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Original Article

# Anobservational Study on Impact of Maternal Body Mass Index on Maternal and Neonatal Outcome

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## ABSTRACT

***Background:*** Obesity is a growing health problem worldwide. According to World Health Organization (WHO) obesity is defined as abnormal or excessive fat accumulation that may impair health and body mass index (BMI) of 30kg/$m^2$ ormore as obese among adults. The prevalence of obesity is increasing in pregnancy. Obesity in pregnancy is responsible for several complications affecting the mother and fetus such as hypertensive disorders of pregnancy (HDP), gestational diabetes mellitus (GDM), dysfunctional labour, preterm labour, caesarean sections, postpartum infections and deep vein thrombosis. And the neonatal complications were congenital malformations, large for gestational age, macrosomic, prematurity, had high incidences of birth injuries, shoulder dystocia and late fetal deaths.

***Objectives:*** To evaluate the impact of maternal BMI on maternal outcomes in terms of Percentage of weight gain in pregnancy Hypergycemia in pregnancy Hypertensive disorders of pregnancy Mode of delivery
To evaluate the impact of maternal BMI on fetal outcomes interms of Birth weight APGAR score NICU admission

***Methodology:*** The study was conducted among 100 patients visiting antenatal clinic at Dr. B R Ambedkar medical college and hospital under strict inclusion and exclusion criteria

***Results:*** Majority of the women were in the age category 21-25 years, 53 (53%), followedby26-30 years in 30 (30%). Primigravida 39(39%), followed by second
gravida36 (36%), third gravida in 15 (15%) and multigravida (>3)in 10 (10%)of the patients respectively. The mean gestational age among the pregnant women was 37.5 weeks. Normal vaginal delivery was the most common mode of delivery, observed in 66 cases (66%). The mean maternal height was 1.60±0.08 meters, the mean maternal weight was 61.456 ± 8.66 kg, and the mean maternal BMI was 23.82 ± 2.62 kg/$m^2$.
The majority of participants, 68 cases (68%), were classified under BMI Category II (23–24.9kg/$m^2$), category I (18–22.9kg/$m^2$) included 20 cases (20%),12 cases (12%) fell under Category III (≥ 25 kg/$m^2$), corresponding to the obese group. 49 women (49%), had a maternal weight gain between7–11.5kg, 30 women (30%) gained
11.6–15 kg, of 17 women (17%) had weight gain of more than 15 kg, 4 women (4%) gained less than 7 kg. 19(19%) of the women had gestational diabetes.
28(28%) of the women had hypertensive disorder. The mean birth weight among the neonates was 2.78±0.53 grams. The mean 1 minute Apgar score was 6±1.96 among the neonates. The mean 5 minute Apgar score was 6.94±1.59 among the neonates. 34 (34%) of the neonates required NICU admission. The most common neonatal complication observed was birth asphyxia, affecting 25

neonates (25%).
***Conclusion:*** This study emphasizes that maternal BMI, weight gain impact pregnancy and neonatal outcomes. . Strengthening antenatal education, nutritional support, and delivery preparedness is essential. Multidisciplinary approaches integrating obstetrics, neonatology, dietetics, and endocrinology can pave the way toward safer pregnancies and healthier neonates.



***Keywords:*** *Bronchiolitis, high-flow nasal cannula, non-invasive ventilation, pediatric respiratory distress, PICU stay.*

## INTRODUCTION

Maternal nutritional status is one of the most important determinants of pregnancy outcome, with maternal body mass index (BMI) serving as a simple and reliable indicator of nutritional health. The increasing prevalence of overweight and obesity among women of reproductive age has become a major public health concern worldwide. According to the World Health Organization (WHO), obesity is defined as abnormal or excessive fat accumulation that may impair health, with a BMI of **≥30 kg/m²** in adults. However, for Asian populations, lower BMI cut-offs are recommended because of the increased risk of metabolic disorders at relatively lower BMI values.

Pregnancy is associated with significant physiological, metabolic, and hormonal adaptations that support fetal growth and development. Maternal BMI before and during pregnancy plays a crucial role in influencing these adaptations and has a substantial impact on both maternal and neonatal outcomes. Both underweight and overweight women are at increased risk of adverse obstetric events. Excess maternal weight is associated with insulin resistance, chronic inflammation, endothelial dysfunction, and altered placental function, predisposing pregnant women to complications such as gestational diabetes mellitus (GDM), hypertensive disorders of pregnancy (HDP), preeclampsia, prolonged labour, operative vaginal delivery, caesarean section, postpartum haemorrhage, wound infections, and thromboembolic events.

Maternal obesity also has significant implications for fetal and neonatal health. Infants born to overweight or obese mothers have an increased risk of congenital anomalies, fetal macrosomia, large-for-gestational-age status, birth trauma, shoulder dystocia, preterm birth, neonatal hypoglycaemia, respiratory distress syndrome, low Apgar scores, neonatal intensive care unit (NICU) admission, and perinatal mortality. Conversely, inadequate maternal BMI and poor gestational weight gain are associated with fetal growth restriction, low birth weight, preterm birth, and increased neonatal morbidity.

India is currently experiencing a nutritional transition characterized by the coexistence of undernutrition and increasing rates of overweight and obesity among women of childbearing age. Changes in dietary habits, urbanization, reduced physical activity, and sedentary lifestyles have contributed to this growing burden. Consequently, understanding the relationship between maternal BMI and pregnancy outcomes has become increasingly important for optimizing antenatal care and reducing maternal and neonatal complications.

Body mass index is an inexpensive, non-invasive, and widely accepted screening tool that can be easily incorporated into routine antenatal practice. Early identification of women with abnormal BMI enables healthcare providers to implement appropriate nutritional counselling, weight management strategies, close surveillance for pregnancy-related complications, and individualized obstetric care.

Although several studies have demonstrated an association between maternal BMI and adverse pregnancy outcomes, variations exist across different populations due to differences in ethnicity, socioeconomic status, dietary patterns, and healthcare access. Therefore, evaluating these associations in the local population is essential for developing context-specific preventive and management strategies.

