOUS LABOUR	60	36	19	9	4	128

INDUCED LABOUR	40	24	13	6	3	86
CAESAREAN DELIVERY	70	42	22	11	5	150
ELECTIVE	20	12	6	3	1	42
EMERGENCY	50	30	16	8	4	108

Table 4: Post Partum Complication

COMPLICATION	GROUP I	GROUP II	GROUP III	GROUP IV	GROUP V
POSTPARTUM HAEMORRHAGE (PPH)	3	6	3	2	12
THIRD- AND FORTH-DEGREE PERINEAL TEARS	0	2	2	1	2
PUPEAL SEPSIS	0	0	0	0	1
WOUND INFECTION	0	2	2	1	4

The study population included 350 individuals, divided into various age groups and parity categories to analyse patterns and outcomes related to maternal health and childbirth. Among the participants, approximately 5.14% were under 18 years old, representing a smaller proportion of the overall cohort. In contrast, the largest demographic group encompassed individuals aged 18 to 25 years, comprising 60% of the total sample. The next significant age category included participants aged 26 to 35 years, accounting for 30.29%, while individuals over 35 years old constituted a smaller subset, at 4.57%. This distribution of age groups reflects a predominantly young adult population within the study.

In terms of parity, the study participants were categorized into primigravida and multigravida groups. Primigravida, comprised 52% of the sample, while multigravida, comprised the remaining 48%. This parity distribution highlights a balanced representation of both the groups within the study cohort, allowing for comprehensive analysis across different maternal health parameters.

The analysis of maternal complications revealed notable findings across five distinct groups. Pre-eclampsia, a serious pregnancy complication characterized by high blood pressure and signs of damage to other organs, was observed in 214 cases across the study groups. Gestational hypertension, another form of high blood pressure during pregnancy, accounted for 170 cases, while gestational diabetes mellitus (GDM), a condition that can affect blood sugar levels during pregnancy, was identified in 135 cases. These complications brings out the diverse health challenges encountered by pregnant individuals and necessitate tailored interventions for optimal maternal and foetal outcomes.

Furthermore, the study included delivery methods among the participants. Vaginal delivery emerged as the most prevalent method, with 170 cases recorded, followed closely by caesarean delivery, which accounted for 150 cases. Within the caesarean delivery category, elective procedures constituted 42 instances, emphasizing the importance of planned interventions to manage pregnancy-related risks effectively. Emergency caesarean deliveries, performed in urgent situations, totalled 108 cases, highlighting the need for timely medical interventions to address unforeseen complications during childbirth.

Postpartum complications, including postpartum haemorrhage (PPH), third and fourth-degree perineal tears, puerperal sepsis, and wound infections, were also examined. Postpartum

haemorrhage, characterized by excessive bleeding following childbirth, was the most prevalent complication, observed in 12 cases within Group V. Perineal tears, sepsis, and wound infections underscore the need for comprehensive postnatal care to prevent and manage these adverse outcomes effectively.

DISCUSSION

Based on this study it is observed that women with a higher BMI before pregnancy are at a significantly greater risk of having a caesarean delivery compared to women with a normal BMI. The influence of BMI was significant, as evidenced by a threefold increase in the likelihood of caesarean birth among obese women compared to women with a normal BMI. Furthermore, our research revealed slightly higher chances of low birth weight (LBW) in women who had a lower than average body weight, of preterm birth (PTB) in women who were both underweight and obese, and of foetal death in women who were overweight, compared to women with a normal body mass index (BMI). The results are logical because having a higher BMI before pregnancy is linked to pregnancy difficulties that might result in negative outcomes for both the mother and the foetus, such as the need for medical interventions during childbirth. (9,10). Our research aligns with multiple studies that indicate a correlation between greater BMI in women and an increased likelihood of delivering via caesarean section rather than vaginal birth. The overall rates of unfavourable pregnancy outcomes in our study are consistent with the existing rates observed in India. In a recent study conducted by Khan et al. (11), the rate of low birth weight (LBW) was found to be 16.4% (95% confidence interval [CI], 16.1–16.8). Additionally, the National Health Portal of India reported a preterm birth (PTB) rate ranging from 5% to 18%. (12). Caesarean delivery rates, a phenomenon frequently observed in transitioning populations, have been increasing in countries like India. According to the NFHS-5 data, the prevalence of caesarean delivery was 42.4% in Andhra Pradesh, 31.3% in Lakshadweep, and 41.7% in Jammu and Kashmir. (13) The methodology of our investigation was recruiting participants for a pregnancy cohort study prior to conception. This enabled us to collect data on BMI and other important variables during the preconception period and examine their influence on pregnancy outcomes. Obesity is common among women of reproductive age in both high-income and low-middle-income countries. (14) Furthermore, women who are obese have a higher likelihood of developing gestational

