International Journal of Gynaecology and Obstetrics Research
www.gynaecologyjournal.in
E-ISSN: 2663-3612
Received: 08-06-2026, Accepted: 08-07-2026, Published: 23-07-2026
Volume 8, Issue 3, 2026, Page No. 7-13

Association of maternal booking body mass index with composite adverse maternal and neonatal outcomes: A retrospective cohort study in a Tertiary Care Hospital

Liza Koley[1], Tarasankar Bag[2], Ayan Mandal[3], Bubai Mandal[4]
[1] Senior Resident, Obstetrics and Gynecology, Medical College, WBUHS, Kolkata, West Bengal, India
[2] Professor & Hod, Obstetrics and Gynaecology, Deben Mahata Govt. Medical College and Hospital, WBUHS, Kolkata, West Bengal, India
[3] Senior Resident, Radiodiagnosis, Medical College, WBUHS, Kolkata, West Bengal, India
[4] Senior Resident, Paediatrics, Deben Mahato Govt. Medical College and Hospital, WBUHS, kolkata, West Bengal, India
DOI: https://doi.org/10.66856/ijgor.2026.8.3.8010

Abstract

Background: While the obstetric risks of maternal obesity are heavily documented, maternal body mass index (BMI) at the initial prenatal visit—the "booking BMI"—exhibits a complex, U-shaped relationship with perinatal outcomes. Both extremes of the weight spectrum present distinct pathological pathways that jeopardize pregnancy safety.

High booking BMI is a well-established driver of metabolic and vascular complications, driving up rates of gestational diabetes, preeclampsia, and macrosomia.

Low booking BMI (underweight) introduces quiet but severe risks, primarily driven by nutritional deficiencies and placental insufficiency, which strongly correlate with foetal growth restriction, low birth weight, and spontaneous preterm birth.

Evaluating individual complications in isolation often dilutes the statistical power and clinical reality of these risks. Utilizing a composite maternal and neonatal adverse outcome capture provides a comprehensive, multi-dimensional assessment of the true perinatal burden. This study investigates the association across the full continuum of maternal booking BMI—with explicit focus on both underweight and obese cohorts—to refine early risk stratification and optimize targeted prenatal interventions.

Methodology: This institution-based, retrospective observational study was conducted from January 2023 to January 2024 at Medical College, Kolkata. A total of 300 patients admitted in Eden building, Medical College, Kolkata were evaluated in the study.

Result and Conclusion: This study demonstrates a significant association between maternal booking BMI and adverse obstetric and perinatal outcomes when utilizing Asian-specific BMI cut-offs. Both extremes of maternal BMI pose substantial risks: maternal overweight and obesity are associated with significantly higher, dose-dependent odds of composite overall adverse outcomes, driven by prominent rising trends in gestational diabetes mellitus, gestational hypertension, caesarean deliveries, and postpartum haemorrhage. Conversely, maternal underweight is uniquely linked to elevated rates of maternal anaemia, postpartum haemorrhage, low birth weight, and neonatal intensive care unit admissions.

Keywords: BMI (Body Mass Index), Maternal obesity, Asian guideline, Maternal outcome, Composite adverse outcome, Neonatal Outcome

Introduction

The global escalation of obesity has emerged as one of the most critical public health challenges of the 21st century, profoundly impacting obstetric practice. Worldwide, a significant and rising proportion of individuals enter pregnancy with an elevated body mass index (BMI). Maternal "booking" BMI—the weight-to-height ratio recorded at the initial antenatal healthcare visit—serves as a pivotal baseline clinical metric (2). While the physiological adaptations of pregnancy require metabolic flexibility, pre-pregnancy or early-pregnancy adiposity alters maternal physiology, triggering chronic low-grade inflammation, insulin resistance, and vascular dysfunction (3). Consequently, deviations from a normal booking BMI are consistently implicated in a wide spectrum of pregnancy complications.

Extensive literature has established robust associations between high maternal booking BMI and individual adverse obstetric outcomes. For the mother, these include sharp increases in the incidence of gestational diabetes mellitus (GDM), hypertensive disorders of pregnancy (including preeclampsia), and primary caesarean delivery (5). For the neonate, the risks span from foetal macrosomia and large-for-gestational-age (LGA) birth weight to shoulder dystocia, birth trauma, and a heightened predisposition to neonatology intensive care unit (NICU) admission. Conversely, low maternal booking BMI presents its own distinct challenges, primarily driven by nutritional deficiencies and placental insufficiency, leading to elevated rates of fetal growth restriction (FGR) and spontaneous preterm birth (6).

