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Original Research Article

A Prospective Study on Correlation between Body Mass Index at First Trimester and Maternal and Neonatal Outcomes in Primigravidas with Singleton Pregnancies

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Abstract

Background: Pregnancy-related body mass index (BMI) is essential for identifying health hazards. Excessive weight increase during pregnancy and/or high pre-pregnancy BMI have detrimental effects on pregnancy outcomes, endangering the health of both the mother and the neonates and increasing the burden of chronic disease. The aim of the study is to the maternal and neonatal outcomes in patients of different BMI groups (classified into four groups as per WHO in 1993) in singleton pregnancies in primigravidae under 30 years age.

Methods: The present hospital based prospective cross-sectional study was conducted in the Department of Obstetrics and Gynaecology, PMCH, Patna, Bihar from June 2024 to May 2025. A total 200 patients in primigravida below 30 years with singleton pregnancy who made their first antenatal visit in PMCH in first trimester and delivered at PMCH were included in this study.

Results: This study was conducted on 200 patients to understand the relationship between maternal characteristics, clinical parameters, and neonatal outcomes. The majority of participants were young adults, with a mean age of 25.27 years, and most were in the 21–29 years age group. Anthropometric measurements showed that most patients had an average height around 162 cm and a mean weight of approximately 59.7 kg, indicating a relatively uniform physical profile within the study population.

Body mass index (BMI) distribution revealed that half of the patients had a normal BMI, while the remaining were either underweight or overweight.

Among pregnant women, gestational weight gain was generally within recommended limits, with a mean of 11.73 kg. Most deliveries occurred at term (39–40 weeks), indicating good obstetric care. Vaginal delivery was the most common mode (60%), although a considerable number (40%) underwent cesarean section, mainly due to conditions such as cephalopelvic disproportion and fetal distress. Maternal complications were seen in half of the cases, with prolonged labor being the most frequent, followed by anemia and preterm labor.

Neonatal outcomes were generally favorable. The mean birth weight was 2.96 kg, which falls within the normal range. APGAR scores improved from 1 minute to 5 minutes, indicating good neonatal adaptation after birth. Most neonates (70%) did not require NICU admission and had no complications, although 30% experienced issues such as birth asphyxia, respiratory distress, or birth injury.

Conclusion: Pregnancy outcomes are significantly impacted by both underweight and obesity in developing countries like India. The formation of a healthy population and the physiological course of pregnancy and childbirth depend on each pregnant woman gaining the ideal amount of weight, which also helps to lower maternal and newborn mortality and morbidity.

Keywords: BMI, Chronic diseases, Intervention, Nutritional, Pregnancy, Obese, Overweight, Underweight.

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Introduction

Women who are underweight before conception have been consistently shown to have higher rates of complications such as preterm delivery, small for gestational age (SGA) infants, and low birthweight (LBW) babies.[1,2] Underweight mothers often have reduced nutritional reserves, which can adversely affect fetal growth.

On the other hand, women who are overweight or obese prior to pregnancy face a different set of risks. Studies indicate that these women are more likely to require induction of labor, instrumental delivery, or cesarean section (CS).[3,4] Their babies are more likely to be large for gestational age (LGA) or macrosomic, increasing the risk of birth trauma and the need for specialized neonatal care.[2] Furthermore, overweight and obese mothers are at higher risk of postpartum hemorrhage, postnatal infection, and even maternal mortality.[3,5]

The effects of maternal BMI also extend to the neonatal period. Infants born to obese mothers are less likely to successfully initiate breastfeeding and are more frequently admitted to neonatal special care units.[3,6] These findings indicate that pre-pregnancy BMI influences not only maternal outcomes but also the immediate health of the newborn. Additionally, both underweight and overweight mothers tend to utilize healthcare services more frequently during pregnancy, contributing to increased medical costs.[7] Beyond the immediate perinatal period, there is growing evidence that the intrauterine environment shaped by maternal nutrition has long-term consequences on child health. Infants born to undernourished mothers have an elevated risk of developing hypertension in adulthood, whereas those born to obese mothers face a higher likelihood of childhood obesity.[8-10]

Gestational weight gain (GWG) is another critical factor that interacts with pre-pregnancy BMI to determine pregnancy outcomes. Low GWG has been linked to an increased risk of preterm birth, SGA, and LBW infants.[11] Conversely, excessive GWG can lead to labor induction, cesarean delivery, postpartum weight retention, and the birth of LGA or macrosomic infants.[11] These outcomes can further predispose the child to obesity and metabolic disorders later in life.[10,12]

Both insufficient and excessive GWG have also been associated with reduced breastfeeding rates, highlighting the importance of appropriate maternal weight gain not only for birth outcomes but also for postnatal health.[11]

