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Original Research Article

A Study of Fetomaternal Outcome in Pregnancies Complicated by Gestational Diabetes Mellitus at a Tertiary Care Hospital in Northeast India

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Abstract:

Background: Gestational diabetes mellitus (GDM) is a common metabolic disorder of pregnancy and is associated with significant adverse maternal and neonatal outcomes. With the rising prevalence of GDM in India and limited region-specific data from Northeast India, evaluating fetomaternal outcomes in this population is essential.

Aim and Objectives: To assess and compare maternal and neonatal outcomes in pregnancies complicated by gestational diabetes mellitus with those in normoglycaemic pregnancies, and to evaluate the association between glycaemic control and pregnancy outcomes.

Materials and Methods: This hospital-based observational comparative study was conducted at a tertiary care hospital in Northeast Tezpur, Assam, from August 2021 to July 2024. A total of 120 pregnant women were enrolled, comprising 60 women diagnosed with GDM and 60 normoglycaemic controls. Participants were followed from diagnosis until delivery and the early neonatal period. Maternal demographic characteristics, antenatal complications, mode of delivery, and neonatal outcomes were recorded.

Results: Women with GDM were significantly older and had higher body mass index compared to controls. Gestational hypertension and polyhydramnios were more common in the GDM group. Caesarean section rates were substantially higher among women with GDM. Neonates born to mothers with GDM had significantly higher birth weight, increased incidence of macrosomia, neonatal hypoglycaemia, and higher rates of NICU admission. Poor glycaemic control within the GDM group was significantly associated with increased operative delivery and adverse neonatal outcomes.

Conclusion: Pregnancies complicated by gestational diabetes mellitus are associated with increased risk of adverse fetomaternal outcomes. Effective glycaemic control plays a crucial role in improving maternal and neonatal prognosis. Early screening, timely diagnosis, and appropriate management of GDM are essential to reduce pregnancy-related complications, particularly in high-risk populations.

Keywords: Gestational diabetes mellitus; Fetomaternal outcome; Neonatal outcome; Glycaemic control; Tertiary care hospital.

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Introduction

Gestational diabetes mellitus (GDM) is defined as hyperglycaemia first detected during pregnancy that is not clearly overt diabetes before gestation, reflecting pregnancy-related insulin resistance superimposed on limited β-cell reserve [1,2]. Over the past two decades, the burden of GDM has increased worldwide, driven by rising maternal age, adiposity, urbanisation, and changing lifestyle patterns; significantly, the adoption of newer diagnostic thresholds (e.g., IADPSG/WHO-aligned criteria) also increases the proportion of women labelled as GDM compared with older criteria [3]. In India, recent pooled estimates suggest that GDM affects a substantial proportion of pregnancies, with wide regional variability attributable to differences in population characteristics, screening strategies, and diagnostic criteria [4]. These observations are especially relevant to diverse regions such as Northeast India, where ethnic heterogeneity, access to antenatal care, and referral patterns may influence detection and outcomes.

GDM is clinically important because maternal glycaemia across a broad continuum—well below overt diabetes—has been shown to correlate in a graded manner with adverse pregnancy outcomes. The landmark Hyperglycemia and Adverse

Pregnancy Outcome (HAPO) study demonstrated continuous associations between higher maternal glucose values and increased risk of large-for-gestational-age birth, primary caesarean delivery, neonatal hypoglycaemia, and fetal hyperinsulinaemia, supporting an outcome-based approach to diagnosis [5]. Consistent with these data, the International Association of Diabetes and Pregnancy Study Groups (IADPSG) proposed diagnostic criteria derived from HAPO, later aligned with World Health Organization (WHO) guidance for hyperglycaemia first detected in pregnancy [1,2]. Despite improved standardisation, debate persists regarding optimal screening pathways (one-step vs two-step) and implementation in resource-limited settings; nevertheless, timely diagnosis remains central to preventing avoidable morbidity.