Despite this wealth of data on isolated complications, assessing the true, holistic burden of maternal BMI on childbirth remains challenging. Evaluating individual clinical endpoints in isolation often lacks the statistical power to capture the overall risk profile and fails to reflect the clinical reality where multiple complications frequently co-occur or cascade. To address this limitation, contemporary obstetric research increasingly relies on composite adverse outcomes. A composite adverse maternal outcome (CAMO) and composite adverse neonatal outcome (CANO) aggregate several severe, clinically relevant

endpoints into single, robust measures. This approach provides a comprehensive overview of morbidity, enhances statistical power, and offers a more pragmatic metric for evaluating healthcare quality and patient risk.

While the independent links between BMI extremes and specific complications are clear, there remains a critical need to characterize how booking BMI—across its entire continuous spectrum—predicts these comprehensive composite morbidities. Furthermore, as demographic shifts continue to alter the obstetric population, understanding the precise threshold effects and the relative compounding risks associated with incremental increases in BMI is essential for optimizing risk stratification.

This study aims to investigate the association between maternal booking BMI and composite adverse maternal and neonatal outcomes within a large, contemporary cohort. By evaluating these relationships through standardized composite measures, we seek to provide clinicians with a clearer prognostic framework to guide early risk identification, tailor antenatal surveillance, and inform targeted intervention strategies designed to mitigate morbidity in high-risk pregnancies.

Material and Methods

This prospective comparative study was carried out on patients of Department of Obstetrics and Gynaecology at Medical College, Kolkata, West Bengal. A total 300 antenatal females of aged ≥ 18, years were for in this study.

Study Location: This was a tertiary carebased study conducted in Medical College, Kolkata.

Study Duration: January 2023 to January 2024.

Sample size: 300 patients.

Subjects & selection method

Study Design and Setting: This was a retrospective cohort study conducted at a tertiary care teaching hospital in India. The study evaluated the clinical records of antenatal women who presented for booking and delivery over oneyear period from 2023 to 2024.

Study Population: A total of N = 300 antenatal women were enrolled in the study based on the following selection criteria:

Inclusion Criteria

- Antenatal women registered (booked) for obstetric care at the tertiary care facility during the study period (2023–2024).
- Documentation of maternal height, weight, and calculated Body Mass Index (BMI) at the time of the booking visit (typically in the first trimester, mean gestational age of 11-13 weeks).
- Singleton pregnancies with complete medical records spanning the antenatal period through to delivery.

Exclusion Criteria

- Multiple gestations (e.g., twins, triplets).
- Pre-existing chronic medical conditions prior to pregnancy, such as chronic hypertension, pre-gestational diabetes mellitus (Type 1 or Type 2), or pre-existing renal disease.
- Incomplete maternal booking records or loss to follow-up (e.g., delivery occurred at another centre).
- Whose who did not give consent to be part of the study.

Exposure and Covariates

The primary exposure of interest was maternal booking BMI (kg/m^2). Due to the unique cardiovascular and metabolic risk profiles in South Asian populations, maternal BMI was categorized using the Asian-specific WHO cut-offs:

Underweight: < 18.5 kg/m^2
Normal Weight (Reference Group): 18.5–22.9 kg/m^2
Overweight: 23.0–24.9 kg/m^2
Obese: 25.0 kg/m^2

Other baseline sociodemographic variables, including maternal age, height, parity, education level, and socioeconomic status, were recorded as covariates.

Outcome Measures

Primary Outcome: The primary outcome was the Composite Overall Adverse Outcome, defined as the occurrence of any one or more maternal or neonatal adverse events.

Secondary Maternal Outcomes: Individual maternal complications including Gestational Diabetes Mellitus (GDM), Hypertensive Disorders of Pregnancy (Gestational Hypertension and Pre-eclampsia), Postpartum Haemorrhage (PPH), Antepartum Haemorrhage (APH), Anaemia (Hb < 11 g/dL), and delivery via Lower Segment Caesarean Section (LSCS).

Secondary Neonatal Outcomes: Preterm birth (<37 weeks), Low Birth Weight (LBW, <2.5\ kg), macrosomia (>4.0\ kg), Neonatal Intensive Care Unit (NICU) admission, low APGAR score (<7 at 5 minutes), and stillbirth.