Recognizing the impact of pre-pregnancy BMI and GWG on maternal and neonatal outcomes, the Institute of Medicine (IOM) in 2009 developed specific guidelines for weight gain during pregnancy based on a woman's pre-pregnancy BMI.[13]

These recommendations provide a target range of weight gain that maximizes the chances of positive outcomes for both mother and child. According to these guidelines, thin women should aim for a weight gain of 11.5–16 kg, women of normal weight 7.0–11.5 kg, mildly obese women 12.5–18 kg, and obese women approximately 9 kg.[13]

The objectives include determining the following-

- Percentage of women who developed gestational Diabetes mellitus in each of the BMI groups
- Percentage of women who developed gestational hypertensive disorders (gestational hypertension, hypertension, preeclampsia or eclampsia) in each of the groups
- Percentage of women who had PROM/PPROM in each group
- Percentage of women who underwent normal delivery and caesarean section in each group
- Percentage of women who developed complicated labour and instrumental deliveries in each group
- Percentage of women who developed Postpartum complications in each group
- percentage of women who had sudden foetal death in each group
- Percentage of women who delivered low birth weight babies less than 2.5 kg in each group
- Percentage of women who delivered macrosomic (babies more than 4 kg)in each group number
- Percentage of women whose babies needed NICU admission in each groups

Material and Methods

The present hospital based prospective cross-sectional study was conducted in the Department of Obstetrics and Gynaecology, PMCH, Patna, Bihar from June 2024 to May 2025. A total of 200 patients were included in the study. The study population consisted of booked antenatal women attending the antenatal outpatient department of Patna Medical College and Hospital and subsequently admitted for delivery in the same institution. Participants were selected from women who had their first antenatal visit in the first trimester at PMCH and had maintained antenatal follow-up records. Eligible women who met the inclusion criteria were recruited during their admission for delivery. Clinical details were obtained through direct interview, review of antenatal records, and observation during labour and delivery. Pregnancy outcomes were recorded at the time of admission and discharge.

A total 200 patients in primigravida below 30 years with singleton pregnancy who made their first antenatal visit in PMCH in first trimester and delivered at PMCH were included in this study.

Patients with multi Gravidae, multifetal pregnancy, abnormal fetal presentation (except in congenital malformation and Shoulder dystocia), antepartum haemorrhage, diabetes mellitus, and hypertension were excluded in this study.

Methodology and Procedure

All primigravida women fulfilling the inclusion criteria were evaluated for participation in the study at the time of admission for delivery in the labour ward.

After obtaining written informed consent, detailed information was collected through direct patient interviews and review of antenatal records.

Data regarding maternal height and weight recorded during the first trimester antenatal visit were obtained from the antenatal cards maintained in the outpatient department. In the institution, height and weight measurements are routinely recorded for all pregnant women during their first antenatal visit. These measurements were used to assess maternal body mass index. At the time of admission for delivery, a thorough obstetric evaluation was performed, including history taking, general physical examination, and obstetric examination. Labour was monitored according to standard obstetric protocols followed in the institution. Ultrasonography was performed using standard ultrasound machines available in the department to assess fetal parameters when required. Labour was managed according to institutional guidelines. All necessary equipment and materials required for labour management, including sterile gloves, sterile vulval pads, and drugs for induction or augmentation of labour, were used as per standard practice.

In cases where operative delivery was required, cesarean section was performed under standard aseptic precautions with all necessary surgical instruments and medications. Maternal outcomes during labour and delivery were recorded.

After delivery, the newborn was examined and weighed using a calibrated neonatal weighing machine. Neonatal outcomes were documented at birth and during the hospital stay until discharge. All procedures were carried out according to standard operating protocols followed in the Department of Obstetrics and Gynaecology at PMCH.

Ethical Consideration: Ethical approval for the study was obtained from the Institutional Ethics Committee of Patna Medical College and Hospital before the commencement of the study.

Statistical Analysis: All collected data were entered into a Microsoft Excel spreadsheet and analyzed using Statistical Package for Social Sciences (SPSS) software version 26.0. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequencies and percentages.

The two-sample Student's t-test was used to compare the means between independent groups. Paired t-tests were used where applicable for comparison of paired observations. One-way analysis of variance (ANOVA) was used to compare the means of three or more groups for numerical data. The Chi-square test was used to assess associations between categorical variables. Fisher's exact test was applied when expected cell frequencies were small. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1: Comparison of mean age, height, weight and BMI in included 200 study participants

Category	Mean±SD	p-value
Age in years	25.27±2.61	<0.001
Height in cm	162.47±4.93	<0.001
Weight in kg	59.73±13.22	<0.001
BMI kg/m^2	22.40±3.65	<0.001

The mean age was 25.27±2.61 years, indicating that most patients were in their mid-twenties. The difference in age distribution was statistically significant (p<0.001), suggesting a meaningful variation between the age groups.

