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Original Research Article

Impact of pre-pregnancy maternal body mass index on obstetric outcomes

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ABSTRACT

Background: Maternal health is crucial in reproductive medicine and understanding the impact of pre-pregnancy maternal body mass index (BMI) on obstetric outcomes is essential for optimizing maternal and neonatal health. To assess the obstetric outcomes in relation to the various categories of pre-pregnancy BMI.
Methods: This prospective observational study was conducted from 2022-2024 at a tertiary care teaching hospital in Chennai, with a sample size of 3032 pregnant women and their pre-pregnancy BMI and other detail were collected.
Results: Most were aged between 26-35 years. Normal BMI was observed in 54.2% of women, followed by 31% overweight and 3.9% obese. Antenatal complications, such as gestational hypertension and diabetes, were more prevalent in overweight and obese groups. Intrapartum complications like induction of labor and caesarean sections were higher among these groups. Postpartum complications, including haemorrhage and sepsis, were more common in obese women. Similarly, foetal complications were prevalent in these groups.
Conclusions: Pre-pregnancy BMI significantly affects obstetric outcomes, with overweight and obese women experiencing higher rates of complications. This underscores the importance of managing maternal weight before and during pregnancy to improve outcomes for both mother and child.

Keywords: Foetal outcomes, Maternal health, Obstetric outcomes, Pre-pregnancy BMI

INTRODUCTION

Maternal health is a critical aspect of reproductive medicine and understanding the impact of various factors on obstetric outcomes is essential for ensuring the well-being of both the mother and the newborn. One such factor that has gained significant attention in recent years is the pre-pregnancy maternal body mass index (BMI).

BMI, a numerical measure of body fat based on an individual's weight and height, serves as a valuable indicator of nutritional status and overall health.[1,2] The rationale behind investigating the effect of pre-pregnancy BMI on obstetric outcomes stems from the escalating rates of obesity worldwide and its potential repercussions on maternal and fetal health. Understanding the association between pre-pregnancy BMI and obstetric outcomes can guide healthcare providers in tailoring personalized care plans, implementing preventive measures and mitigating the risk of complications during pregnancy. By identifying modifiable risk factors, such as maternal obesity, healthcare professionals can contribute to optimizing maternal and neonatal health.[3,4]

Existing studies have provided valuable insights into the relationship between pre-pregnancy BMI and obstetric outcomes. For example, Catalano et al, study reported associations between maternal obesity and increased rates of cesarean deliveries and neonatal intensive care unit admissions.[5] With this background, this study was undertaken with an objective to assess the obstetric outcomes in relation to the various categories of pre-pregnancy BMI.

METHODS

Study type

This prospective observational study.

Study place

The study was conducted in the Department of Obstetrics and Gynaecology, Sri Ramachandra Institute of Higher Education and Research Institute, Chennai.

Pregnant women aged 18 years and above attending the OBG OPD with singleton pregnancy and cephalic presentation, with gestational age of 28 weeks and above, with any parity and without any medical disorders were considered for this study. During the period of 2022–2024, a total of 3034 such women were considered and after obtaining Institutional Human Ethics Committee clearance (Ref: CSP-MED/22/AUG/79/xx), women were explained about the study and included into the study after obtaining written consent.

They were followed up from first visit to the hospital till the time of discharge, all relevant data was collected using a structured proforma including socio-demographic details, anthropometric details, obstetric examination, antenatal variables, intra-partum and postpartum variables and fetal outcomes. For the categorization of the pre-pregnancy BMI, WHO guidelines were considered where the BMI ranges were<18.5, 18.5-24.9, 25.0-29.9 and>30.0 kg/m2 for underweight, normal, overweight and obese categories respectively.

The data were entered using Microsoft Office Excel 2013 and analyzed using SPSS software version 22. Chi-square test and Fisher exact test were applied, where the associations were considered significant if the p-value is<0.05 at 95% CI.