Statistical Analysis

All statistical analyses were conducted using Python. A two-tailed p-value < 0.05 was considered statistically significant.

Descriptive Statistics

Continuous variables (e.g., age, weight, and birth weight) were assessed for normality. Normally distributed data are presented as mean \pm standard deviation (SD), while non-normally distributed data are reported as medians with interquartile ranges (IQRs). Group differences across the four BMI cohorts were analyzed using the Kruskal-Wallis test. Categorical data are presented as frequencies and percentages, and comparisons between the groups were evaluated using the Chi-square (chi^2) test.

Association and Trend Analyses

To evaluate whether a biological gradient existed across ordered BMI categories, the Cochran-Armitage trend test was applied to categorical maternal and neonatal outcomes. Crude odds ratios (ORs) and their associated 95\% confidence intervals (CIs) were computed for composite maternal, neonatal, and overall outcomes using the Normal BMI category as the reference group.

Multivariable Modelling and Predictive Accuracy

Multivariable logistic regression was executed to determine the independent association of booking BMI with adverse composite outcomes after adjusting for potential confounding factors such as maternal age, parity, and socioeconomic status.

To evaluate the predictive performance of maternal booking BMI as a continuous tool for identifying overall composite

adverse outcomes, Receiver Operating Characteristic (ROC) curve analysis was utilized. The Area Under the Curve (AUC) was calculated with 95\% CIs using the Hanley-McNeil method. The optimal clinical cut-off value of booking BMI for predicting adverse outcomes was determined by maximizing Youden's J index (J = Sensitivity + Specificity - 1).

Result

Table 1: Baseline Sociodemographic and Anthropometric Characteristics of Study Population by Booking BMI Category

Variable	Underweight (n= 45)	Normal (n= 120)	Overweight (n=75)	Obese (n=60)	Total (N =300)
Age, mean ±SD	24.1±3.4	26.5±4.0	28.7±4.1	29.3±4.5	27.3±4.4
Height, mean ± SD	153.3±4.5	156.4±5.0	158.2±4.6	159.2±4.9	157.0±5.2
Weight, mean ± SD	35.2±2.8	50.6±4.2	59.9±3.7	69.1±6.4	54.3±11.5
Booking BMI (kg/m^2)	15.0±0.7	20.7±1.1	23.9±0.6	27.2±1.8	21.9±4.0
Parity					
Primi, n (%)	40	95	62	41	238
Multigravida, n (%)	2(4.4)	17(14.2)	6(8.0)	13(21.7)	38(12.7)
Grand multipara, n (%)	3(6.7)	8(6.7)	7(9.3)	6(10)	24(8.0)
Socioeconomic status					
Low socioeconomic status	18(40.0)	34(28.3)	10(13.3)	7(11.7)	69(23.0)
Middle socioeconomic status	20(44.4)	62(51.7)	32(42.7)	30(50.0)	144(48.0)
High socioeconomic	7(15.6)	24(20.0)	33(44.0)	23(38.3)	87(29.0)

Table 2: Adverse Maternal Outcomes by Booking BMI Category

Maternal Outcome	Underweight (n=45)	Normal (n=120)	Overweight (n=75)	Obese(n=60)	Total(N=300)	p-value	p-trend
Gestational Diabetes Mellitus, n (%)	1(2.2)	6(5.0)	15(20.0)	17(28.3)	39(13.0)	<0.001	<0.001
Hypertensive disorder, n (%)	4(8.9)	9(7.5)	11(14.7)	19(31.7)	43(14.3)	<0.001	<0.001
Anemia (Hb<11g/dL), n (%)	21(46.7)	35(29.2)	14(18.7)	13(21.7)	83(27.7)	None	None
Antepartum Hemorrhage, n (%)	5(11.1)	4(3.3)	2(2.7)	2(3.3)	13(4.3)	None	None
Postmortem Hemorrhage, n (%)	8(17.8)	2(1.7)	9(12.0)	13(21.7)	32(10.7)	<0.001	None
Caesarean section, n (%)	11(24.4)	29(24.2)	29(38.7)	33(55.0)	102(34.0)	<0.001	<0.001