The present prospective observational study was undertaken to evaluate the impact of maternal body mass index on maternal and neonatal outcomes among pregnant women attending the antenatal clinic at Dr. B. R. Ambedkar Medical College and Hospital. The study aims to assess the association between maternal BMI and pregnancy complications, mode of delivery, gestational weight gain, birth weight, Apgar score, and NICU admission, thereby contributing evidence to improve antenatal risk stratification and maternal–fetal healthcare outcomes.

## MATERIALSANDMETHODS

**Source of study:** All pregnant women attending antenatal clinic at the DRBR Ambedkar medical college and hospital during study period.

**Sample size:** 100

**Study design:** Prospective Observational study

**Study place:** Department of OBG, Dr. B R AMBEDKAR MEDICAL COLLEGEANDHOSPITAL.
**Study period:** May2023 to October 2024

**Method of collection of Data**
Written informed consent will be taken from patient for willingness to participate in study and to follow up till delivery.
Demographic data, clinical data collected

All the antenatal mother during the irfirst visit to antenatal clinic, asked appropriate history of present pregnancy, past history, family history, personal history, and general physical examination and BMI calculated.

The women is categorized according other BMI CATEGORY 1 – BMI 18.0–22.9 Kg/m²
CATEGORY 2– BMI23.0–24.9Kg/m²

CATEGORY3– BMI>25 Kg/m²

Women underwent regular ANC investigations including OGCT, Serum TSH. The antenatal women is advised to follow up regularly till delivery.

Under maternal outcome, the variables studied included percentage of weight gain in pregnancy, hyperglycemia in pregnancy, hypertensive disorders of pregnancy, mode of delivery.
Under neonatal outcomes the variables studied included birth weight, APGAR, NICU admission.

**Inclusion criteria:**
Age of 18–35 years. Singleton pregnancy Spontaneous conception

**Exclusion criteria:**
Women with multiplepregnancies

Women with chronic diseases such as hypertension, diabetes Women with previous cesarean section
Women with uterine and fetal congenital anomalies.

**STATISTICAL ANALYSIS:**
**Statistical Methods:**
Data entered in to Microsoft Excel data sheet and analyzed using SPSS22 version software.
Categorical data represented in the form of Frequencies and proportions. Chi-square used as test of significance.
Continuous data represented as mean and standard deviation. Student's t-test the test of significance for quantitative data.

p-value<0.05consideredas statistically significant.

**Sample Size:100**
Sample size of 100 selected, based on the below mentioned formula: P = 41.67%, Q = 100 – 41.67 = 58.33%
L=Absoluteprecisionwas10% Sample size (n) = $Z^2 \times PQ / L^2$
$=(1.96)^2 \times 41.67 \times 58.33/(10)^2$ n = 9337.43 / 100
n =93.37

Samplesizen =Round figure100 cases

**RESULTS**
**Age**
The mean age of the patients was 24.88±3.55 years. Majority of the women were in the age category 21-25 years, 53(53%), followed by 26-30 years in 30(30%) respectively. The results were shown in table 1 and chart 1.

**Table4: Agewise distribution among the study participants**

| Agecategory(Years) | Frequency | Percentage(%) |
|---|---|---|
| 18-20 | 10 | 10 |
| 21-25 | 53 | 53 |
| 26-30 | 30 | 30 |
| >30 | 7 | 7 |

| | | |
|---|---|---|
| Total | 100 | 100 |

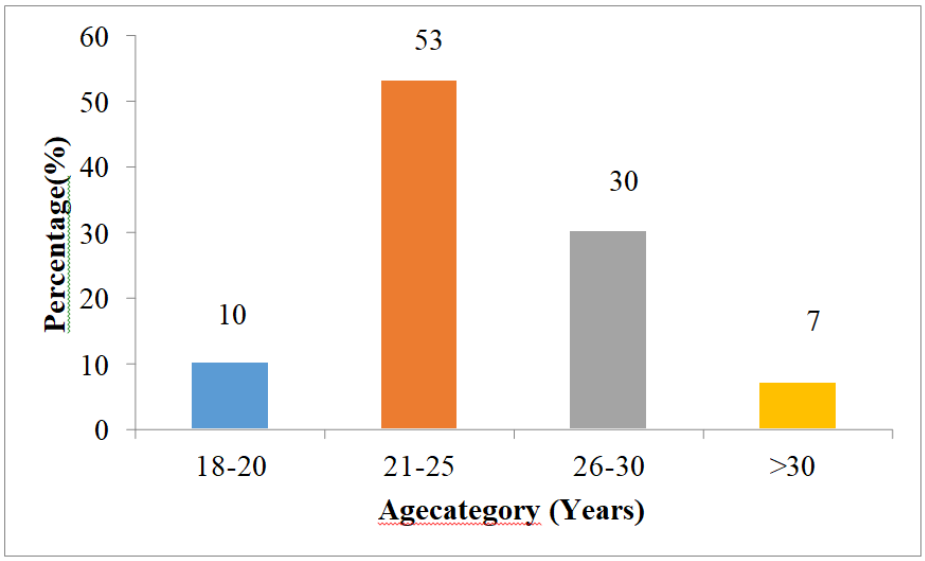


**Fig 1:Age wise distribution among the study participants**

**Gravida**

In this study, the majority of women were primigravida 39(39%), followed by second gravida 36 (36%), third gravida in 15 (15%) and multigravida (>3) in 10 (10%) of the patients respectively. The results were shown in table 2 and chart 2.