RESULTS

Among the 3034 study participants, mean gestational age was 37.45±0.9 weeks. Pre-pregnancy anthropometric measurements showed that the mean height was 171.29±3.9 cm, mean weight was 70.19±9.3 kg and mean BMI was found to be 23.95±3.4 kg/m^2. Further, the BMI categorization showed that 54.3% were normal and among those with abnormal BMI, most were overweight (30.9%), followed by underweight (10.9%) and remaining 3.9% were obese (Figure 1).

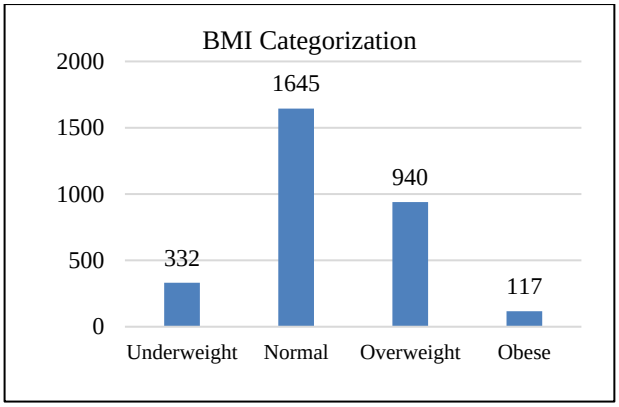

Figure 1: BMI category distribution among study participants (n=3034).

Among the 3034 study participants, most were in the 26-35 years age group (52.9%). Upon analyzing the BMI with different age groups, among all the age groups, those with normal BMI were more. Among the abnormal BMI categories, in the 18-25 years and 26-35 years groups, most were overweight (35.4% and 30.0% respectively). However, in the more than 35 years age group, most were underweight (34%). This difference of BMI categorization with age of the participant was statistically significant (p<0.0.5). Similarly, most were primigravida (56.1%) and underweight were comparatively more among multigravida (14.7%). This difference of BMI with parity was significant (p<0.05) (Table 1).

Among the different BMI categories, distribution of the antenatal complications showed that all presented conditions i.e., pre-eclampsia, gestational HTN, eclampsia, gestational DM, anemia, APH, placental abruption and malpresentation showed significant difference, with most being distributed among the overweight and obese categories, except anemia, which was found to be comparatively more among the underweight category (p<0.05) (Table 2).

Similarly, all the presented intra-partum variables, i.e. and all the presented post-partum variables, i.e., PPH, Perineal tear, Puerperal sepsis, Wound infection respectively showed significant difference with BMI categories, with most being present among the overweight and obese categories (p<0.05) (Table 3 and 4). Among the fetal complications, most had IUGR (9.6%) and all the presented fetal complications, i.e., IUGR, Macrosomia and Shoulder dystocia showed significant difference with BMI categories, with most being presented among overweight and obese categories (p<0.05) (Table 5).

Table 1: Age and Parity distribution of the study participants in the different BMI groups (n=3034).

Variable	Underweight (n=332)		Normal (n=1645)		Overweight (n=940)		Obese (n=117)		P value
Age (in years)	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	
18-25	68	5.5	710	57.6	436	35.4	18	1.5	
26-35	197	12.3	842	52.5	482	30.0	84	5.2	<0.001*
>35	67	34.0	93	47.2	22	11.2	15	7.6	

Continued.

Variable	Underweight (n=332)		Normal (n=1645)		Overweight (n=940)		Obese (n=117)		P value
Parity	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	
Primigravida	136	7.9	955	56.1	556	32.7	56	3.3	<0.001*
Multigravida	196	14.7	690	51.8	384	28.9	61	4.6	

(*p<0.05 is statistically significant).

Table 2: Antenatal complications distribution of the study participants in the different BMI groups (n=3034).