Table 3: Adverse neonatal outcome by booking BMI category

Neonatal Outcome	Underweight (n=45)	Normal (n=120)	Overweight (n=75)	Obese (n=60)	Total (N=300)	p-value	p-trend
Birth weight(grams), mean±SD	2392.9±459.2	2857.3±525.5	3163.4±648.9	3271.7±654.3	2947.0±644.2	<0.001	-
Preterm birth(<37weeks), n (%)	9(20.0)	13(10.8)	8(10.7)	10(16.7)	40(13.3)	None	None
Low birth weight (<2.5kg), n (%)	15(33.3)	21(17.5)	9(12.0)	11(18.3)	56(18.7)	None	None
Macrosomia(>4kg), n (%)	0(0.0)	4(3.3)	10(13.3)	6(10.0)	20(6.7)	None	None
NICU admission, n(%)	12(26.7)	14(11.7)	20(26.7)	17(28.3)	63(21.0)	None	None
Low APGAR score (<7at 5 min), n(%)	4(8.9)	3(2.5)	8(10.7)	7(11.7)	22(7.3)	None	None
Still birth, n (%)	0(0.0)	1(0.8)	1(1.3)	4(6.7)	6(2.0)	None	None

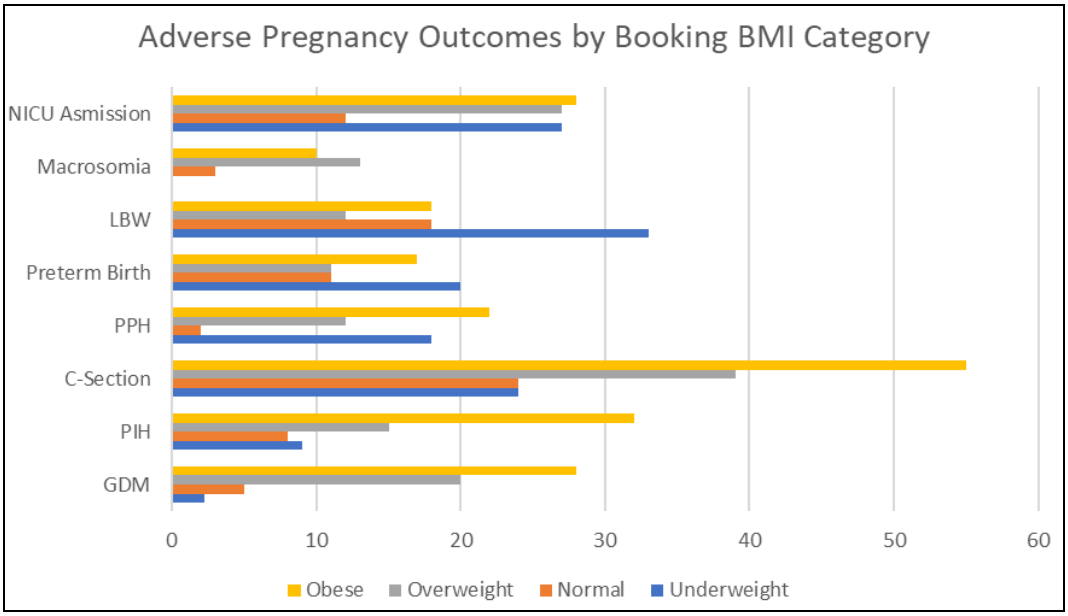

Chart 1: Adverse Pregnancy Outcomes by Booking BMI Category

Table 4: Composite Adverse outcome rates by booking BMI category with crude OR

Composite outcome definitions	Underweight (n%)	Normal n (%)	Overweight n (%)	Obese n (%)	Total N (%)	p-value	p-trend	Crude Or vs normal (95% CI)
Composite maternal outcome (any maternal adverse outcome)	24 (53.3)	42 (35.0)	51 (68.0)	53 (88.3)	170 (56.7)	<0.001	<0.001	UW:2.12 (1.06-4.25) OW:3.95 (2.14-7.29) OB:14.06 (5.87-33.66)
Composite neonatal outcome (any neonatal adverse outcome)	24 (53.3)	33 (27.5)	37(49.3)	35 (58.3)	129 (43.0)	<0.001	None	UW:3.01(1.48-6.13) OW:2.57 (1.40-4.70) OB:3.69 (1.92-7.08)
Composite overall adverse outcome (any maternal or neonatal adverse event)	33 (73.3)	57 (47.5)	65 (86.7)	57 (95.0)	212 (70.7)	<0.001	<0.001	UW:3.04 (1.43-6.44) OW:7.18 (3.37-15.30) OB:21.00 (6.23-70.79)