The adverse fetomaternal effects of GDM extend beyond fetal overgrowth and delivery complications. Mothers with GDM have higher risks of hypertensive disorders of pregnancy, operative delivery, and future progression to type 2 diabetes mellitus (T2DM) [6]. Neonates are at increased risk of hypoglycaemia, respiratory distress, birth trauma, and need for neonatal intensive care, with downstream implications for childhood adiposity and metabolic risk [5]. Crucially, interventional evidence indicates that identifying and treating GDM can reduce clinically meaningful perinatal morbidity and fetal overgrowth, supporting systematic screening and structured glycaemic management during pregnancy [7,8].

Given the rising prevalence of GDM in India and the known impact of regional, demographic, and health-system factors on pregnancy outcomes, region-specific evidence is essential. Studies from tertiary care centres can provide valuable insight into referral-linked case mix, real-world management patterns, and outcome profiles, thereby informing locally relevant protocols and counselling. Therefore, the present study aims to evaluate maternal and perinatal outcomes among pregnancies complicated by GDM at a tertiary care hospital in Northeast India, and to generate evidence that may support improved screening, management, and resource planning in similar settings.

Materials and Methods

Study Design and Setting: This hospital-based observational comparative study was conducted in the Department of Obstetrics and Gynaecology at a tertiary care hospital in Tezpur, Assam, Northeast India. The study was carried out over a period of three years from August 2021 to July 2024.

Study Population: A total of 120 pregnant women fulfilling the inclusion criteria were enrolled in the study and divided into two groups:

- **Study group (GDM group):** 60 pregnant women diagnosed with gestational diabetes mellitus
- **Control group:** 60 normoglycaemic pregnant women matched for gestational age

All participants were followed prospectively until delivery and the early neonatal period.

Inclusion Criteria

- Pregnant women aged 18–40 years
- Singleton pregnancy
- Gestational age ≥ 24 weeks
- Women diagnosed with gestational diabetes mellitus based on standard diagnostic criteria (study group)
- Normoglycaemic pregnant women with normal glucose tolerance test (control group)
- Willingness to participate and provide informed consent

Exclusion Criteria

- Pre-existing diabetes mellitus (Type 1 or Type 2)
- Multiple gestation
- Known chronic medical disorders such as chronic hypertension, renal disease, thyroid disorders, or cardiac disease
- Pregnancies complicated by major fetal congenital anomalies
- Women on long-term steroid therapy
- Incomplete antenatal records or loss to follow-up

Diagnostic Criteria for Gestational Diabetes Mellitus: All pregnant women were screened for gestational diabetes mellitus between 24 and 28 weeks of gestation. GDM was diagnosed using a standard oral glucose tolerance test (OGTT) performed according to institutional protocol. Women meeting the diagnostic thresholds for GDM were included in the study group, while those with normal glucose tolerance were enrolled as controls.

Management Protocol: Women diagnosed with gestational diabetes mellitus were managed as per institutional protocol. Initial management included medical nutrition therapy (MNT) and lifestyle modification. Women who failed to achieve adequate glycaemic control with MNT were initiated on oral hypoglycaemic agents (metformin) or insulin therapy, depending on glycaemic profile, gestational age, and clinical judgement. Blood glucose monitoring was performed using fasting and postprandial values. Glycaemic control was categorized as well-controlled or poorly-controlled based on serial antenatal glucose measurements.