**Table5: Distribution of gravida among the study participants**

| Gravida | Frequency | Percentage(%) |
|---|---|---|
| Primigravida | 39 | 39 |
| Secondgravida | 36 | 36 |
| Thirdgravida | 15 | 15 |
| Multigravida(>3) | 10 | 10 |

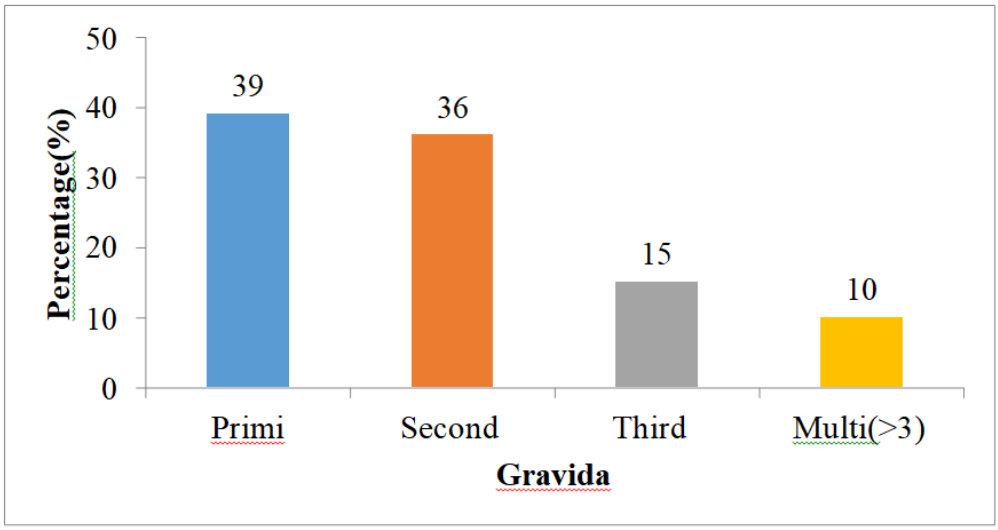


**Fig2:Distribution of gravida among the study participants**

**Gestational Age**

The mean gestational age among the pregnant women was 37.55±2.27 weeks. In the present study, most participants (66%) had a gestational age between 38–40 weeks, indicating that the majority delivered at term. A smaller proportion (18%) had gestational age between 34–37 weeks, corresponding to late preterm deliveries, while 9% delivered before 34 weeks, suggesting earlypretermbirths. Only 7% of pregnancies extended beyond40 weeks, reflecting limited occurrence of post-term deliveries. The results were shown in table 3 and chart 3.

**Table 6: Distribution of gestational age among the study participants**

| Gestational age category (in weeks) | Frequency | Percentage(%) |
|---|---|---|
| <34 | 9 | 9 |
| 34-37 | 18 | 18 |
| 38-40 | 66 | 66 |
| >40 | 7 | 7 |

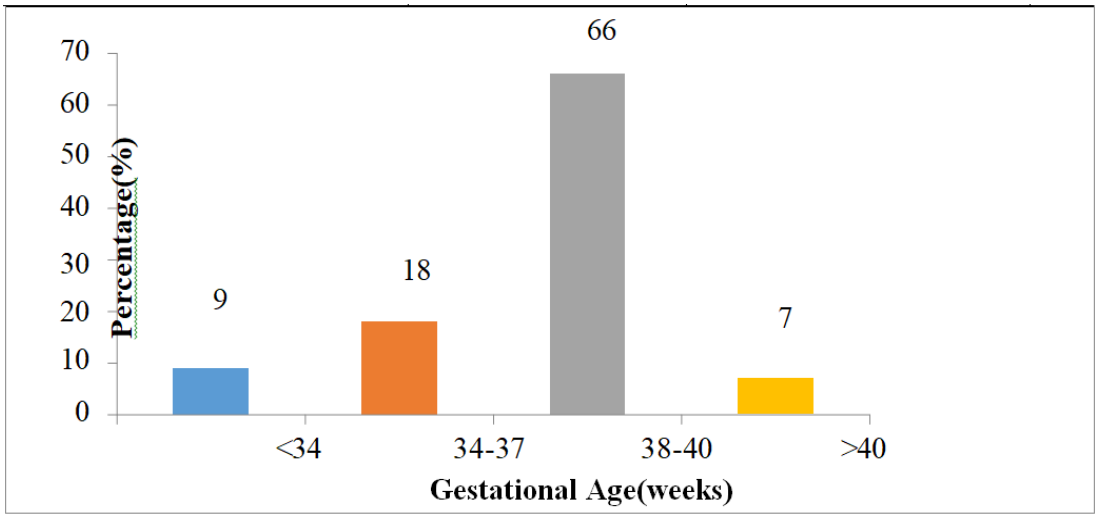


**Fig3: Distribution of gestational age among the study participants**

**Mode of delivery**

In the present study, normal vaginal delivery was the most common mode of delivery, observed in 66 cases (66%), reflecting a predominance of spontaneous deliveries. Instrumental deliveries were note din 16 cases (16%), indicating assistedvaginal births using forceps or vacuum extraction when required. Caesarean sections accounted for 18 cases (18%), representing deliveries necessitating surgical intervention due to maternal or fetal indications.The results were shown in table 4 and chart 4.

**Table7: Mode of delivery among the study participants**

| Modeof Delivery | Frequency | Percentage(%) |
|---|---|---|
| NormalVaginal | 66 | 66 |
| CaesareanSection | 18 | 18 |
| Instrumental | 16 | 16 |