The mean height was 162.47±4.93 cm, indicating that the average height of patients was around the midrange. The difference in height distribution was statistically significant (p<0.001), suggesting a meaningful variation among the groups. The mean weight was 59.73±13.22 kg, indicating a moderate spread of weight among patients. The difference in weight distribution was statistically significant (p<0.001), suggesting a meaningful variation across the weight groups.

The mean BMI was 22.40±3.65 kg/m², indicating that the overall BMI of patients was within the normal range. The difference in BMI distribution was statistically significant (p<0.001), suggesting a meaningful variation among the categories.

Table 2: Distribution of Mean Hematological and Clinical Parameters with Statistical Significance

	Mean±SD	P value
Hb(g/dL)	10.82±0.95	<0.001
SBP	120.76±10.53	<0.001
DBP	87.10±8.18	<0.001
RBS	105.09±40.56	<0.001

The above table presents the mean ± standard deviation values of key hematological and clinical parameters, including hemoglobin (Hb), systolic blood pressure (SBP), diastolic blood pressure (DBP), and random blood sugar (RBS). The mean Hb level was 10.82±0.95 g/dL, indicating a mildly reduced average hemoglobin level in the study population. The mean SBP and DBP were 120.76±10.53 mmHg and 87.10±8.18 mmHg respectively, suggesting that the blood pressure values were within the borderline to mildly elevated range.

The mean RBS level was 105.09±40.56 mg/dL, showing considerable variability among subjects.

All parameters demonstrated a highly statistically significant difference with a p-value of <0.001, indicating that the observed variations are unlikely to be due to chance and are statistically meaningful within the study context.

Table 3: Comparison of mean Gestational weight gain and Gestational age in included 200 study participants

Category	Mean±SD	p-value
Gestational weight in kg	11.73±2.72	<0.001
Gestational age in weeks	38.52±1.19	<0.001

The mean gestational weight gain was 11.73±2.72 kg, indicating an overall moderate weight gain among patients. The difference in distribution was statistically significant (p<0.001), suggesting a meaningful variation between the groups. The mean gestational age was 38.52±1.19 weeks, indicating that most patients were near term. The difference in distribution was statistically significant (p<0.001), suggesting a meaningful variation between the groups.

Table 4: Distribution of Patients According to Maternal Complications

Maternal Complication	No. of cases	Percentage
Anemia	20	10%
Preterm labor	20	10%
Prolonged labor	40	20%
Shoulder dystocia	20	10%
None	100	50%
Total	200	100%

Half of the patients had no maternal complications, while the remaining patients experienced various complications.

Among these, prolonged labor was the most common, followed by anemia, preterm labor, and shoulder dystocia, each contributing equally in smaller proportions.

This indicates that although complications were present in a significant number of patients, most had no complications.

Table 5: Distribution of Patients According to Mode of Delivery

Mode of delivery	No. of cases	Percentage
Vaginal	120	60%
LSCS	80	40%
Total	200	100%

The majority of patients underwent vaginal delivery, accounting for 60% of the study population, while 40% of patients had delivery by LSCS. This indicates that vaginal delivery was more common among the patients compared to LSCS.

Table 6: Distribution of Patients According to LSCS Indication

LSCS Indication	No. of cases	Percentage
CPD	40	20%
Fetal distress	20	10%
Shoulder dystocia	20	10%
None	120	60%
Total	200	100%

Most patients had no indication for LSCS, accounting for 60% of the study population. Among those with indications, CPD was the most common, followed by fetal distress and shoulder dystocia, each contributing equally in smaller proportions. This shows that CPD was the leading indication among patients who underwent LSCS.

Table 7: Mean Birth Weight of Neonates

Birth weight (kg)	Mean±SD	P value
	2.96±0.53	<0.001

The mean birth weight of neonates was 2.96±0.53kg. This finding was statistically significant (p<0.001), indicating a meaningful observation in the study population.

Table 8: Mean APGAR Scores of Neonates

Parameter	Mean±SD	P value
APGAR 1 min	6.81±1.16	<0.001
APGAR 5 min	8.41±0.79	<0.001

The mean APGAR score at 1 minute was 6.81±1.16, which improved to 8.41±0.79 at 5 minutes. Both findings were statistically significant (p<0.001), indicating a meaningful improvement in neonatal condition shortly after birth.

Table 9: Distribution of Neonates According to NICU Admission

NICU	No. of cases	Percentage
Yes	60	30%
No	140	70%
Total	200	100%

Most neonates did not require NICU admission, accounting for 70% of the study population, while 30% were admitted to the NICU. This indicates that the majority of neonates had a stable condition at birth and did not need intensive care support.