Variable	Underweight (n=332)		Normal (n=1645)		Overweight (n=940)		Obese (n=117)		P value
	N	%	N	%	N	%	N	%	
Pre-eclampsia	04	2.5	30	18.6	97	60.2	30	18.6	<0.001*
Gestational HTN	03	1.5	55	26.8	102	49.8	45	22.0	<0.001*
Eclampsia	00	0.0	02	9.5	16	76.2	03	14.3	<0.001*
Gestational DM	04	1.4	09	3.2	205	73.7	60	21.6	<0.001*
Anemia	107	37.9	113	40.1	56	19.9	06	2.1	<0.001*
APH	06	5.3	00	0.0	105	92.1	03	2.6	<0.001*
Placental abruption	04	2.5	36	22.9	112	71.3	05	3.2	<0.001*
Malpresentation	13	9.6	35	25.7	78	57.4	10	7.4	<0.001*

(*p<0.05 is statistically significant)

Table 3: Intra-partum variables distribution of the study participants in the different BMI groups (n=3034).

Variable	Underweight (n=332)		Normal (n=1645)		Overweight (n=940)		Obese (n=117)		P value
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	
Caesarean delivery	161	15.7	526	51.4	281	27.5	55	5.4	<0.001*
Induced labour	37	4.3	368	42.4	420	48.4	42	4.8	<0.001*
Emergency section	96	14.2	344	50.7	200	29.5	38	5.6	<0.001*

(*p<0.05 is statistically significant)

Table 4: Post-partum complications distribution of the study participants in the different BMI groups (n=3034).

Variable	Underweight (n=332)		Normal (n=1645)		Overweight (n=940)		Obese (n=117)		P value
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	
PPH	04	5.4	27	36.5	20	27.0	23	31.1	<0.001*
Perineal tear (3^0, 4^0)	00	0.0	02	22.2	04	44.4	03	33.3	<0.001*
Puerperal Sepsis	00	0.0	06	16.2	21	56.8	10	27.0	<0.001*
Wound Infection	04	9.1	08	18.2	24	54.5	08	18.2	<0.001*

(*p<0.05 is statistically significant)

Table 5: Fetal complications distribution of the study participants in the different BMI groups (n=3034).

Variable	Underweight (n=332)		Normal (n=1645)		Overweight (n=940)		Obese (n=117)		P value
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	
IUGR	76	26.2	119	41.0	90	31.0	05	1.7	<0.01*
Macrosomia	00	0.0	00	0.0	16	55.2	13	44.8	<0.01*
Shoulder dystocia	00	0.0	03	18.8	09	56.3	04	25.0	<0.01*

(*p<0.05 is statistically significant)

DISCUSSION

Maternal body mass index (BMI) prior to pregnancy plays a crucial role in determining obstetric outcomes, yet its influence remains a subject of ongoing research. This prospective observational study aimed to assess the impact of pre-pregnancy maternal BMI on obstetric outcomes among over 3000 participants from the Department of Obstetrics and Gynaecology, SRIHER, Chennai involved categorization of participants based on BMI into underweight, normal, overweight and obese groups and comparing them with various obstetric outcomes.

With a median age of 27 years and the majority falling within the age group of 26 to 35 years (52.9%), this cohort seems representative of reproductive-age women, albeit with a notable proportion of younger and older participants as well. In previous studies, age has been recognized as a significant factor influencing obstetric outcomes, often with older maternal age associated with increased risks such as gestational diabetes, hypertension and caesarean delivery, while younger age might correlate with higher rates of preterm birth and low birth weight infants.[7,8]

Fuchs et al, studied that advanced maternal age (40 years and over) was associated with preterm birth.[9] Londero et al, confirm a negative impact of extreme maternal ages on pregnancy.[10]

However, the distribution in this study indicates a balanced representation across age groups, which may mitigate some of these age-related biases. The study found that 10.9% of women were underweight, consistent with previous studies indicating a persistent issue of undernutrition among Indian women of reproductive age.

However, a higher prevalence of underweight women was reported in rural Haryana, possibly due to regional differences in nutrition and healthcare access.[11] The prevalence of overweight and obesity was 31% and 3.9%, similar to the National Family Health Survey-4 (NFHS-4), which reported a combined prevalence of around 30% among Indian women of reproductive age.[12]

The study found that women with a normal pre-pregnancy BMI have a mean gestational age of 37.45 weeks, which aligns with previous research by Zong et al.[13] Chen et al, found that maternal pre-pregnancy BMI was associated with the longitudinal fetal growth and the association was partly driven by maternal fasting glucose in first trimester.[14] In our study, 5.3% of pregnant mothers had pre-eclampsia and 6.8% had gestational hypertension.