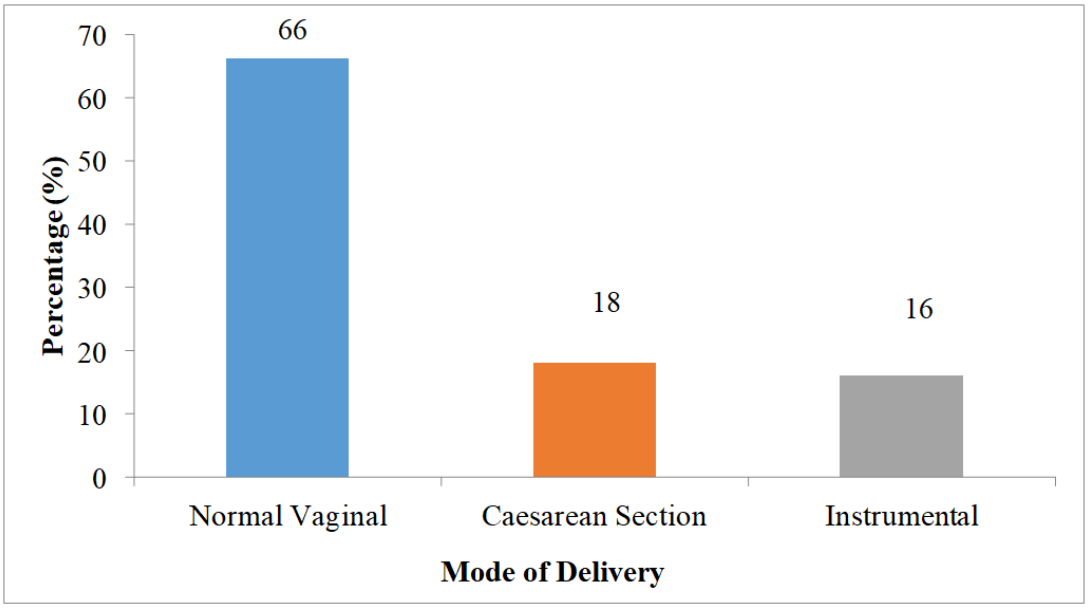


**Fig4:Mode of delivery among the study participants**

**Anthropometric details**

In the present study, the mean maternal height was 1.60 ± 0.08 meters, the mean maternal weight was 61.456 ± 8.66 kg, and the mean maternal BMI was 23.82 ± 2.62 kg/m². The results were shown in table 5.

**Table 8: Anthropometric details of the study population**

| Anthropometric Parameters | Mean | SD |
|---|---|---|
| Maternal Height (meters) | 1.6052 | 0.08 |
| Maternal Weight (inKgs) | 61.456 | 8.66 |
| Maternal BMI ($Kg/m^2$) | 23.829 | 2.62 |

**BMI category**

In the presentstudy, the majority of participants, 68cases (68%),wereclassifiedunder BMICategoryII (23–24.9kg/m²),representingtheoverweight BMIrange. CategoryI (18–22.9 kg/m²) included 20 cases (20%), indicating a smaller proportion of normal weight women. Only 12 cases (12%) fell under Category III (≥ 25 kg/m²), corresponding to the obese group.. The results were shown in table 6 and Chart 5.

**Table 9: BMI category among the study participants**

| BMICategory | BMIrange($Kg/m^2$) | Frequency | Percentage |
|---|---|---|---|
| CategoryI | 18-22.9 | 20 | 20.0 |
| CategoryII | 23-24.9 | 68 | 68.0 |
| CategoryIII | ≥25 | 12 | 12.0 |

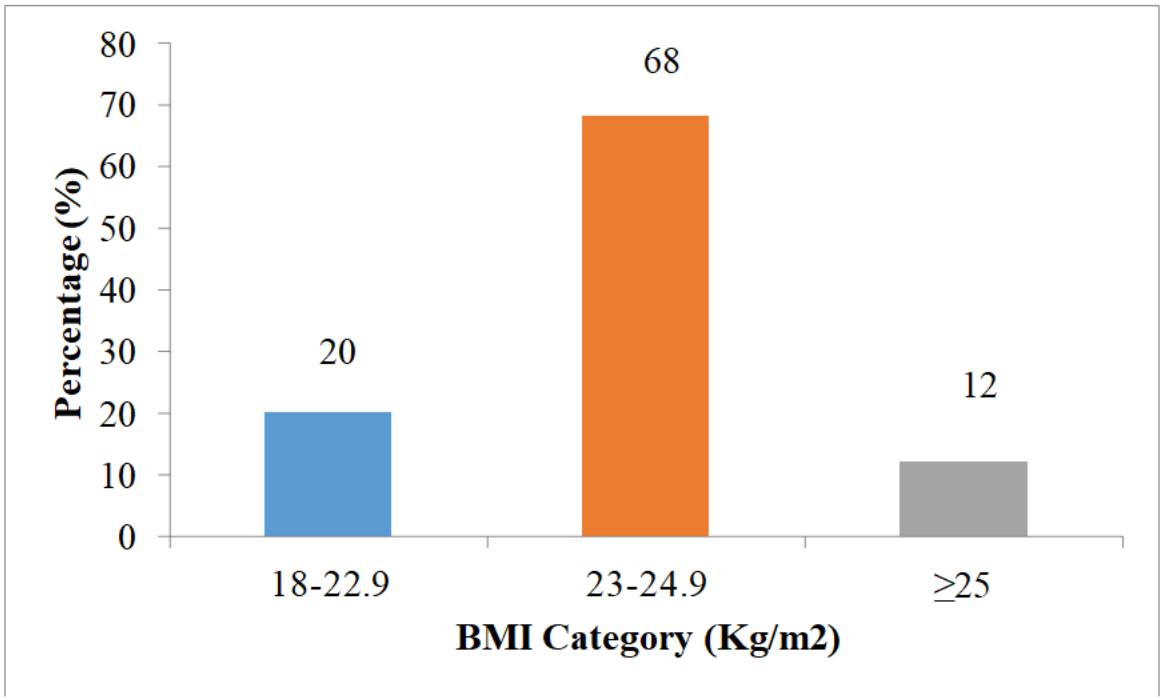


**Fig 5: BMI category among the study participants**

**Percentage weight gain**

In the present study, the majority of participants, 49 women (49%), had a maternal weightgainbetween7–11.5 kg,indicatingadequategestationalgain.30women(30%) gained 11.6–15 kg, reflecting optimal or slightly higher weight gain. A smaller group of 17 women (17%) had weight gain of more than 15 kg, suggesting excessive gain, while only 4 women (4%) gained less than 7 kg, representing inadequate weight gain during pregnancy. The results were shown in table 7 and Chart 6.