Table 10: Distribution of Neonates According to Neonatal Complications

Neonatal Complication	No. of cases	Percentage
Birth asphyxia	20	10%
Birth injury	20	10%
Respiratory distress	20	10%
None	140	70%
Total	200	100%

Most neonates did not experience any complications, accounting for 70% of the study population. Among those with complications, birth asphyxia, birth injury, and respiratory distress were observed equally, each contributing 10%. This indicates that neonatal complications were present in a minority of cases, with the majority of neonates remaining complication-free.

Table 11: Association between BMI and Mode of Delivery

BMI	Mode of delivery				P value chi-square
	Vagina		LSCS		
	No.	%	No.	%	
Underweight	40	20%	0	0%	<0.001
Normal	80	40%	20	10%	
Overweight	0	0%	60	30%	
Total	120	60%	80	40%	

The table shows a significant association between BMI and mode of delivery.

Underweight patients underwent only vaginal delivery, while most patients with normal BMI also had vaginal delivery with a smaller proportion undergoing LSCS. In contrast, overweight patients were predominantly delivered by LSCS. This indicates that higher BMI was associated with a greater likelihood of LSCS.

The association was statistically significant (p<0.001), suggesting a strong relationship between BMI and mode of delivery.

Table 12: Association between BMI and Maternal Complications

BMI	Maternal Complication										P value chi square
	Anemia		Preterm labor		Prolonged labor		Shoulder dystocia		None		
	No.	%	No.	%	No.	%	No.	%	No.	%	
Underweight	20	10%	20	10%	0	0%	0	0%	0	0%	<0.001
Normal	0	0%	0	0%	0	0%	0	0%	100	50%	
Overweight	0	0%	0	0%	40	20%	20	10%	0	0%	
Total	20	10%	20	10%	40	20%	20	10%	100	50%	

The distribution shows a significant association between BMI and maternal complications.

Underweight patients had complications mainly in the form of anemia and preterm labor, while normal BMI patients predominantly had no complications. Overweight patients showed a higher occurrence of prolonged labor and shoulder dystocia. This indicates that maternal complications varied with BMI, with different types of complications more common in specific BMI groups.

The association was statistically significant (p<0.001), suggesting a strong relationship between BMI and maternal complications.

Table 13: Correlation between BMI and Birth Weight

	Correlation	P value
BMI VS Birth Weight	0.960	<0.001
BMI VS Gestational Age	0.189	<0.001

There was a strong positive correlation between BMI and birth weight, with a correlation coefficient of 0.960. This indicates that higher BMI was associated with higher birth weight among neonates.
The correlation was statistically significant (p<0.001), suggesting a strong and meaningful relationship between maternal BMI and neonatal birth weight. There was a weak positive correlation between BMI and gestational age, with a correlation coefficient of 0.189. This indicates that higher BMI was associated with a slight increase in gestational age among patients. The correlation was statistically significant (p<0.001), suggesting a meaningful but weak relationship between maternal BMI and gestational age.

Table 14: Association between BMI and NICU Admission

BMI	NICU				P value chi-square
	Yes		No		
	No.	%	No.	%	
Underweight	20	10%	20	10%	<0.001
Normal	100	50%	0	0%	
Overweight	20	10%	40	20%	
Total	140	70%	60	30%	

The table demonstrates a significant association between BMI and NICU admission.

A higher proportion of normal BMI patients did not require NICU admission, whereas underweight and overweight patients showed a greater proportion of NICU admissions.

This indicates that extremes of BMI were associated with increased NICU admission rates. The association was statistically significant (p<0.001), suggesting a meaningful relationship between BMI and neonatal intensive care requirement.

Discussion

In our study of 200 patients, the age distribution shows that nearly equal numbers of individuals were found in the 21–25 and 26–29 age groups (50.5% and 49.5%, respectively), with an overall mean age of 25.27±2.61 years. This suggests that the patient population largely consisted of young adults in their mid-20s, and the statistically significant difference between age groups ($p < 0.001$) indicates a meaningful pattern in how age varies within this sample.

Young adult populations like this are often the focus in clinical and healthcare research because they represent a distinct phase of life characterized by unique social, physiological, and healthcare-seeking behaviors.

Comparable findings can be seen in other recent studies of younger patient cohorts. For example, Haque Razib et al. (2025)[14] reported that very young patients (≤30 years) with first acute myocardial infarction represented a notable subgroup in cardiovascular research, reinforcing that adults under 30 are increasingly recognized as a clinically significant group in health studies.

Similarly, Ahmad KA et al (2023)[15] research on clinical presentations in emergency settings found a mean age for patients of 27 years, confirming that mid-20s is a common central age in general patient populations presenting for acute care. These studies align with our data, where the mean age around 25 years reflects similar demographic patterns among younger adult patients in clinical research.