Previous research has consistently demonstrated an association between higher pre-pregnancy BMI and increased risks of hypertensive disorders during pregnancy. Our findings align with other studies, reinforcing the notion that increased BMI is a significant risk factor for hypertensive disorders in pregnancy.[15] The prevalence of GDM in our cohort was 9.2%. Our results corroborate these associations, suggesting that elevated pre-pregnancy BMI is a critical factor in the development of GDM.[16] In our study, 9.3% of pregnant women experienced anemia. This contrasts with a study that found a lower incidence of anemia.[17] Some studies have suggested that higher BMI can be associated with nutritional deficiencies leading to anemia, particularly in populations with inadequate nutritional intake or poor dietary habits.[18]

Antepartum haemorrhage occurred in 3.8% of our participants and placental abruption was observed in 5.2%. These complications have also been linked to higher pre-pregnancy BMI in the literature. Malpresentation was noted in 4.5% of our study population. The incidence of eclampsia in our study was 0.7%, which is consistent with global rates reported in the literature.[19] While eclampsia is less frequently studied in relation to pre-pregnancy BMI, it is well-established that severe pre-eclampsia and gestational hypertension can escalate to eclampsia, particularly in women with higher BMI.

The caesarean rate of our study population was found to be 33.7% and a significantly higher caesarean rate was observed in the obese mothers. This is because of higher incidence of antenatal complications like pre-eclampsia, gestational diabetes mellitus, macrosomia, antepartum haemorrhage, placental abruption and malpresentation in these women.

A significantly higher incidence of postpartum complications like postpartum haemorrhage (19.7%) and third-/ fourth-degree perineal tears (2.9%) was noted in the obese mothers in the present study. This is probably because of increased incidence of macrosomia, need for operative/ instrumental delivery and other antenatal complications like pre-eclampsia and placental abruption observed in the obese mothers.

The study collected detailed data on various obstetric outcomes and their association with pre-pregnancy maternal BMI among as large as over 3000 participants, providing a comprehensive understanding of the topic and further enhancing the reliability and generalizability of results.

This study was not able to avoid selection bias resulting from participants being selected from specific healthcare facilities and reliance on self-reported pre-pregnancy BMI.

CONCLUSION

The potential implications of maternal obesity on both short-term and long-term health outcomes for both the mother and the child underscore the importance of this investigation, necessitating the need for further research to fill the existing gaps in the understanding of how pre-pregnancy BMI contributes to obstetric outcomes. This

may help in the better public health initiatives aimed at preventing and managing maternal obesity, ultimately improving overall pregnancy outcomes.

Recommendations

From the study findings, targeted interventions are recommended to address the higher prevalence of antenatal complications like gestational hypertension, gestational diabetes mellitus and pre-eclampsia among overweight and obese pregnant mothers. This includes personalized care plans, regular monitoring of blood pressure and glucose levels and dietary and lifestyle interventions to manage weight gain during pregnancy.

Efforts aimed at increasing awareness among healthcare providers and pregnant women about the risks associated with obesity during pregnancy and the importance of early detection and management of complications can also be undertaken. Finally, postpartum care should be tailored to address the increased risk of complications, such as hemorrhage, wound infections and puerperal sepsis, particularly among overweight and obese mothers.