**Table10: Percentage weight gain among the study participants**

| Percentageweightgain(Kgs) | Frequency | Percentage(%) |
|---|---|---|
| <7 | 4 | 4 |
| 7-11.5 | 49 | 49 |
| 11.6-15 | 30 | 30 |
| >15 | 17 | 17 |

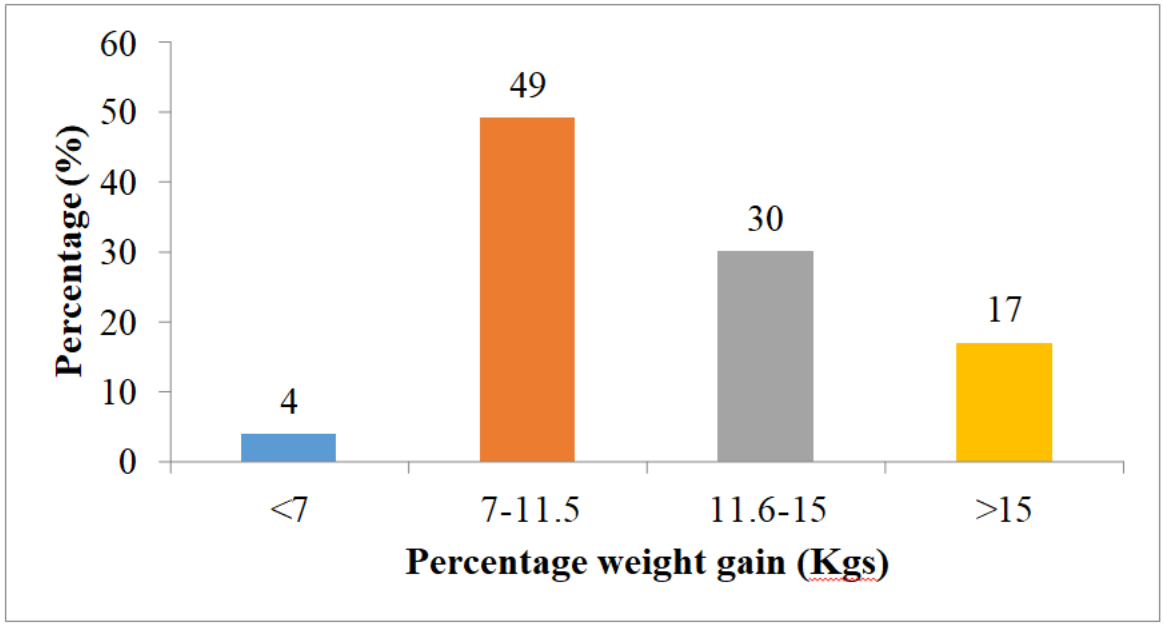


**Fig 6: Percentage weight gain among the study participants**

**Gestational Diabetes**

Inthisstudy,19(19%)of the women had gestational diabetes.The results were shown in table 8 and Chart 7.

**Table11:Incidence of Gestational Diabetes among the study participants**

| Gestational Diabetes | Frequency | Percentage(%) |
|---|---|---|
| Yes | 19 | 19 |
| No | 81 | 81 |

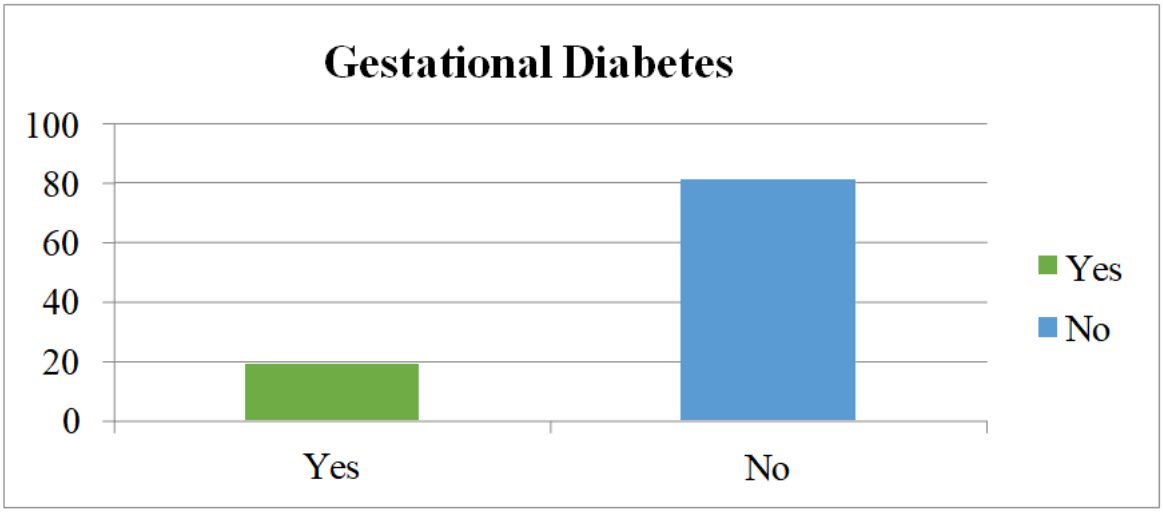


**Fig7: Incidence of Gestational Diabetes among the study participants**

**Hypertensive disorder**

In this study, 28(28%) of the women had hypertensive disorder. The results were shown in table 9 and Chart 8.

**Table12: Incidence of hypertensive disorder among the study participants**

| **Hypertensive disorder** | Frequency | Percentage(%) |
|---|---|---|
| Yes | 28 | 28 |
| No | 72 | 72 |