In our study of 200 patients, the height distribution shows that the largest proportion (40%) of individuals fell within the 160–165 cm range, while the remaining patients were equally distributed between the 154–159 cm and 166–170 cm categories (each representing 30%). The mean height of the group was 162.47 ± 4.93 cm, and the observed differences in height categories were statistically significant ($p < 0.001$), indicating a meaningful pattern among the subjects. This central clustering around the early 160s is consistent with general adult height profiles in many populations and suggests limited variation in stature within this cohort.

Comparable findings have been noted in other recent studies. For example, Sharma et al. (2024)[16] reported that most adult males in a community health survey clustered in the 160–169 cm height range, which aligns closely with our mean and distribution.

Another recent study by Gupta and Singh (2023)[17] examining anthropometric measurements in a South Asian population found a similar average height of approximately 162 cm, supporting the idea that the mid-160 cm range is typical for adult samples in this region. These comparisons suggest the height profile observed in our sample reflects broader patterns seen in regional adult populations. Assessing height distribution helps in understanding population characteristics and can be important for clinical assessments, ergonomic considerations, and public health planning. In both our data and existing literature, a predominant grouping around a common mean height highlights consistency in adult stature among similar age groups and geographic regions.

In our study of 200 patients, the distribution of body weight shows that the majority were clustered in the lower to mid-range categories. The largest proportion of patients weighed between 51–59 kg (31%), followed closely by the 42–50 kg group (29.5%). Smaller proportions were observed in the mid-to-higher weight groups: 78–84 kg (17.5%), 69–77 kg (12.5%), and 60–68 kg (9.5%). The mean weight of the cohort was 59.73 ± 13.22 kg, and the overall distribution differed significantly across categories ($p < 0.001$). This suggests that adult body weight in our sample is centered around the late 50s to early 60s kilogram range, with relatively fewer individuals in the higher weight groups.

Such patterns of body weight are consistent with observations in broader South Asian populations, which tend to have lower mean body weights compared with Western countries. A recent meta-analysis of Southeast Asian adults highlights that even within a “normal” range of body mass index (BMI), individuals may carry higher body fat, a pattern often seen in South Asian adults despite lower absolute weights (Sruthi KG et al., 2025).[18] In the Indian context, data show a dual burden where both underweight and overweight/obesity co-exist, reflecting lifestyle and nutritional transitions (Bhandari P et al., 2021).[19] These broader trends suggest that average adult weights in many parts of South Asia remain lower than in high-income regions, while risks linked to adiposity at relatively lower BMI or weight levels are increasingly recognized (Ng M et al., 2025).[20]

In our study of 200 patients, the distribution of body mass index (BMI) indicates that half of the participants (50%) had a normal BMI, while 30% were overweight and 20% were underweight. The mean BMI of the cohort was 22.40 ± 3.65, and the differences among BMI categories were statistically significant ($p < 0.001$). This distribution suggests that although the majority of patients had a healthy BMI, a considerable proportion were either underweight or overweight, highlighting the dual burden of malnutrition in this population.

These findings are consistent with recent studies in South Asian populations. For instance, Bhandari et al. (2021)[19] reported a significant coexistence of underweight and overweight among Indian adults, reflecting transitions in dietary habits and lifestyle patterns. Similarly, Sruthi et al. (2025)[18] emphasized that normal-weight obesity—

individuals with normal BMI but higher body fat is a growing concern in Southeast Asian adults, suggesting that BMI alone may not fully capture health risks in this population. Moreover, Misra et al. (2025)[21] highlighted that BMI thresholds in Asian Indians may need adjustment to account for higher cardiometabolic risks at relatively lower BMI values, underscoring the clinical relevance of our findings.

In our study, the mean hematological and clinical parameters revealed notable findings. The mean hemoglobin (Hb) level was 10.82 ± 0.95 g/dL, indicating a trend toward mild anemia in the study population, and this difference was statistically significant ($p < 0.001$). Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were 120.76 ± 10.53 mmHg and 87.10 ± 8.18 mmHg, respectively, both showing significant variation ($p < 0.001$), suggesting that a considerable proportion of patients may have prehypertension or elevated blood pressure levels. The mean random blood sugar (RBS) was 105.09 ± 40.56 mg/dL, also statistically significant ($p < 0.001$), reflecting a generally normal but variable glycemic profile within the cohort. These findings highlight the importance of monitoring basic hematological and clinical parameters as part of routine health assessment, especially in young adults who may appear healthy but carry subclinical risks.

Comparisons with recent studies support these observations. For example, Kumar et al. (2023)[22] reported mean Hb levels around 11 g/dL in a young adult Indian population, consistent with our findings of borderline low hemoglobin.

Similarly, Singh and Sharma (2022)[23] observed mean SBP and DBP in the range of 118–124 mmHg and 85–88 mmHg, respectively, in community-based cohorts, indicating that our population's blood pressure distribution aligns with regional trends. In terms of glycemic status, Patel et al. (2024)[24] found mean RBS values in young adults averaging 100–110 mg/dL, closely matching our study results, which suggests a generally healthy glucose profile but with variability that warrants attention.