Data Collection: Data were collected using a pre-designed and pre-tested structured proforma. The following information was recorded:

Maternal Parameters

- Age
- Gravidity and parity
- Body mass index (BMI)
- Family history of diabetes mellitus
- Gestational age at diagnosis
- Antenatal complications such as gestational hypertension, polyhydramnios, preterm labor, and antepartum hemorrhage
- Mode of delivery (normal vaginal delivery, instrumental delivery, or caesarean section)

Neonatal Parameters

- Birth weight
- Presence of macrosomia
- APGAR score at 5 minutes
- Neonatal hypoglycemia
- Requirement of NICU admission

Outcome Measures

Primary Outcome: Fetomaternal outcome in pregnancies complicated by gestational diabetes mellitus

Secondary Outcomes

- Comparison of maternal and neonatal outcomes between GDM and normoglycaemic pregnancies
- Association between level of glycaemic control and adverse pregnancy outcomes within the GDM group

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequency and percentage. Comparison of continuous variables between groups was done using Student's t-test. Categorical variables were analyzed using the Chi-square test or Fisher's exact test, as appropriate. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 120 pregnant women were included in the study, of whom 60 were diagnosed with gestational diabetes mellitus (GDM), and 60 normoglycaemic women served as controls. All participants were followed from diagnosis until delivery and the early neonatal period.

Maternal Baseline Characteristics: Baseline demographic and clinical characteristics of both groups are summarized in Table 1. Women in the GDM group were significantly older and had higher body mass index than those in the control group. A family history of diabetes mellitus was also considerably more prevalent among women with GDM. Gravidity distribution did not differ significantly between the two groups.

Table 1: Baseline Maternal Characteristics

Variable	GDM Group (n = 60)	Control Group (n = 60)	p-value
Age (years), mean ± SD	28.6 ± 4.2	25.9 ± 3.8	0.001*
BMI (kg/m²), mean ± SD	26.8 ± 3.1	23.7 ± 2.9	<0.001*
Multigravida, n (%)	38 (63.3)	30 (50.0)	0.12
Family history of diabetes, n (%)	24 (40.0)	9 (15.0)	0.002*

Antenatal and Maternal Complications: Maternal complications were more frequent in the GDM group. Gestational hypertension was observed in nearly one-fourth of women with GDM, significantly higher than controls ($p < 0.05$). Polyhydramnios occurred more commonly among GDM pregnancies and was statistically significant. Although preterm labor was more frequent in the GDM group, the difference did not reach statistical significance. Antepartum hemorrhage was uncommon in both groups.

Mode of Delivery: The distribution of the mode of delivery between the two groups is illustrated in Graph 1. Caesarean section was performed significantly more often in women with GDM, while normal vaginal delivery was more common in the control group. The rate of instrumental delivery was comparable between groups.

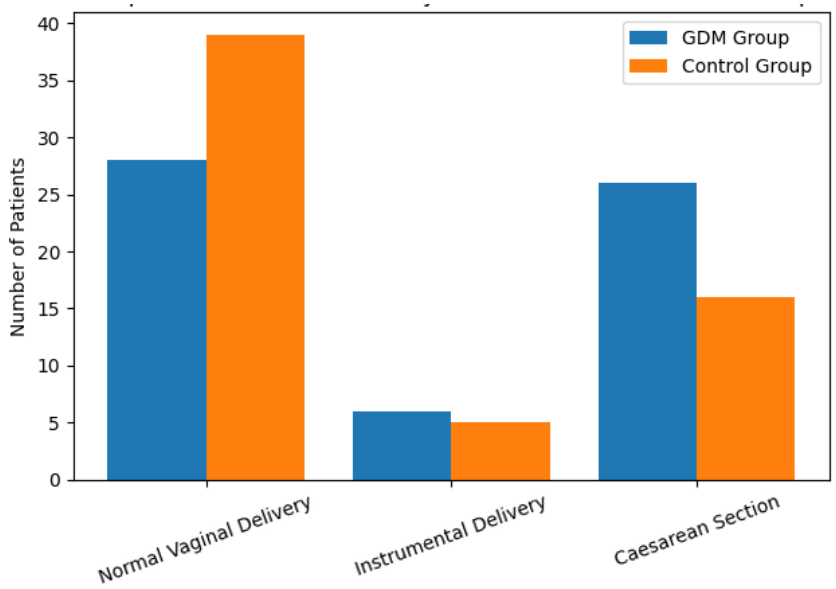

Figure 1: Comparison of Mode of Delivery Between GDM and Control Groups: This bar diagram demonstrates a higher rate of caesarean section among women with gestational diabetes mellitus compared to normoglycaemic controls, while normal vaginal delivery was more common in the control group. Instrumental delivery rates were comparable between the two groups.