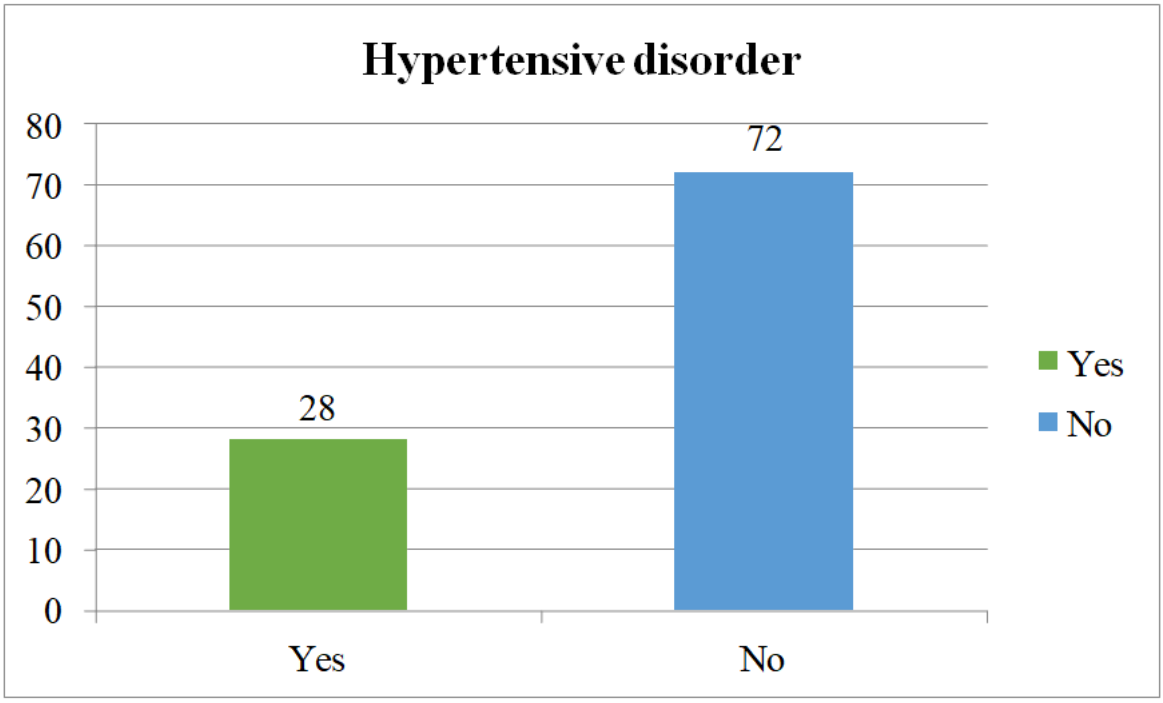


**Fig 8: Incidence of hypertensive disorder among the study participants**

**Neonatal outcome Birth weight**

The mean birth weight among the neonates was 2.78±0.53 grams. Majority of the neonates had birth weight > 3 Kgs in 90(90%), followed by 10 (10%) of the neonates had birth weight between 2.5-3Kgs. The results were shown in table 10 and Chart 9.

**Table13:Birth weight categories among the neonates**

| Birth weight category(Kgs) | Frequency | Percentage(%) |
|---|---|---|
| 2.5-3 | 10 | 10 |
| >3 | 90 | 90 |

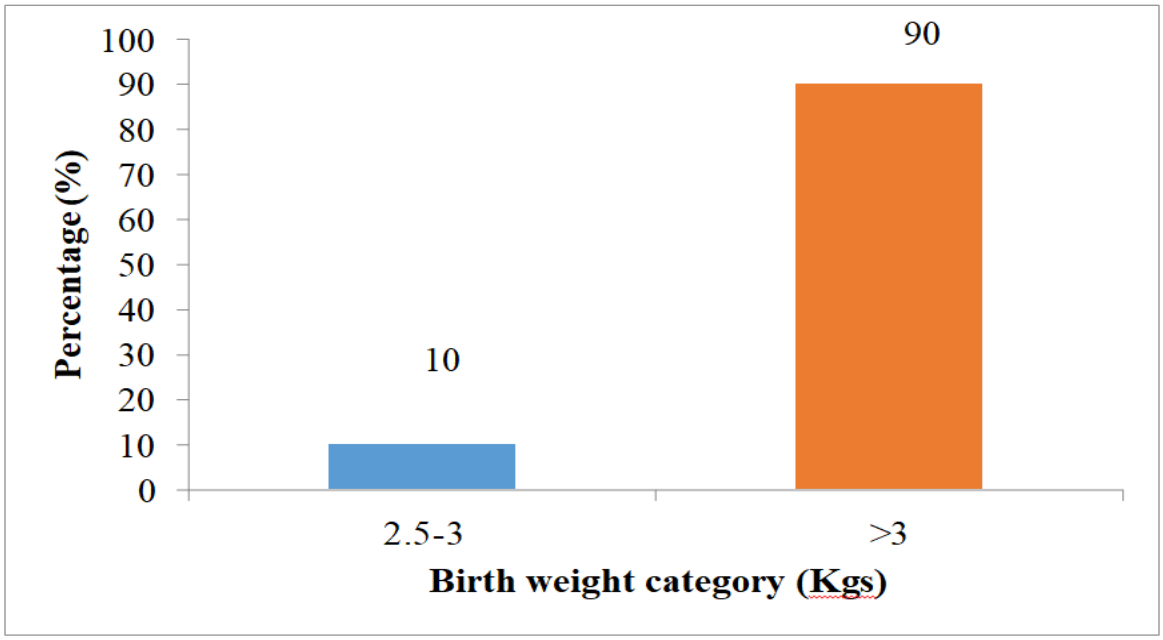


**Fig 9: Birth weight categories among the neonates**

**APGA Rscoresat 1 minute**

The mean 1 minute Apgar score was 6±1.96 among the neonates. Majority of the neonates had APGA Rscores<7,25(25%).The results were shown in Table11and chart 10.

**Table14: APGA Rscoresat 1 minute among the neonates**

| APGARscoresat1 minute | Frequency | Percentage(%) |
|---|---|---|
| <7 | 25 | 25 |
| >7 | 75 | 75 |

