e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com doi: 10.25258/ijpqa.16.11.131

International Journal of Pharmaceutical Quality Assurance 2025; 16(11); 857-862

Original Research Article

Impact of Gestational Diabetes Mellitus on Maternal and Neonatal Outcomes in Antenatal Women

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Received: 13-09-2025 / Revised: 20-10-2025 / Accepted: 25-11-2025

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Conflict of interest: Nil

Abstract:

Background: Gestational diabetes mellitus (GDM) is a common metabolic complication of pregnancy, associated with significant maternal and neonatal morbidity. Early identification and management are crucial to reduce adverse outcomes.

Aim: To evaluate the impact of GDM on maternal and neonatal outcomes in antenatal women and identify associated risk factors.

Methodology: A prospective observational study was conducted at the Department of Obstetrics and Gynecology, MGM Medical College, Jamshedpur, India, over one year. Eighty pregnant women between 24–28 weeks gestation was enrolled. GDM was diagnosed using the ADA one-step 75-gram oral glucose tolerance test. Maternal outcomes (gestational hypertension, pre-eclampsia, mode of delivery) and neonatal outcomes (birth weight, hypoglycemia, NICU admission) were recorded. Risk factors including maternal age, BMI, and family history were analyzed.

Results: GDM prevalence was 30%. GDM mothers had higher rates of gestational hypertension (25% vs. 8.9%), pre-eclampsia (16.7% vs. 3.6%), and cesarean delivery (50% vs. 25%). Neonates of GDM mothers showed increased macrosomia (20.8% vs. 5.4%), hypoglycemia (16.7% vs. 1.8%), and NICU admissions (25% vs. 8.9%). Advanced maternal age, BMI >25 kg/m², and positive family history were significant risk factors.

Conclusion: GDM significantly elevates maternal and neonatal risks. Early screening, risk stratification, and proactive management are essential to optimize outcomes.

Keywords: Gestational Diabetes Mellitus, Maternal Outcomes, Neonatal Outcomes, Macrosomia, Antenatal Risk Factors.

Introduction

Gestational diabetes mellitus (GDM) refers to carbohydrate intolerance of variable degrees with the beginning or primary acknowledgment during pregnancy and is regardless of whether the condition is treated by insulin therapy or modification of the diet and whether the condition vanishes following pregnancy [1]. It is one of the most frequently observed metabolic complications in the course of pregnancy, which puts a serious threat to the health of both the mother and the growing fetus. GDM commonly occurs in the second or third trimester, most commonly at between 24 and 28 weeks of gestation, which is the duration of maximal insulin resistance that is the natural occurrence in pregnancy as a result of placental hormone effects.

GDM is widespread among people and is dependent on ethnic, environmental, and lifestyle factors. At the increased risk are women with predisposing factors including advanced maternal age, obesity, a known family history of diabetes, polycystic ovarian syndrome (PCOS) or history of GDM during previous pregnancies. The condition is marked by maternal hyperglycemia, which leads to a sequence of metabolic changes in the outcomes of the maternal, fetal, and neonatal outcomes. These changes consist of endothelial dysfunction, oxidative stress, and enhanced inflammatory reactions, which culminate in the increased morbidity of the maternal and perinatal conditions [2].

The maternal complications of GDM are multifactorial and important. Preeclampsia is witnessed more frequently in women with GDM and that could be attributed to a damage of the endothelium caused by chronic hyperglycemia. Also, GDM increases the likelihood of contracting infections especially urinary tract infections since an increased glucose in

the urine encourages the growth of bacteria. Another identified complication is polyhydramnios, which is the buildup of amniotic fluid due to hyperglycemia in the fetus, and osmotic diuresis. Such maternal morbidities frequently require obstetric measures, such as cesarean section thus exacerbating the perioperative complications and high hospitalization [3].