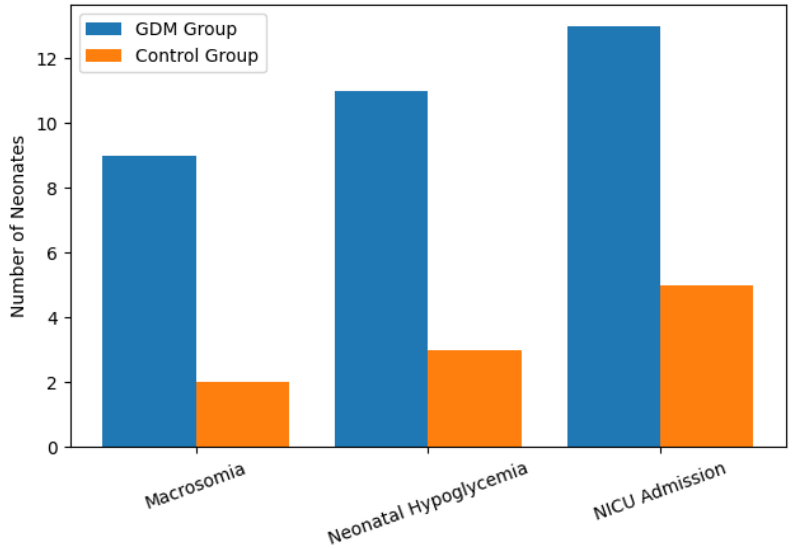

Figure 2. Comparison of Major Neonatal Outcomes Between GDM and Control Groups. Neonates born to mothers with gestational diabetes mellitus showed a higher incidence of macrosomia, neonatal hypoglycaemia, and NICU admission compared to those born to normoglycaemic mothers.

Neonatal Outcomes: Neonatal outcome parameters are presented in Table 2. Mean birth weight was significantly higher among neonates born to mothers with GDM. The incidence of macrosomia, neonatal hypoglycemia, and NICU admission was increased dramatically in the GDM group. Although a low Apgar score at 5 minutes was more frequent among neonates of mothers with GDM, the difference was not statistically significant.

Table 2: Neonatal Outcomes

Outcome	GDM Group (n = 60)	Control Group (n = 60)	p-value
Birth weight (kg), mean ± SD	3.35 ± 0.48	2.89 ± 0.41	<0.001*
Macrosomia (>4 kg), n (%)	9 (15.0)	2 (3.3)	0.03*
Neonatal hypoglycemia, n (%)	11 (18.3)	3 (5.0)	0.02*
NICU admission, n (%)	13 (21.7)	5 (8.3)	0.04*

Association of Glycaemic Control with Pregnancy Outcome: Within the GDM group, women with poor glycaemic control demonstrated a significantly higher incidence of caesarean delivery, neonatal macrosomia, and NICU admission compared to those with well-controlled blood glucose levels. This association highlights the importance of adequate glycaemic control in reducing adverse fetomaternal outcomes. Among women with GDM, glycaemic control was achieved using medical nutrition therapy alone or in combination with metformin or insulin, as per individual requirements.

Table 3: Pregnancy Outcomes Based on Glycaemic Control in GDM

Outcome	Well-controlled (n = 38)	Poorly-controlled (n = 22)	p-value
Caesarean section, n (%)	12 (31.6)	14 (63.6)	0.01*
Macrosomia, n (%)	3 (7.9)	6 (27.3)	0.04*
NICU admission, n (%)	5 (13.2)	8 (36.4)	0.03*

Discussion

Gestational diabetes mellitus (GDM) represents a significant and increasingly prevalent obstetric complication, particularly in South Asian populations, where genetic predisposition and lifestyle factors contribute to heightened insulin resistance during pregnancy. The present study evaluated fetomaternal outcomes in pregnancies complicated by GDM at a tertiary care hospital in Northeast India. It demonstrated a higher burden of adverse maternal and neonatal outcomes compared to normoglycaemic pregnancies.