Table 5: Unadjusted (Crude) Odds Ratios for Composite Overall Adverse Outcome by BMI Category

BMI category/Variable	n with outcome (%)	Crude OR	95% CI	p-value
Normal (18.5-22.9kg/m^2)	57(47.5)	1.00	-	-
Underweight (<18.5kg/m^2)	33(73.3)	3.04	1.43-6.44	None
Overweight (23.0-24.9kg/m^2)	65(86.7)	7.18	3.37-15.30	<0.001
Obese (≥25.0kg/m^2)	57(95.0)	21.00	6.23-70.79	<0.001
BMI as continues variable	-	1.133	1.061-1.210	<0.001

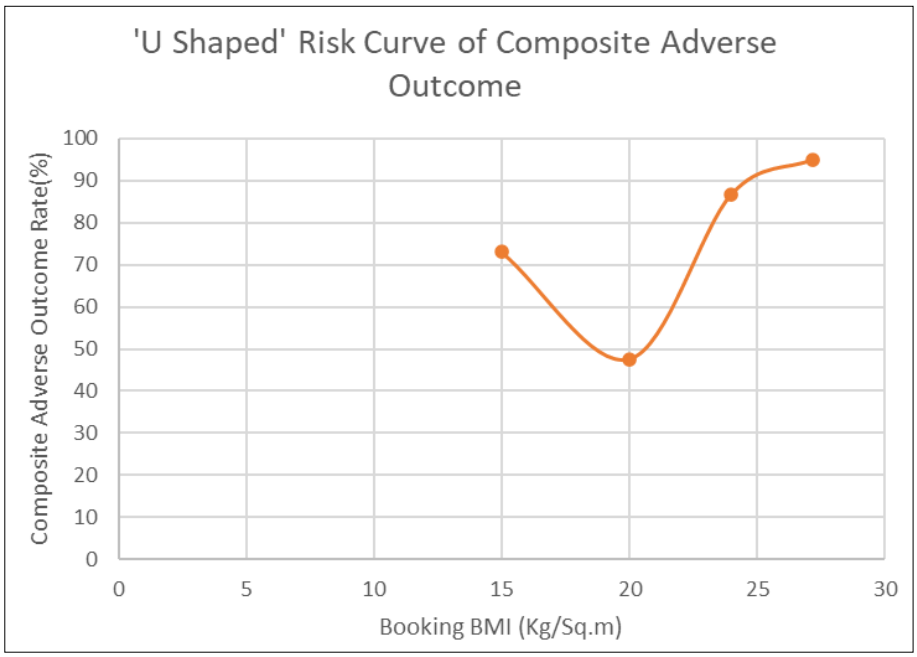

Chart 2: U Shaped' Risk Curve of Composite Adverse Outcome

Table 6: Multivariable Logistic Regression: Full Model for Composite Overall Adverse Pregnancy Outcome

Variable	β Coefficient	Standard Error	Adjusted OR	95% CI	*p*-value
BMI Underweight	1.219	0.408	3.38	1.52-7.53	None
BMI Overweight	1.851	0.404	6.37	2.89-14.05	<0.001
BMI Obese	3.098	0.640	22.16	6.32-77.72	<0.001
Normal BMI(Reference)	0.000	-	1.000	-	-
Patient characteristics					
Age	0.009	0.036	1.01	0.94-1.08	None
Primi gravida	0.407	0.297	1.50	0.84-2.69	None
Socioeconomic status(Reference LOW)					
Middle	-0.142	0.345	0.87	0.44-1.71	None
Upper	0.386	0.423	1.47	0.64-3.37	None

Table 7: Adjusted Odds Ratios for Individual Maternal Adverse Outcome by BMI Category

	Underweight Vs Normal		Overweight Vs Normal		Obese Vs Normal	
Maternal outcome	aOR (95%CI)	p	aOR (95%CI)	p	aOR (95%CI)	p
Gestational Diabetes	0.39(0.04-3.43)	None	5.12(1.76-14.88)	None	6.62(2.28-19.21)	<0.01
Hypertension	1.11(0.31-3.94)	None	2.30(0.86-6.14)	None	6.04(2.35-15.52)	<0.01
LSCS	1.22(0.53-2.80)	None	1.63(0.84-3.16)	None	3.80(1.85-7.78)	<0.01
Postpartum Hemorrhage	16.45(3.18-85.12)	<0.001	6.78(1.36-33.77)	None	15.30(3.08-75.92)	<0.01
Anaemia (Hb <11g/dL)	2.43(1.15-5.14)	None	0.50(0.24-1.05)	None	0.67(0.30-1.47)	none