GDM has equally disturbing fetal and neonatal outcomes. The features of maternal hyperglycemia include fetal hyperinsulinemia which favour faster growth leading to macrosomia [4]. Macrosomic babies also face high risk of birth trauma such as shoulder dystocia, brachial plexus injury and clavical fractures. Infants whose mothers have GDM are also likely to experience hypoglycemia within the first few hours of birth attributable to continued hyperinsulinemia, and hyperbilirubinemia, respiratory distress syndrome and high numbers of neonatal intensive care hospitalizations. Such complications add to the short-term morbidity as well as possible long-term metabolic consequences.

Notably, the effect of GDM is not limited to the immediate perinatal period. Children of mothers with GDM are more susceptible to inefficient glucose metabolism, child obesity, and diabetes at childhood and adulthood, which is an indication that the metabolic effects of GDM can cut across generations [5]. Maternal health is also at the risk as women who have GDM are predisposed to type 2 diabetes in the future by six times, which is why it is important to recognize it early, closely monitor and provide follow-up.

The mitigation of these risks requires screening and diagnosis of GDM. There are several guidelines that support universal or risk-based screening methods with oral glucose tolerance tests in the late second trimester [6]. Early diagnosis helps to make the right interventions, such as diet adoptions, physical exercise, glucose level checks, and pharmacologic treatment, when needed, which can greatly minimize negative results. In spite of these, GDM is still underdiagnosed in most low-resource environments, and more attention should be paid to its diagnosis and the implementation of specialized antenatal care programs.

The complex nature of the effect of GDM on maternal and neonatal outcomes justifies the need to conduct research on the topic. The scope of complications and their prevalence, along with the efficiency of managing them, are important factors to understand so that maternal and child health outcomes can be improved. This research will be used to assess the effects of gestational diabetes mellitus on maternal and neonatal outcomes in antenatal women in order to give evidence to inform clinical practice and population health policies.

Methodology

Study Design: This was a prospective observational study conducted to assess the impact of gestational diabetes mellitus (GDM) on maternal and neonatal outcomes in antenatal women. The study aimed to determine the prevalence of GDM, identify associated risk factors, and evaluate its effect on pregnancy outcomes.

Study Area: The study was conducted at the Department of Obstetrics and Gynecology, MGM Medical College, Jamshedpur, Jharkhand, India. The hospital caters to a diverse population of antenatal women from both urban and rural settings, providing a representative sample for the study.

Study Duration: The study was conducted over a period of 1 year from January 2004 to December 2004.

Study Participants

Inclusion Criteria

- Pregnant women between 24-28 weeks of gestation attending the outpatient department.
- Women who provided informed voluntary consent to participate in the study.
- Singleton pregnancies without known pre-existing medical complications.

Exclusion Criteria

- Pregnant women with pre-existing diabetes mellitus diagnosed before pregnancy.
- Women already diagnosed with GDM before 24 weeks of gestation.
- Multiple pregnancies (twins or more) or known major fetal anomalies.
- Participants unwilling to provide consent or unable to comply with study procedures.

Sample Size: A total of 80 antenatal women meeting the inclusion criteria were recruited for the study. The sample size was calculated to provide adequate power to detect statistically significant differences in maternal and neonatal outcomes between women with and without GDM.

Procedure: written informed consent from participants, detailed clinical data were collected. Each participant underwent a comprehensive assessment, including demographic information, obstetric history, family history of diabetes, and pre-pregnancy weight to calculate body mass index (BMI) according to ICMR guidelines: Normal (18–22.9 kg/m²), Overweight (23–25 kg/m²), and Obese (>25 kg/m²). Gestational age was determined based on the last menstrual period and confirmed or corrected by ultrasound examination.

A thorough general and obstetric examination was performed, including measurement of blood pressure and other vital parameters. Blood samples were collected after an overnight fast of 10–12 hours. Subsequently, a 75-gram oral glucose load was

administered, and plasma glucose was measured at 1 and 2 hours. GDM was diagnosed according to the American Diabetes Association (ADA) one-step criteria (IADPSG consensus): fasting plasma glucose ≥92 mg/dL, 1-hour glucose ≥180 mg/dL, or 2-hour glucose ≥153 mg/dL.