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REFERENCES

1. Santos S, Voerman E, Amiano P, Barros H, Beilin LJ, Bergström A, et al. Impact of maternal body mass index and gestational weight gain on pregnancy complications: an individual participant data meta-analysis of European, North American and Australian cohorts. BJOG Int J Obstet Gynaecol 2019;126(8):984–95.
2. Lisonkova S, Muraca GM, Potts J, Liauw J, Chan WS, Skoll A, et al. Association Between Prepregnancy Body Mass Index and Severe Maternal Morbidity. JAMA. 2017;318(18):1777–86.
3. Woo Baidal JA, Locks LM, Cheng ER, Blake-Lamb TL, Perkins ME, Taveras EM. Risk Factors for Childhood Obesity in the First 1,000 Days: A Systematic Review. Am J Prev Med. 2016;50(6):761–79.
4. Wallace JM, Bhattacharya S, Horgan GW. Weight change across the start of three consecutive pregnancies and the risk of maternal morbidity and SGA birth at the second and third pregnancy. PloS One. 2017;12(6):179589.
5. Catalano PM, Shankar K. Obesity and pregnancy: mechanisms of short term and long term adverse consequences for mother and child. BMJ. 2017;356:41.
6. World Health Organization (WHO). Fact sheets. A healthy lifestyle- WHO recommendations. Available at: https://www.who.int/europe/news. Accessed on 2 1November 2024.
7. Voerman E, Santos S, Inskip H, Amiano P, Barros H, et al. Life cycle project-maternal obesity and childhood outcomes study group, association of gestational weight gain with adverse maternal and infant outcomes. JAMA. 2019;321(17):1702–15.
8. Sugai S, Nishijima K, Haino K, Yoshihara K. Pregnancy outcomes at maternal age over 45 years: a systematic review and meta-analysis. Am J Obstet Gynecol MFM. 2023;5(4):67.
9. Fuchs F, Monet B, Ducruet T, Chaillet N, Audibert F. Effect of maternal age on the risk of preterm birth: A large cohort study. PLoS ONE. 2018;13(1):191002.
10. Londero AP, Rossetti E, Pittini C, Cagnacci A, Driul L. Maternal age and the risk of adverse pregnancy outcomes: a retrospective cohort study. BMC Pregnancy Childbirth. 2019;19(1):261.
11. Al Kibria GM, Swasey K, Hasan MZ, Sharmeen A, Day B. Prevalence and factors associated with underweight, overweight and obesity among women of reproductive age in India. Glob Health Res Policy. 2019;4(1):24.
12. National Family Health Survey-4 (2015-16). India Fact sheet. 2024. Available at: https://bogs.org.in. Accessed on 21 August 2024.
13. Zong X, Wang H, Yang L, Guo Y, Zhao M, Magnussen CG, et al. Maternal Pre-pregnancy Body Mass Index Categories and Infant Birth Outcomes: A Population-Based Study of 9 Million Mother–Infant Pairs. Front Nutr. 2022;9:789833.
14. Chen Q, He Z, Wang Y, Yang X, Liu N, Zhang S, et al. Effect of Maternal Pre-Pregnancy Body Mass Index on Longitudinal Fetal Growth and Mediating Role of Maternal Fasting Plasma Glucose: A Retrospective Cohort Study. Diabetes Metab Syndr Obes. 2024;17:1911–21.
15. Poon LC, Nguyen-Hoang L, Smith GN, Bergman L, O'Brien P, Hod M, et al. Hypertensive disorders of pregnancy and long-term cardiovascular health: FIGO best practice advice. Int J Gynecol & Obst. 2023;160:22-34.
16. Rahnemaei FA, Abdi F, Kazemian E, Shaterian N, Shaterian N, Behesht Aeen F. Association between body mass index in the first half of pregnancy and gestational diabetes: A systematic review. SAGE Open Med. 2022;10:20503121221109911.
17. Liyew AM, Tesema GA, Alamneh TS, Worku MG, Teshale AB, Alem AZ, et al. Prevalence and determinants of anemia among pregnant women in East Africa; A multi-level analysis of recent Demographic and Health Surveys. PLoS ONE. 2021;16(4):250560-75
18. Rashidi AA, Heidari Bakavoli AR, Avan A, Aghasizade M, Ghazizadeh H, Tayefi M, et al. Dietary Intake and Its Relationship to Different Body Mass Index Categories: A Population-Based Study. J Res Health Sci. 2018;18(4):426.

19. Getaneh Y, Fekadu E, Jemere AT, Mengistu Z, Tarekegn GE, Oumer M. Incidence and determinants of adverse outcomes among women who were managed for eclampsia in the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia. BMC Pregnancy Childbirth. 2021;21(1):734.

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