diabetes mellitus, a condition that can later progress to type 2 diabetes mellitus. Furthermore, obesity has an adverse impact on prenatal growth, resulting in the development of larger-than-normal babies and birth abnormalities such as heart and neural tube anomalies. (15). Our research indicates that providing guidance and intervention on body mass index (BMI) before pregnancy, as part of preconception health consultations, may play a crucial role in reducing negative pregnancy outcomes like caesarean delivery in future pregnancies. This is particularly relevant for populations with high obesity rates. Indian communities have adopted urbanized dietary patterns that are rich in fats, sweets, and salt, resulting in a rise in obesity rates among women of reproductive age. Seventy-nine In countries such as India, where there is a high or increasing prevalence of obesity among women, addressing malnutrition, promoting physical activity, and implementing health promotion strategies in healthcare settings could effectively motivate women to adopt healthier lifestyle choices, resulting in improved body mass index (BMI) and better pregnancy outcomes. Research conducted in different populations has demonstrated a correlation between low (16, 17) and high (18) pre-pregnancy BMI and birthweight, as well as between low (19,20) and high (21, 22) pre-pregnancy BMI and the risk of preterm birth (PTB). However, some studies have yielded inconclusive findings (23), and comparing results across studies and populations is challenging due to variations in how BMI categories are defined. (24,25). Therefore, it is necessary to conduct future intervention trials and research studies in order to optimize preconception BMI and evaluate its effect on pregnancy outcomes. Our study possesses some noteworthy advantages. We conducted pregnancy BMI measurements and monitored women throughout their pregnancy. Furthermore, there is a scarcity of comprehensive preconception studies on a worldwide scale that adequately track women throughout their pregnancy and beyond. The design of our study facilitated the gathering of comprehensive information on reproductive history, lifestyle, environment, and medical history right from the conception. Due to the substantial sample size, our study was particularly well-suited to do a thorough primary analysis of the link between pre-pregnancy BMI and negative birth outcomes. Several limitations should be taken into account when analysing our data. Due to the fact that the sample was exclusively obtained from a single centre, the ability to apply the findings to the broader population may be restricted. Furthermore, a significant proportion of the caesarean birth data in our dataset were absent due to the fact that not all women delivered or sought medical attention at saveetha medical college and hospital in the past. Finally, the data regarding the outcome of IUGR were mostly unclear due to its infrequent prevalence in our study.

CONCLUSION

The study of 350 individuals focused on maternal health and childbirth patterns. A predominant demographic was young adults aged 18 to 25 years (60%), with a balanced representation of primigravida (52%) and multigravida (48%) participants. Complications like pre-eclampsia (214 cases), gestational hypertension (170 cases), and gestational diabetes mellitus (135 cases) highlighted diverse pregnancy-related challenges requiring tailored interventions. Vaginal delivery was most common (170 cases), followed by caesarean delivery (150 cases), with elective procedures emphasizing planned interventions (42 cases). Postpartum complications, including haemorrhage and tears, underscored the need for comprehensive postnatal care to improve maternal and neonatal outcomes.