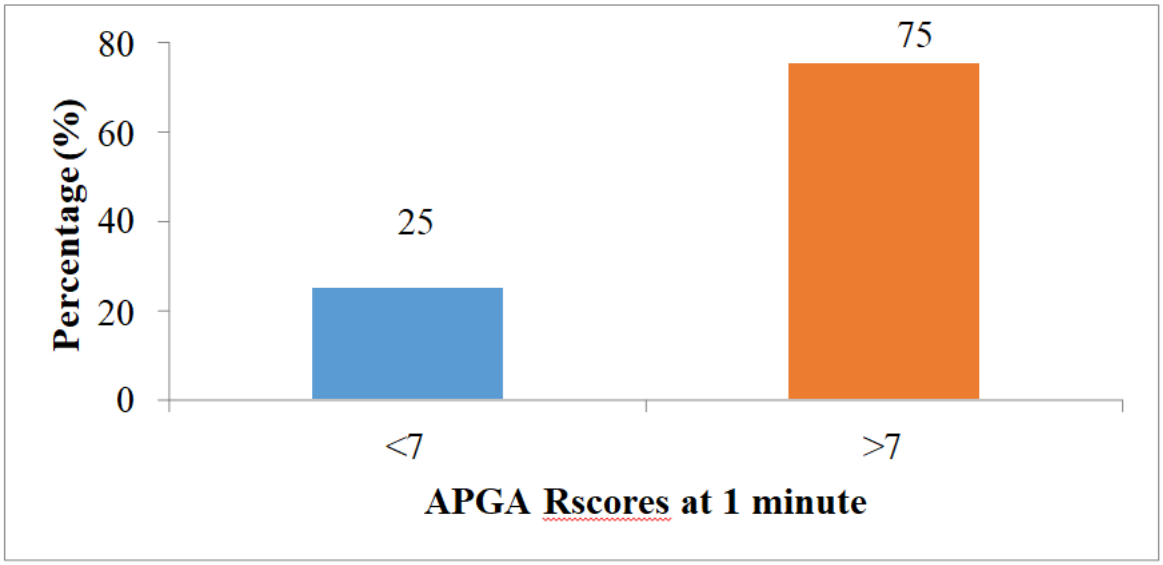


**Fig10: APGA Rscores at 1 minute among the neonates**

**APGAR scores at 5 minute**

The mean 5 minute Apgar score was 6.94±1.59 among the neonates. Majority of the neonates had APGAR scores<7,55(55%). The results were shown in Table 12 and chart 11.

**Table15: APGA Rscores at 5 minute among the neonates**

| APGA Rscores at 5 minute | Frequency | Percentage(%) |
|---|---|---|
| <7 | 55 | 55 |
| <7 | **45** | **45** |

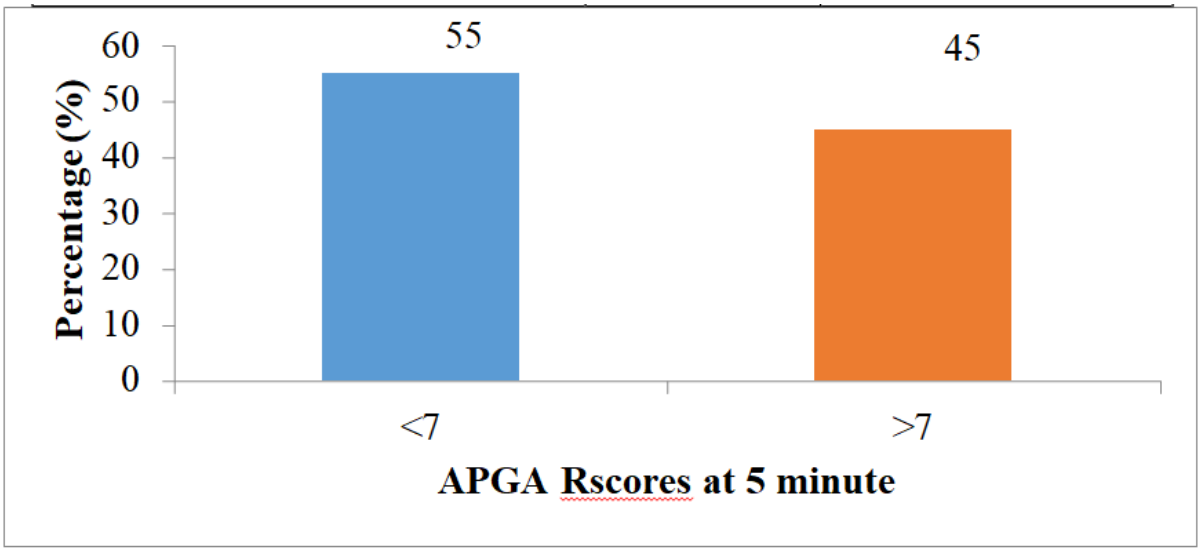


**Fig 11: APGAR scores at 5 minute among the neonates**

**Neonatal Complications**

In the present study, the most common neonatal complication observed was birth asphyxia, affecting 25 neonates (25%).Sepsisandhypoglycemiawereeachreportedin 19 cases (19%), highlightingsignificant early neonatal morbidity. Respiratorydistress wasnotedin11 cases (11%),indicating compromised neonatal respiratory adaptation. Importantly, 26 neonates (26%) had no complications,suggestingafavourableoutcome in about one-fourth of the cohort. The results were shown in table 13 and chart 12.

**Table16: Neonatal complicationsin the present study**

| NeonatalComplications | Frequency | Percentage(%) |
|---|---|---|
| BirthAsphyxia | 25 | 25 |
| Sepsis | 19 | 19 |
| Hypoglycemia | 19 | 19 |
| RespiratoryDistress | 11 | 11 |
| No complications | 26 | 26 |