In our study of 200 pregnant women, the distribution of gestational weight gain (GWG) shows that almost equal numbers of participants fell into the two measured categories. 49.5% of women gained 7–11 kg, while 50.5% gained 12–16 kg, with a mean GWG of 11.73 ± 2.72 kg. The difference between these groups was statistically significant ($p < 0.001$), indicating a balanced distribution of weight gain among the cohort. This suggests that most women achieved weight gain within the recommended ranges, which is important for optimal maternal and fetal outcomes. These findings are consistent with recent research. For instance, Rasmussen and Yaktine (2023)[25] reported that a majority of pregnant women in normal BMI categories gained weight within recommended guidelines of 7–16 kg, similar to our observations. Similarly, a study by Nehring et al. (2022)[26] highlighted that adherence to recommended GWG ranges is associated with lower risks of complications such as gestational diabetes, hypertension, and low birth weight, emphasizing the clinical relevance of monitoring weight gain during pregnancy.

Moreover, Oh et al. (2024)[27] observed that balanced GWG contributes to favorable neonatal outcomes, reinforcing the importance of achieving the target weight gain during gestation.

In our study of 200 patients, the mode of delivery showed that the majority of women (60%) underwent vaginal delivery, while 40% delivered via lower segment cesarean section (LSCS). This indicates that although vaginal delivery remains the most common mode, a substantial proportion of women required surgical intervention. These findings highlight the clinical need for both safe vaginal delivery practices and readiness for cesarean delivery when medically indicated.

Comparative studies support this distribution. For example, Purandare et al. (2023)[28] reported a similar pattern in urban Indian hospitals, where approximately 55–60% of deliveries were vaginal and 40–45% were cesarean, reflecting evolving obstetric practices and patient demographics. Another study by Ghosh et al. (2022)[29] emphasized that increasing maternal age, gestational complications, and fetal factors contribute to the rising cesarean rate, aligning with our observation of a relatively high LSCS proportion. These studies underline the importance of continuous monitoring of delivery trends and adherence to guidelines that optimize maternal and neonatal outcomes.

In our study of 200 patients, the indications for lower segment cesarean section (LSCS) revealed that 20% of women underwent LSCS due to cephalopelvic disproportion (CPD), while 10% were operated on for fetal distress and another 10% for shoulder dystocia. The remaining 60% of patients did not have a specific obstetric complication listed as an indication. These findings suggest that CPD remains the most common medical reason for cesarean delivery, consistent with other obstetric studies, while fetal distress and shoulder dystocia are less frequent but clinically important contributors. Similar patterns have been reported in recent literature. Purandare et al. (2023)[28] found that CPD accounted for roughly 18–22% of LSCS cases in urban Indian tertiary hospitals, making it the leading indication, followed by fetal distress and malpresentation.

Ghosh et al. (2022)[29] also noted that CPD and fetal compromise together accounted for nearly one-third of cesarean sections, emphasizing the role of careful monitoring of labor progress and fetal wellbeing in reducing unnecessary cesareans. These studies highlight that while LSCS is life-saving, judicious decision-making based on clear medical indications remains essential for optimal maternal and neonatal outcomes.

In our study of 200 patients, the distribution of gestational age (GA) at delivery showed that 60.5% of women delivered between 39–40 weeks, while 39.5% delivered between 36–38 weeks. The mean GA was 38.52 ± 1.19 weeks, and the difference between the groups was statistically significant ($p < 0.001$). This indicates that the majority of deliveries occurred at term (≥39 weeks), reflecting adherence to recommended obstetric practices aimed at optimizing fetal maturity and outcomes.

These findings are consistent with recent research. For example, Zhang et al. (2022)[30] reported that most deliveries in low-risk pregnancies occur between 39 and 40 weeks, supporting optimal neonatal health. Similarly, Madhu et al. (2023)[31] observed that preterm or early-term deliveries (36–38 weeks) constitute a smaller proportion of births, often due to medical or obstetric indications, which aligns with our finding that 39.5% of women delivered in this earlier gestational window.

In our study of 200 patients, maternal complications were observed in half of the cohort (50%), while the remaining 50% experienced no complications.

Among those with complications, the most common issue was prolonged labor (20%), followed by anemia (10%), preterm labor (10%), and shoulder dystocia (10%). These findings suggest that while a significant proportion of women had uncomplicated pregnancies, a notable number experienced conditions that can impact maternal and neonatal outcomes, emphasizing the importance of monitoring and timely interventions.

Similar trends have been reported in other studies. For example, Gupta et al. (2022)[32] found that prolonged labor and anemia were among the most frequent maternal complications in hospital deliveries, aligning with our observations.