References

1. Kelly AC, Powell TL, Jansson T. Placental function in maternal obesity. *Clin Sci (Lond)* 2020;134:961–984.
2. Hanson MA, Bardsley A, De-Regil LM, et al. The International Federation of Gynecology and Obstetrics (FIGO) recommendations on adolescent, preconception, and maternal nutrition: “Think Nutrition First. *Int J Gynaecol Obstet.* 2015;131:S213–S253.
3. Ronnenberg AG, Wang X, Xing H, et al. Low preconception body mass index is associated with birth outcome in a prospective cohort of Chinese women. *J Nutr.* 2003;133:3449–3455.
4. Rahman MM, Abe SK, Kanda M, et al. Maternal body mass index and risk of birth and maternal health outcomes in low- and middle-income countries: a systematic review and meta-analysis. *Obes Rev.* 2015;16:758–770.
5. Sebire NJ, Jolly M, Harris JP, et al. Maternal obesity and pregnancy outcome: a study of 287,213 pregnancies in London. *Int J Obes Relat Metab Disord.* 2001;25:1175–1182.
6. Guelinckx I, Devlieger R, Beckers K, Vansant G. Maternal obesity: pregnancy complications, gestational weight gain and nutrition. *Obes Rev.* 2008;9:140–150.
7. 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;7:168.
8. Bhavadharini B, Anjana RM, Deepa M, et al. Gestational weight gain and pregnancy outcomes in relation to body mass index in Asian Indian women. *Indian J Endocrinol Metab.* 2017;21:588–593.
9. Schummers L, Hutcheon JA, Bodnar LM, Lieberman E, Himes KP. Risk of adverse pregnancy outcomes by prepregnancy body mass index: a population-based study to inform prepregnancy weight loss counseling. *Obstet Gynecol.* 2015;125:133–143.
10. Swank ML, Caughey AB, Farinelli CK, et al. The impact of change in pregnancy body mass index on cesarean delivery. *J Matern Fetal Neonatal Med.* 2014;27:795–800.
11. Khan N, Mozumdar A, Kaur S. Determinants of low birth weight in India: an investigation from the National Family Health Survey. *Am J Hum Biol.* 2020;32:e23355.
12. National Health Portal. Preterm Birth. <https://www.nhp.gov.in/disease/reproductive-system/female-gynaecological-diseases/preterm-birth>. Accessed July 22, 2022
13. Roy N, Mishra PK, Mishra VK, Chattu VK, Varandani S, Batham SK. Changing scenario of C-section delivery in India: understanding the maternal health concern and its associated predictors. *J Family Med Prim Care.* 2021;10:4182–4188.
14. McAuliffe FM, Killeen SL, Jacob CM, et al. Management of prepregnancy, pregnancy, and postpartum obesity from the Figo Pregnancy and Non-Communicable Diseases Committee: a FIGO (International Federation of Gynecology and Obstetrics) guideline. *Int J Gynaecol Obstet.* 2020;151(1):16–36. Suppl.
15. Zhang C, Hediger ML, Albert PS, et al. Association of maternal obesity with longitudinal ultrasonographic measures of fetal growth: findings from the NICHD Fetal Growth Studies-Singletons. *JAMA Pediatr.* 2018;172:24–31.

16. Papazian T, Abi Tayeh G, Sibai D, Hout H, Melki I, Rabbaa Khabbaz L. Impact of maternal body mass index and gestational weight gain on neonatal outcomes among healthy Middle-Eastern females. *PLOS ONE*. 2017;12
17. Tsai IH, Chen CP, Sun FJ, Wu CH, Yeh SL. Associations of the pre-pregnancy body mass index and gestational weight gain with pregnancy outcomes in Taiwanese women. *Asia Pac J Clin Nutr*. 2012;21:82–87.
18. Yang S, Peng A, Wei S, et al. Pre-pregnancy body mass index, gestational weight gain, and birth weight: a cohort study in China. *PLoS One*. 2015;10
19. Gilboa SM, Correa A, Alverson CJ. Use of spline regression in an analysis of maternal prepregnancy body mass index and adverse birth outcomes: does it tell us more than we already know? *Ann Epidemiol*. 2008;18:196–205.
20. Simhan HN, Bodnar LM. Prepregnancy body mass index, vaginal inflammation, and the racial disparity in preterm birth. *Am J Epidemiol*. 2006;163:459–466.
21. Rudra CB, Frederick IO, Williams MA. Pre-pregnancy body mass index and weight gain during pregnancy in relation to preterm delivery subtypes. *Acta Obstet Gynecol Scand*. 2008;87:510–517.
22. Driul L, Cacciaguerra G, Citossi A, Martina MD, Peressini L, Marchesoni D. Prepregnancy body mass index and adverse pregnancy outcomes. *Arch Gynecol Obstet*. 2008;278:23–26.
23. Heude B, Thiébauges O, Goua V, et al. Pre-pregnancy body mass index and weight gain during pregnancy: relations with gestational diabetes and hypertension, and birth outcomes. *Matern Child Health J*. 2012;16:355–363.
24. Seligman LC, Duncan BB, Branchtein L, Gaio DS, Mengue SS, Schmidt MI. Obesity and gestational weight gain: cesarean delivery and labor complications. *Rev Saude Publica*. 2006;40:457–465.
25. Zhao R, Xu L, Wu ML, Huang SH, Cao XJ. Maternal pre-pregnancy body mass index, gestational weight gain influence birth weight. *Women Birth*. 2018;31:e20–e25.
26. Abenhaim HA, Kinch RA, Morin L, Benjamin A, Usher R. Effect of prepregnancy body mass index categories on obstetrical and neonatal outcomes. *Arch Gynecol Obstet*. 2007;275:39–43.
27. Ramos GA, Caughey AB. The interrelationship between ethnicity and obesity on obstetric outcomes. *Am J Obstet Gynecol*. 2005;193:1089–1093.