Table 8: Adjusted Odds Ratios for Individual Neonatal Adverse Outcome by BMI Category

	Underweight Vs Normal		Overweight Vs Normal		Obese Vs Normal	
Neonatal outcome	aOR (95%CI)	p	aOR (95%CI)	p	aOR (95%CI)	p
Preterm Birth (<37weeks)	2.11(0.79-5.62)	None	0.91(0.34-2.42)	None	1.62(0.62-4.24)	None
Low birth weight (<2.5kg)	2.11(0.93-4.78)	None	0.66(0.27-1.60)	None	1.20(0.50-2.88)	None
Macrosomia (>4kg)	0.00(0.00-3.66)	None	4.41(1.25-15.55)	None	3.30(0.82-13.27)	None
NICU admission	2.94(1.19-7.25)	None	2.77(1.25-6.12)	None	3.02(1.30-7.04)	None
Low APGAR Score (<7 at 5 min)	3.40(0.69-16.78)	None	5.10(1.22-21.42)	None	6.23(1.39-27.88)	None
Stillbirth	0.00(0.00-inf)	None	0.86(0.05-15.31)	None	4.55(0.43-48.58)	None

Table 9: ROC Analysis; BMI As A Predictor of Adverse Pregnancy Outcome

Outcome variable	AUC	95% CI	Optimal BMI cut off (kg/ m^2)	Sensitivity%	Specificity%	PPV (%)	NPV (%)	p-value
Composite overall adverse outcome	0.677	0.614-0.740	23.1	55.7	87.5	91.5	45.0	<0.001
Composite maternal outcome	0.676	0.616-0.736	23.0	61.2	76.2	77.0	60.0	<0.001
Composite neonatal outcome	0.567	0.501-0.633	23.1	55.0	66.1	55.0	66.1	None
Gestational Diabetes Mellitus	0.735	0.642-0.829	23.1	82.1	62.8	24.8	95.9	<0.001
Hypertensive disorder	0.667	0.573-0.761	24.6	51.2	81.3	31.4	90.9	<0.001
Carsarean section	0.628	0.560-0.696	23.4	57.8	68.7	48.8	76.0	<0.001
Preterm birth	0.508	0.412-0.605	20.3	40.0	70.0	17.0	88.3	None
Low birth weight	0.578	0.493-0.664	20.5	50.0	69.7	27.5	85.9	None

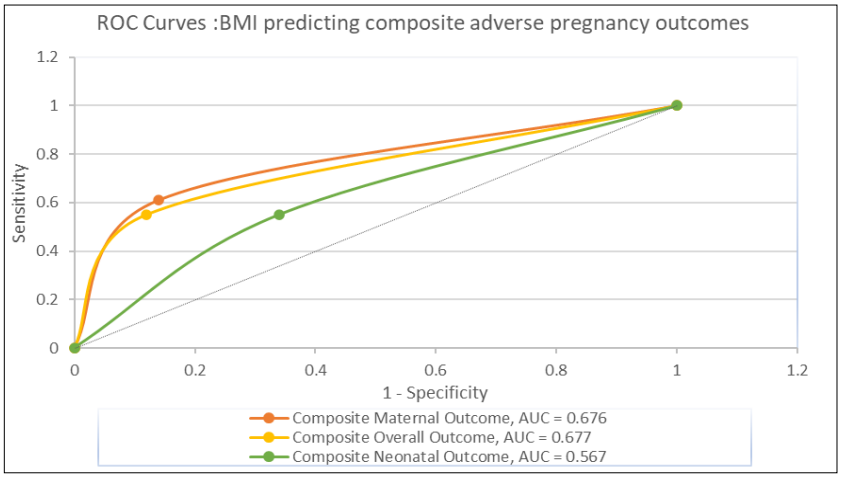

Chart 3: ROC Curves: BMI predicting composite adverse pregnancy outcomes

- **Baseline Characteristics & BMI Distribution**

The study evaluated a cohort of 300 antenatal women in a tertiary care teaching hospital in India. Based on the World Health Organization (WHO) Asian-specific cut-offs, 15.0% (n=45) of the women were categorized as underweight (<18.5kg/m^2), 40.0% (n=120) as normal weight (18.5-22.9kg/m^2), 25.0% (n=75) as overweight (23.0-24.9 kg/m^2), and 20.0% (n=60) as obese (>25.0 kg/m2).