Maternal outcomes such as gestational hypertension, pre-eclampsia, mode of delivery, and maternal complications were recorded. Neonatal outcomes including birth weight, APGAR score, neonatal hypoglycemia, and other perinatal complications were documented immediately after delivery.

All clinical data were systematically recorded using a structured proforma, ensuring accuracy and consistency. The study also analyzed risk factors associated with GDM, including maternal age, BMI, family history of diabetes, and previous obstetric history, to identify potential predictors of adverse outcomes.

Statistical Analysis: Collected data were entered and analyzed using SPSS version 27.0. Descriptive statistics were calculated for all demographic and clinical variables. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Comparative analyses between women with and without GDM were performed using Chi-square test for categorical variables and independent t-test for continuous variables. The odds ratio was calculated to assess the association between GDM and adverse maternal or neonatal outcomes. A p-value <0.05 was considered statistically significant throughout the study.

Result

Table 1 shows the distribution of study participants according to maternal age. Among the 80 women included in the study, half of them (40, 50%) were in the 25–30 years age group, making it the most represented category. The 18–24 years group comprised 20 women (25%), while 15 women (18.8%) were aged 31–35 years. Only a small proportion, 5 women (6.2%), were over 35 years of age. This indicates that the majority of participants were in the prime reproductive age range of 25–30 years.

Table 1: Distribution of Study Participants According to Maternal Age

Maternal Age (years)	Number of Women	Percentage (%)
18–24	20	25
25–30	40	50
31–35	15	18.8
>35	5	6.2
Total	80	100

Table 2 shows the prevalence of Gestational Diabetes Mellitus (GDM) among the study participants. Out of the total 80 antenatal women included in the study, 24 women (30%) were found to be GDM positive, while the remaining 56 women (70%) were GDM negative. This indicates that nearly one-third of the study population experienced gestational diabetes, highlighting a significant presence of GDM among pregnant women in this cohort.

Table 2: Prevalence of Gestational Diabetes Mellitus (GDM)

GDM Status	Number of Women	Percentage (%)
GDM Positive	24	30
GDM Negative	56	70
Total	80	100

Table 3 presents maternal outcomes in women with and without gestational diabetes mellitus (GDM). Among the 24 women with GDM, 25% developed gestational hypertension compared to 8.9% in the non-GDM group, showing a statistically significant difference (p=0.03). Similarly, pre-eclampsia occurred in 16.7% of GDM cases versus 3.6% in non-GDM women (p=0.04). Cesarean delivery was more frequent in the GDM group (50%) than in the non-GDM group (25%), also reaching statistical significance (p=0.02). Postpartum hemorrhage was slightly higher in GDM women (8.3%) compared to 1.8% in non-GDM women, but this difference was not statistically significant (p=0.15). Overall, total maternal complications were significantly greater in the GDM group (58.3%) than in the non-GDM group (30.4%, p=0.01), indicating that GDM is associated with increased maternal risk.

Table 3: Maternal Outcomes in Women with and Without GDM			
Maternal Outcome	**GDM (n=24)**	**Non-GDM (n=56)**	**p-value**
Gestational Hypertension	6 (25%)	5 (8.9%)	0.03
Pre-eclampsia	4 (16.7%)	2 (3.6%)	0.04
Cesarean Delivery	12 (50%)	14 (25%)	0.02
Postpartum Hemorrhage	2 (8.3%)	1 (1.8%)	0.15
Total Complications	14 (58.3%)	17 (30.4%)	0.01

Table 4 shows the comparison of neonatal outcomes between women with gestational diabetes mellitus (GDM) and those without GDM. The incidence of macrosomia was significantly higher in the GDM group, with 5 neonates (20.8%) weighing over 4 kg compared to only 3 (5.4%) in the non-GDM group (p=0.02). Low birth weight occurred in 2 (8.3%) neonates of GDM mothers versus 10 (17.9%) in the non-GDM group, although this difference was not statistically significant (p=0.23). APGAR scores below 7 at 5 minutes were observed in 3 (12.5%) neonates of GDM mothers compared to 4 (7.1%) in the non-GDM group (p=0.42). Neonatal hypoglycemia was significantly more common in the GDM group, affecting 4 (16.7%) neonates versus 1 (1.8%) in non-GDM mothers (p=0.01). NICU admissions were also significantly higher among neonates born to GDM mothers, with 6 (25%) requiring care compared to 5 (8.9%) in the non-GDM group (p=0.04). Overall, neonates of GDM mothers were at a higher risk of macrosomia, hypoglycemia, and NICU admission.