In the present study, women with GDM were significantly older and had higher body mass index than controls. Advancing maternal age and increased BMI are well-established risk factors for the development of GDM, as both contribute to heightened insulin resistance during pregnancy [10,11]. Similar demographic trends have been reported in large Indian and international studies, underscoring the role of modifiable and non-modifiable risk factors in GDM pathogenesis [4]. The significantly higher prevalence of family history of diabetes among GDM mothers in this study further supports the contribution of genetic susceptibility.

Maternal complications such as gestational hypertension and polyhydramnios were observed more frequently in the GDM group. Hyperglycaemia-induced osmotic diuresis in the fetus, leading to increased amniotic fluid volume, has been proposed as a key mechanism underlying polyhydramnios in GDM pregnancies [12]. The association between GDM and hypertensive disorders of pregnancy has also been consistently reported, possibly due to shared pathophysiological mechanisms such as endothelial dysfunction and chronic inflammation [13].

The present study demonstrated a significantly higher rate of caesarean section among women with GDM. This finding is consistent with previous studies that have reported increased operative delivery rates in GDM pregnancies, mainly attributable to fetal macrosomia, failed induction, and associated obstetric complications [14,15]. Increased clinical vigilance and a lower threshold for operative delivery in GDM cases may also contribute to this observation.

Neonatal outcomes in the present study revealed significantly higher birth weight, increased incidence of macrosomia, neonatal hypoglycaemia, and NICU admission among infants born to mothers with GDM. These findings align with the results of the Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study, which established a continuous relationship between maternal glycaemia and adverse neonatal outcomes, even at glucose levels previously considered normal [5]. Fetal hyperinsulinaemia secondary to maternal hyperglycaemia is a key mechanism leading to increased fat deposition, macrosomia, and postnatal hypoglycaemia [16].

An important observation in this study was the significant association between poor glycaemic control and adverse pregnancy outcomes within the GDM group. Women with poorly controlled GDM had higher rates of caesarean delivery, neonatal macrosomia, and NICU admission. This reinforces evidence from randomized controlled trials demonstrating that effective treatment of GDM through dietary intervention and insulin therapy significantly reduces perinatal morbidity [7,8]. The stepwise management approach using medical nutrition therapy, followed by metformin or insulin when required, aligns with current evidence supporting individualized treatment strategies in GDM. These findings highlight the critical importance of early diagnosis, strict glycaemic monitoring, and timely therapeutic intervention.

Data from Northeast India on GDM-related outcomes are limited. The present study contributes evidence from a tertiary care setting, reflecting real-world referral patterns and management challenges. Given the rising prevalence of GDM in India and its long-term implications for maternal and offspring metabolic health, strengthening antenatal screening and post-partum follow-up is essential, particularly in resource-constrained settings [17].

Conclusion

Gestational diabetes mellitus is a common and clinically significant complication of pregnancy that is associated with increased maternal and neonatal morbidity. The present study demonstrated that pregnancies complicated by GDM had a higher incidence of adverse maternal outcomes, including gestational hypertension and increased operative delivery, as well as unfavorable neonatal outcomes such as macrosomia, neonatal hypoglycemia, and higher NICU admission rates when compared to normoglycaemic pregnancies. Importantly, poor glycaemic control was significantly associated with worse fetomaternal outcomes, underscoring the critical role of early diagnosis, regular antenatal surveillance, and effective glycaemic management. Strengthening universal screening strategies and ensuring optimal management of GDM, particularly in tertiary care settings, can substantially improve pregnancy outcomes and reduce long-term metabolic risk for both mother and child.

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