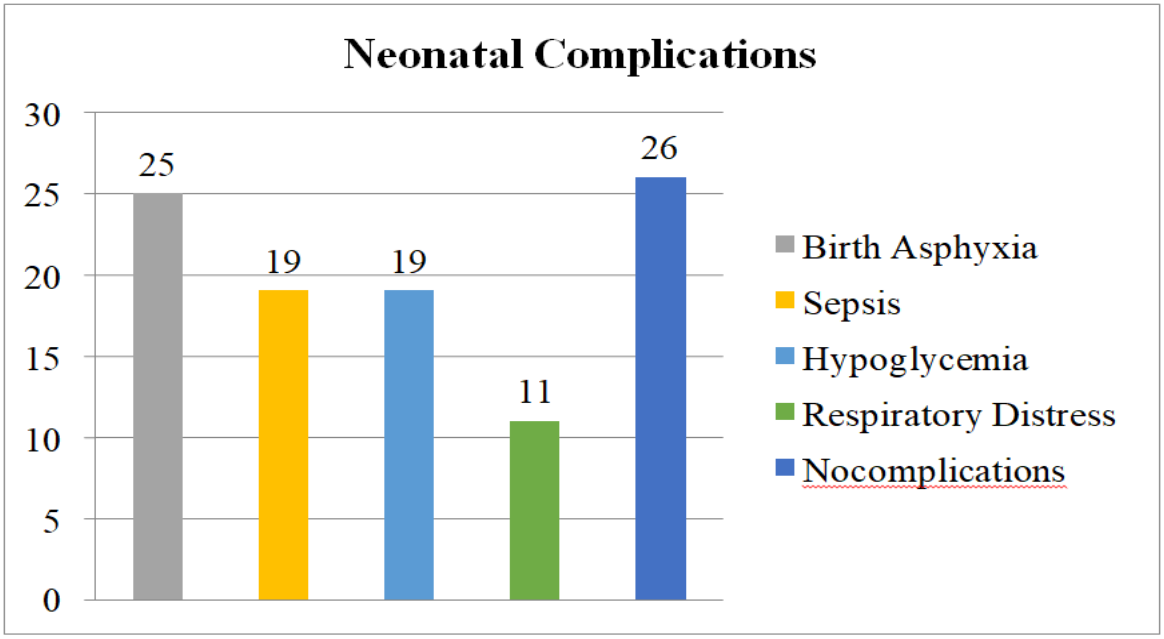


**Fig12: Neonatal complications in the present study**

**NICU Admission**

In this study, 34(34%) of the neonates required NICU admission. The results were shown in table 14 and chart 13.

**Table17: NICU Admission among the neonates**

| NICU Admission | Frequency | Percentage(%) |
|---|---|---|
| Yes | 34 | 25 |
| No | 66 | 19 |

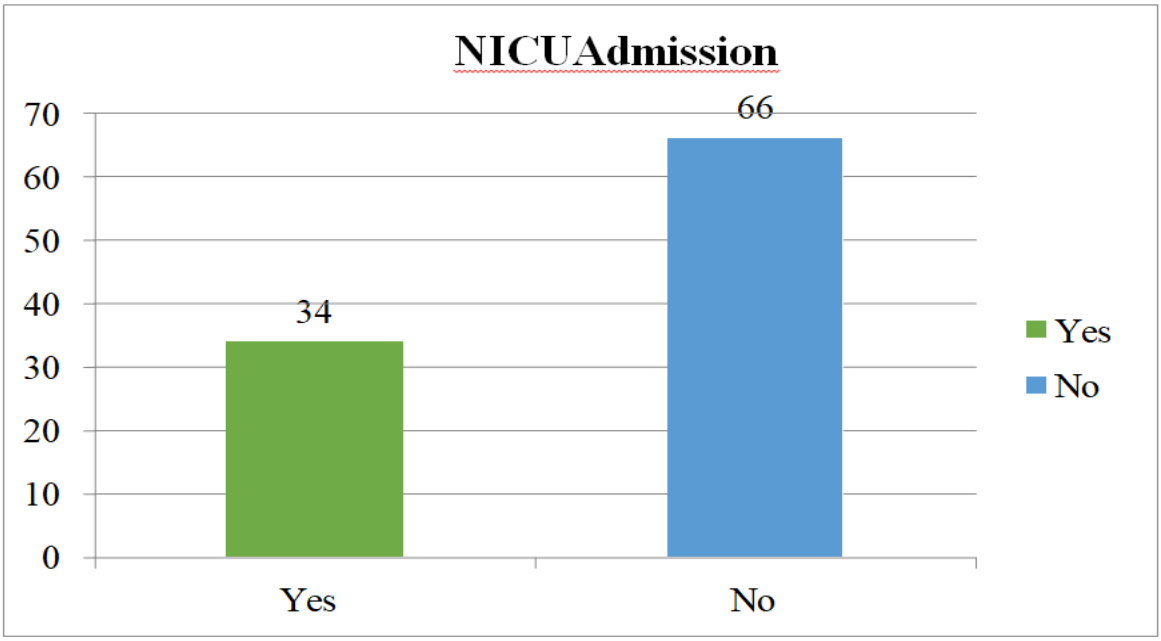


**Fig13: NICU Admission among the neonates**

## SUMMARY

The study involved 100 pregnant women with a mean maternal age of 24.88 ± 3.55 years, the majority (53%) falling in the 21–25 years category. In terms of obstetric history, 39% were primigravida, followed by 36% second gravida. Most participants (66%)delivered after gestational age(38–40weeks),while 9% had preterm delivery before 34 weeks, and only 7% extended beyond 40 weeks.

Normal vaginal delivery was the most common mode of delivery (66%), with 18% undergoing caesarean section and 16% requiring instrumental assistance. The mean maternal height was 1.6052±0.08 meters, weight 61.46±8.66kg, and BMI23.82±2.62 kg/m². Most women (68%) were classified under BMI Category II (23–24.9 kg/m²), suggesting a predominantly normal to high-normal BMI distribution.

Regarding gestational weight gain, 49% of participants gained 7–11.5 kg, indicating adequategain, while 17% had excessive gain(>15kg), and only 4%gained lessthan7 kg. Medical complications included gestational diabetes in 19% and hypertensive disorders in 28% of women.

Among neonatal outcomes, the mean birth weight was 2.78 ± 0.53 kg, with 90% of neonates weighing more than 3 kg. The mean Apgar scores were 6 ± 1.96 at 1 minute and 6.94 ± 1.59 at 5 minutes. Notably, 25% had Apgar <7 at 1 minute, and 55% had Apgar <7 at 5 minutes, indicating delayed neonatal adaptation in a subset.

Common neonatal complications included birth asphyxia (25%), sepsis (19%), hypoglycemia (19%), and respiratory distress(11%), while 26% of neonates had no complications. NICU admission was required in 34% of cases, indicating a considerable burden of immediate postnatal care requirements.

## CONCLUSION

In conclusion, this study emphasizes that maternal BMI, weight gain impact pregnancy and neonatal outcomes. . Strengthening antenatal education, nutritional support, and delivery preparedness is essential. Multidisciplinary approaches integrating obstetrics, neonatology, dietetics, and endocrinology can pave the way toward safer pregnancies and healthier neonates.

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