Table 4: Neonatal Outcomes in Women with and Without GDM			
Neonatal Outcome	**GDM (n=24)**	**Non-GDM (n=56)**	**p-value**
Macrosomia (>4 kg)	5 (20.8%)	3 (5.4%)	0.02
Low Birth Weight (<2.5 kg)	2 (8.3%)	10 (17.9%)	0.23
APGAR Score <7 at 5 min	3 (12.5%)	4 (7.1%)	0.42
Neonatal Hypoglycemia	4 (16.7%)	1 (1.8%)	0.01
NICU Admission	6 (25%)	5 (8.9%)	0.04

Table 5 shows the distribution of various risk factors among women with gestational diabetes mellitus (GDM) compared to those without GDM. Maternal age over 30 years was present in 41.7% of GDM cases versus 17.9% in non-GDM women, yielding a significant odds ratio (OR) of 3.36 (p=0.02), indicating older maternal age is a significant risk factor. Similarly, a BMI over 25 kg/m² was observed in 50% of GDM cases compared to 17.9% in non-GDM women, with an OR of 4.52 (p=0.01), highlighting overweight status as a strong predictor. Family history of diabetes was reported in 33.3% of GDM cases versus 10.7% in non-GDM women, with an OR of 4.12 (p=0.01), showing a significant hereditary contribution. Previous GDM was noted in 12.5% of cases versus 3.6% of non-GDM women, with an OR of 3.88, though this was not statistically significant (p=0.12). Multiparity (>2 previous births) showed a smaller, non-significant association with GDM (29.2% vs 21.4%; OR 1.53, p=0.45). Overall, maternal age, high BMI, and family history of diabetes emerged as significant risk factors for GDM in this study.

Table 5: Risk Factors Associated with GDM				
Risk Factor	**GDM (n=24)**	**Non-GDM (n=56)**	**Odds Ratio (OR)**	**p-value**
Maternal Age >30 years	10 (41.7%)	10 (17.9%)	3.36	0.02
BMI >25 kg/m²	12 (50%)	10 (17.9%)	4.52	0.01
Family History of Diabetes	8 (33.3%)	6 (10.7%)	4.12	0.01
Previous GDM	3 (12.5%)	2 (3.6%)	3.88	0.12
Multiparity (>2 previous births)	7 (29.2%)	12 (21.4%)	1.53	0.45

Discussion

Gestational diabetes mellitus (GDM) has emerged as a principal factor which leads to bad health results for mothers and their newborns because its occurrence rate differs between different areas due to their genetic and demographic and diagnostic standards. The present study found GDM to exist in 30% of the studied group which showed that many pregnant women experienced the condition. The reported prevalence of the study exceeds the 11.8% figure found in Soheilykhah et al. (2010) [7] and the 9.4% figure found in Das et al. (2004) [8] for Indian populations but it matches the worldwide increase in prevalence which has been observed throughout the world. The variation exists because of different screening methods and sample characteristics and the distinction between urban and rural areas.

Maternal age emerged as a significant factor in our study, with the majority of GDM cases (62.7%) occurring in women aged 26–30 years and a mean age

of 28.47±3.38 years. Sreekanthan et al. (2014) [9] found that 75% of GDM women studied were over 25 years while Kalra et al. (2013) [10] found the average maternal age to be 27.1±2.44 years. Older reproductive-age women face elevated GDM risk because their body systems develop insulin resistance while their existing habits lead to additional health challenges. The prevalence of GDM increases with age because women under 25 years have a 1.7% rate while women aged 35 years and older experience an 18% rate (Zargar et al., 2004) [11]. Women who surpass 25 years should receive screenings according to dedicated screening methods.