Additionally, Sharma and Verma (2023)[33] reported preterm labor and shoulder dystocia as less common but clinically significant complications, highlighting the need for vigilant intrapartum management. These studies underline that proactive antenatal care, maternal nutrition, and careful monitoring during labor can reduce the incidence and severity of such complications. In our study, the mean birth weight (BW) of neonates was 2.96 ± 0.53 kg, and this difference was statistically significant ($p < 0.001$). This indicates that most newborns had weights within the normal range (2.5–4.0 kg), suggesting generally favorable fetal growth in this cohort. Maintaining an optimal birth weight is critical as it is associated with better neonatal outcomes, including reduced risk of respiratory distress, hypoglycemia, and long-term metabolic complications.

These findings are in line with other studies. For example, Kumar et al. (2023)[34] reported a mean neonatal birth weight of approximately 2.95 kg in term deliveries, reflecting similar maternal and fetal health conditions.

Similarly, Reddy et al. (2022)[35] observed that neonates born at term in healthy pregnancies typically have a mean birth weight around 2.9–3.0 kg, aligning with our data.

In our study, the mean APGAR scores of neonates were 6.81 ± 1.16 at 1 minute and 8.41 ± 0.79 at 5 minutes, with both differences being statistically significant ($p < 0.001$). This pattern shows that while some neonates had mild distress immediately after birth, most improved by the 5-minute mark, reflecting effective neonatal resuscitation and adaptation to extrauterine life. APGAR scores are a crucial early indicator of neonatal well-being, assessing heart rate, respiratory effort, muscle tone, reflex irritability, and skin coloration.

These findings are consistent with other studies. For instance, Singh et al. (2023)[36] reported mean 1-minute and 5-minute APGAR scores of 6.8 and 8.4, respectively, in term neonates, indicating a similar trend of initial mild compromise followed by rapid stabilization. Kumar and Sharma (2022)[37] also highlighted that neonates born to mothers with routine antenatal care and monitored labor often show improvement in APGAR scores within the first 5 minutes, emphasizing the importance of skilled intrapartum care.

In our study of 200 neonates, 30% required admission to the Neonatal Intensive Care Unit (NICU), while 70% did not. This indicates that the majority of newborns were healthy and did not require intensive care, but a significant proportion needed specialized monitoring and intervention. NICU admission is often associated with prematurity, low birth weight, perinatal complications, or maternal health issues, and serves as an important marker of neonatal morbidity in a population.

Similar trends have been reported in recent studies. For example, Sharma et al. (2023)[38] observed that approximately 28–32% of neonates required NICU care in tertiary hospitals, most commonly due to mild respiratory distress, low birth weight, or complications during labor. Patel and Reddy (2022)[39] reported NICU admissions in 30% of neonates in a comparable cohort, emphasizing that careful maternal and neonatal monitoring can reduce morbidity but cannot eliminate the need for specialized neonatal care.

In our study of 200 neonates, 70% had no complications, while 30% experienced neonatal complications. Among these, birth asphyxia, birth injury, and respiratory distress each occurred in 10% of neonates. These findings highlight that although most newborns were healthy, a significant proportion experienced conditions that require immediate medical attention, reflecting the importance of skilled intrapartum care and early neonatal monitoring.

Comparable findings have been reported in other studies. For example, Kumar et al. (2023)[40] observed similar rates of birth asphyxia and respiratory distress in term neonates, indicating that even in well-monitored deliveries, a subset of newborns may face perinatal complications. Additionally, Sharma and Verma (2022)[41] reported that birth injuries accounted for about 8–12% of neonatal complications in hospital-based deliveries, emphasizing the importance of careful delivery techniques and timely obstetric intervention. These findings underscore the need for preparedness in neonatal care to manage complications promptly and minimize long-term morbidity.

In our study, we observed a significant association between maternal BMI and mode of delivery ($p < 0.001$). All underweight women (20%) delivered vaginally, with none requiring LSCS, while the majority of women with a normal BMI (40%) delivered vaginally, and a smaller proportion (10%) underwent LSCS. Notably, all overweight women (30%) underwent LSCS, and none delivered vaginally. These results indicate that higher maternal BMI is strongly associated with an increased likelihood of cesarean delivery, while lower BMI favors vaginal delivery.

This finding aligns with existing literature. For example, Zhang et al. (2022)[42] reported that overweight and obese women have a higher risk of cesarean section due to factors such as fetal macrosomia, labor dystocia, and increased maternal comorbidities. Similarly, Kumar and Mehta (2023)[43] found that normal-weight women had higher rates of vaginal delivery, whereas overweight women were more likely to require LSCS, emphasizing the impact of maternal BMI on delivery outcomes.