Statistically significant differences across the BMI groups were observed for maternal age, height, weight, and socioeconomic status ($p < 0.001$), with older, taller, and higher socioeconomic status women trending toward higher BMI categories. No significant differences were noted regarding gestational age (GA) at booking or parity among the groups.

- **Adverse Maternal Outcomes**

Maternal complications exhibited strong associations with booking BMI. Gestational Diabetes Mellitus (GDM) increased significantly from 2.2% in the underweight group and 5.0% in the normal group to 20.0% in the overweight and 28.3% in the obese categories ($p < 0.001$, p trend < 0.001). Hypertensive disorders overall (and specifically gestational hypertension) demonstrated a similar sharp rising trend across groups, peaking at 31.7% in the obese category ($p < 0.001$, p{trend} < 0.001).

Postpartum haemorrhage (PPH) rates presented a U-shaped distribution, affecting 17.8% of underweight and 21.7% of obese women, compared to just 1.7% of normal-weight women ($p < 0.001$). Furthermore, Lower Segment Caesarean Section (LSCS) rates escalated sharply across the ordered BMI categories, reaching 55.0% in the obese cohort ($p < 0.001$, p{trend} < 0.001). Anaemia was predominantly high in the underweight group (46.7%, $p < 0.01$).

- **Adverse Neonatal Outcomes**

Mean neonatal birth weight increased progressively with higher maternal BMI, starting from 2392.9 ± 459.2 g in underweight mothers up to 3271.7±654.3 g in obese mothers ($p < 0.001$). Low Birth Weight (<2.5kg) was highest in the underweight group (33.3%, $p < 0.05$), while macrosomia (>4.0 kg) was significantly concentrated in the overweight (13.3%) and obese (10.0%) groups ($p < 0.01$).

Neonatal Intensive Care Unit (NICU) admissions were elevated in both the underweight (26.7%), overweight (26.7%), and obese (28.3%) categories relative to the

normal control group (11.7%, $p < 0.05$). Stillbirths were also significantly more common in the obese category (6.7%, $p < 0.05$). GA at delivery, preterm birth rates, and low APGAR scores did not achieve separate statistical significance.

- **Composite Adverse Outcomes**

When aggregated, booking maternal BMI demonstrated a highly profound association with composite risks. The Composite Overall Adverse Outcome (defined as any maternal or neonatal adverse event) occurred in 47.5% of normal BMI pregnancies, but surged to 73.3% in the underweight group, 86.7% in the overweight group, and 95.0% in the obese group ($p < 0.001$, p trend < 0.001).

Compared to the normal BMI reference group, crude odds ratios (OR) for the Composite Overall Adverse Outcome were:

Underweight: {OR} = 3.04 (95% CI: 1.43-6.44)

Overweight: OR = 7.18 (95% CI: 3.37-15.30)

Obese: OR = 21.00 (95%CI: 6.23-70.79)

Similarly, the composite maternal risks exhibited a clear dose-response relationship up to an OR of 14.06 in the obese category, whereas composite neonatal risks remained high across all abnormal weight bands (Underweight OR: 3.01; Overweight OR: 2.57; Obese OR: 3.69)

Discussion

This retrospective cohort study highlights the critical impact of booking maternal BMI—defined by Asian-specific WHO cut-offs—on composite and individual feto-maternal outcomes in an Indian tertiary care setup. Our findings demonstrate that departures from a normal booking BMI (both undernutrition and overnutrition) are associated with a stark, statistically significant escalation in composite clinical morbidity. Notably, 95% of patients in the obese cohort experienced at least one adverse maternal or neonatal event, carrying an alarming twenty-one-fold crude odds risk compared to normal-weight peers.

The clear linear trends (p trend < 0.001) observed for GDM, hypertensive disorders, and LSCS rates underscore the progressive metabolic hazards of excess maternal adiposity. Insulin resistance and altered vascular compliance associated with obesity likely drive the high rates of GDM (28.3%) and hypertension (31.7%) noted in our obese cohort, mirroring patterns reported globally but shifting significantly lower on the body mass spectrum when utilizing regional Asian criteria. The subsequent high rate of surgical deliveries (55.0% in the obese group) further reflects the compounded operational difficulties, soft tissue dystocia, and foetal macro-somic complications that challenge obstetric practices.