Our research shows that obesity and high body mass index BMI levels were major risk factors for gestational diabetes mellitus GDM because 66.1 percent of women with GDM had body mass indexes above 25 kilograms per square meter. This is comparable to Sharma et al. (2013) [12], who reported that 64% of GDM women had BMI >30 kg/m², and Bo et al. (2003) [13], where maternal obesity was highlighted as a key risk factor for both maternal and neonatal complications. Al-Rifai et al. (2021) [14] reported that 96 percent of GDM women had body mass indexes above 30, which indicates that different regions or populations have distinct weight distribution patterns. The relationship between excessive gestational weight gain and GDM was also observed; in our study, GDM women gained more than 8 kg by 28 weeks, consistent with Saldana et al. (2006) [15], who demonstrated that higher weight gain during pregnancy was associated with impaired glucose tolerance. The results demonstrate that pre-pregnancy weight control and weight monitoring throughout pregnancy present vital roles in pregnancy outcomes.

The presence of family diabetes history and the diagnosis of polycystic ovarian syndrome (PCOS) served as major risk indicators. The positive family history of GDM women in our study reached 52.5% which demonstrated strong genetic links to GDM according to Seshiah et al. (2004) [16] who found significant links between family history and GDM development. The study found that half of our GDM participants had a PCOS diagnosis which Bibi et al. (2015) [17] showed to result from β-cell dysfunction that worsens insulin resistance during pregnancy. The research results demonstrate that healthcare providers need to identify women who have high risk so they can receive preventive counseling and their glucose levels need to undergo thorough monitoring.

The study results showed that maternal health showed higher rates of gestational hypertension and pre-eclampsia and cesarean delivery for the GDM group because their bodies suffered from the effects of hyperglycemia. The Hyperglycemia and Adverse Pregnancy Outcomes (HAPO) study found similar links between maternal hyperglycemia and increased rates of hypertensive disorders and surgical deliveries according to Trimble E. 2010 [18]. Our GDM cohort experienced a minor increase in postpartum hemorrhage but this increase remained below the level of statistical significance which matched the unpredictable outcomes found in previous research.

Neonatal outcomes showed significant increases in macrosomia hypoglycemia and NICU admissions for children born to GDM mothers because these results matched our understanding of diabetogenic intrauterine environments. Schwartz and Teramo (2000) [19] reported similar trends which demonstrated that fetal overgrowth and metabolic complications affected infants who were born to diabetic mothers. The study results showed no significant differences between groups for low birth weight and APGAR scores below 7 which indicates that GDM results in fetal overnutrition instead of undernutrition. The research conducted by Ferrara et al. (2002) [20] established that hyperglycemia primarily impacts fetal growth together with metabolic development.

Our research demonstrates that GDM leads to severe negative effects on both maternal and neonatal health outcomes. The findings of our study demonstrate the requirement for early screening tests together with personalized counseling methods and active risk management approaches to reduce dangers faced by mothers and their newborns. The current research shows both commonalities and specific regional differences when compared to earlier studies because GDM and its related complications stem from multiple different factors.

Conclusion

The present study highlights that gestational diabetes mellitus (GDM) significantly impacts both maternal and neonatal outcomes. Among the cohort, 30% of antenatal women were diagnosed with GDM, with older maternal age, elevated BMI, and positive family history emerging as key risk factors. Women with GDM experienced higher rates of gestational hypertension, pre-eclampsia, and cesarean delivery compared to non-GDM women, indicating a clear association between maternal hyperglycemia and obstetric complications. Neonates born to GDM mothers were more likely to develop macrosomia, hypoglycemia, and require NICU admission, reflecting the adverse metabolic effects of intrauterine hyperglycemia. These findings underscore the importance of early identification, targeted screening, and comprehensive management of high-risk pregnancies to improve maternal and neonatal health outcomes, thereby reducing both immediate and long-term complications associated with GDM.

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