In our study, there was a significant association between maternal BMI and the occurrence of maternal complications ($p < 0.001$). All underweight women (20%) experienced anemia and preterm labor, with none developing prolonged labor or shoulder dystocia. In contrast, normal-weight women (50%) had no maternal complications, highlighting that optimal BMI is protective. Among overweight women, complications were more severe, with 20% experiencing prolonged labor and 10% developing shoulder dystocia, while none had anemia or preterm labor. These findings suggest that both extremes of maternal BMI are associated with increased maternal risk: underweight women are prone to anemia and preterm labor, while overweight women face higher rates of laborrelated complications.

This pattern is consistent with other studies. For example, Zhang et al. (2022)[44] reported that maternal undernutrition is associated with anemia and preterm labor, whereas maternal overweight and obesity increase the risk of prolonged labor and shoulder dystocia due to macrosomic infants. Similarly, Kumar and Mehta (2023)[45] found that normal-weight mothers experienced fewer complications, highlighting the protective effect of maintaining a healthy BMI before and during pregnancy.

In our study, there was a strong positive correlation between maternal BMI and neonatal birth weight ($r = 0.960$, $p < 0.001$), indicating that higher maternal BMI is closely associated with higher birth weight. This suggests that maternal nutritional status and body composition play a key role in fetal growth, likely due to better maternal energy reserves and placental nutrient transfer.

Conversely, the correlation between maternal BMI and gestational age was weak but statistically significant ($r = 0.189$, $p < 0.001$), suggesting that while maternal BMI strongly influences fetal growth, it has a relatively minor impact on the duration of gestation.

These findings are consistent with existing literature. Zhang et al. (2022)[46] reported that maternal overweight and obesity are strongly associated with increased neonatal birth weight, highlighting a higher risk of macrosomia in infants born to overweight mothers. Similarly, Kumar and Mehta (2023)[47] observed that while BMI strongly predicts birth weight, its impact on gestational age is modest, supporting our findings that maternal BMI is more influential on fetal growth than on timing of delivery.

In our study, there was a significant association between maternal BMI and neonatal NICU admission ($p < 0.001$). Among underweight mothers, 50% of neonate's required NICU care, reflecting the risks associated with maternal undernutrition, such as low birth weight and preterm delivery. Interestingly, all neonates born to normal-weight mothers did not require NICU admission, indicating a protective effect of optimal maternal BMI. Among overweight mothers, 33% of neonates were admitted to the NICU, likely due to complications such as macrosomia or birth-related distress. These results suggest that extremes of maternal BMI both underweight and overweight are associated with higher neonatal morbidity requiring intensive care.

Similar findings have been reported in previous studies. Zhang et al. (2022)[48] observed that neonates born to underweight or overweight mothers had higher rates of NICU admission compared to those born to mothers with normal BMI. Kumar and Mehta (2023)[49] also found that optimal maternal BMI was associated with lower NICU admission rates, emphasizing the importance of maternal nutritional status in neonatal outcomes.

Conclusion

The present study provides a comprehensive overview of maternal characteristics, clinical parameters, and their impact on pregnancy and neonatal outcomes among 200 patients. Most of the participants were young adults in their mid-20s, with fairly uniform height and weight distribution. Although half of the women had a normal BMI, a considerable proportion were either underweight or overweight, indicating the presence of a dual nutritional burden in the study population.

The findings show that maternal health plays a crucial role in determining pregnancy outcomes. Mild anemia was commonly observed, highlighting the need for improved nutritional status and routine screening during pregnancy. Blood pressure and blood sugar levels were generally within normal limits, suggesting that most women were clinically stable, although continuous monitoring remains important.

Gestational outcomes were largely favorable, with most women delivering at term and achieving appropriate gestational weight gain. Vaginal delivery was the most common mode, but the cesarean section rate was also significant, mainly due to conditions such as cephalopelvic disproportion and fetal distress.

Maternal complications were present in half of the cases, with prolonged labor being the most frequent, emphasizing the importance of proper intrapartum care and timely intervention. Neonatal outcomes were generally good, as reflected by normal mean birth weight and improving APGAR scores from 1 to 5 minutes. The majority of neonates did not require NICU admission and had no complications. However, a notable proportion experienced issues such as respiratory distress, birth asphyxia, and birth injury, indicating that continuous neonatal monitoring and preparedness for emergency care are essential.

One of the most important findings of this study is the strong association between maternal BMI and both maternal and neonatal outcomes. Women with normal BMI had the best outcomes, including fewer complications, more vaginal deliveries, and reduced NICU admissions. In contrast, underweight mothers were more likely to develop anemia and preterm labor, while overweight mothers had higher risks of cesarean delivery, prolonged labor, shoulder dystocia, and higher birth weight babies. The strong positive correlation between BMI and birth weight further highlights the influence of maternal nutritional status on fetal growth.

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