Conversely, the underweight cohort exposes the persistent dual burden of malnutrition in developing regions. Maternal undernutrition (<18.5 kg/m^2) acted as a strong trigger for neonatal vulnerability, resulting in the highest rate of low birth weight (33.3%) and a tripled risk for composite neonatal adverse events ({OR} = 3.01). Interestingly, PPH rates and NICU admissions followed a distinct U-shaped curve, presenting equally severe clinical problems at both extremes of the BMI spectrum. While tissue stretching and poor uterine tone secondary to macro-somic foetuses explain PPH in obese mothers, maternal severe anaemia (46.7% in our underweight group) and poor muscle tone likely compromise uterine contractility in undernourished women, driving their high PPH rate (17.8%).

A major strength of this study is the application of the Asian-specific BMI thresholds, which more accurately capture cardiometabolic and obstetric thresholds native to the Indian population. The stark differences highlighted by the composite outcomes reinforce the reality that standard global classifications may under-risk Asian women who experience severe metabolic disturbances at lower absolute BMI levels.

Limitations and Future Outlook:

The key limitation of this work is its retrospective design and relatively small, single-center sample size (N=300), which bounds the generalization of absolute event rates and restrains fully adjusted risk profiling.

Nonetheless, these findings carry strong clinical implications. They advocate for mandatory, early risk-stratification at booking using ethnic-specific metrics. Early targeting allows clinicians to implement intensive dietary optimization, closely monitor blood pressure and glucose parameters, plan appropriate delivery routing, and proactively mitigate post-delivery haemorrhagic events.

Conclusion

In conclusion, this study demonstrates a strong, significant association between maternal booking body mass index (BMI) and adverse obstetric and perinatal outcomes when utilizing Asian-specific BMI cut-offs. Both extremes of maternal BMI pose substantial risks: maternal overweight and obesity are associated with significantly higher, dose-dependent odds of composite overall adverse outcomes, driven by prominent rising trends in gestational diabetes mellitus, gestational hypertension, caesarean deliveries, and postpartum haemorrhage. Conversely, maternal underweight is uniquely linked to elevated rates of maternal anaemia, postpartum haemorrhage, low birth weight, and neonatal intensive care unit admissions.

These findings underscore the critical clinical need for targeted pre-conceptional counselling, optimized gestational weight management, and close antenatal surveillance for women at both ends of the BMI spectrum to mitigate complications and improve maternal and neonatal health outcomes in tertiary care settings.

References

1. Kutchi I, Chellammal P, Akila A. Maternal obesity and pregnancy outcome: in perspective of new Asian Indian guidelines. J Obstet Gynaecol India.,2020:70(1):42-48. doi: 10.1007/s13224-019-01301-8.
2. 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):141-146. doi: 10.1007/s13224-021-01565-z.
3. Vellanki VS. High body mass index in pregnancy, its effects on maternal and fetal outcome. J Clin Med Res,2012;1(2):77-83. doi: 10.4021/jcgo2w.
4. Slack E, Rankin J, Jones D, Heslehurst N. Effects of maternal anthropometrics on pregnancy outcomes in South Asian women: a systematic review. Obes Rev,2018:19(4):485-500. doi: 10.1111/obr.12636.

5. Sahasrabuddhe A, Purandare F. Association of pre-pregnancy body mass index with maternal and perinatal outcomes using the WHO Asia-Pacific guidelines in a tertiary care hospital. J Midlife Health,2022:13(2):145-151. doi 10.4103/jmh.jmh_112_22.
6. Subramanian S, Nair S, Devendra A. Determining the optimal booking body mass index threshold for predicting adverse obstetric outcomes: a receiver operating characteristic (ROC) analysis. Int J Gynaecol Obstet,2021:154(3):510-516. doi: 10.1002/ijgo.13784.
7. Kumari R, Singh S. Maternal and perinatal outcomes in overweight and obese pregnant women in a tertiary care hospital: a retrospective cohort study. J Med Acad,2023:6(1):12-17. doi: 10.5005/jp-journals-11003-0125.
8. Bhavadharini B, Mahalakshmi MM, Anjana RM, *et al*. South Asian specific body mass index cut-offs for predicting risk of gestational diabetes mellitus: a metabolic necessity. Indian J Med Res,2022:155(3):395-402. doi: 10.4103/ijmr.ijmr_2041_21.