OPEN ACCESS

Scholars International Journal of Obstetrics and Gynecology

Abbreviated Key Title: Sch Int J Obstet Gynec
ISSN 2616-8235 (Print) |ISSN 2617-3492 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Impact of Gestational Diabetes Mellitus on Delivery Outcomes and Early Neonatal Health

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DOI: https://doi.org/10.36348/sijog.2026.v09i02.004 | **Received:** 24.12.2025 | **Accepted:** 20.02.2026 | **Published:** 26.02.2026

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Abstract

Background: Gestational diabetes mellitus is a common metabolic complication of pregnancy and is associated with significant maternal and neonatal morbidity. The rising prevalence of gestational diabetes, particularly in low- and middle-income countries, poses increasing challenges for obstetric and neonatal care. Maternal hyperglycemia alters intrauterine metabolic conditions, potentially leading to adverse delivery outcomes and early neonatal complications. ***Objective:*** To evaluate the impact of gestational diabetes mellitus on mode of delivery, maternal complications and early neonatal outcomes in a tertiary care hospital setting. ***Methods:*** This prospective observational study was conducted in the Department of Obstetrics and Gynecology, Rangpur Medical College and Hospital, Bangladesh, from January to December 2025. A total of 150 pregnant women were enrolled, including 75 with gestational diabetes mellitus and 75 without gestational diabetes. Maternal socio-demographic characteristics, obstetric outcomes and early neonatal outcomes were recorded. Data were analyzed using descriptive statistics and chi-square tests. ***Results:*** Women with gestational diabetes had higher rates of caesarean section (52.0% vs. 32.0%), pregnancy-induced hypertension (18.7% vs. 8.0%), preterm delivery (21.3% vs. 9.3%) and polyhydramnios (10.7% vs. 2.7%). Neonates born to mothers with gestational diabetes showed increased macrosomia (22.7% vs. 8.0%), neonatal hypoglycemia (18.7% vs. 4.0%) and neonatal intensive care unit admission (24.0% vs. 9.3%). ***Conclusion:*** Gestational diabetes mellitus significantly increases the risk of adverse maternal and early neonatal outcomes. Early detection and comprehensive management strategies are essential to reduce associated morbidity.

Keywords: Gestational diabetes mellitus, maternal outcomes, neonatal outcomes.

INTRODUCTION

Gestational diabetes mellitus is defined as glucose intolerance first recognized during pregnancy and represents one of the most common metabolic disorders complicating gestation [1,2]. The condition arises from a combination of pregnancy-induced insulin resistance and inadequate pancreatic β-cell compensation, resulting in maternal hyperglycemia with potential short- and long-term consequences for both mother and offspring [3]. Recent global estimates indicate that gestational diabetes affects a substantial proportion of pregnancies worldwide, with considerable regional variation depending on diagnostic criteria and population characteristics [4,5].

The prevalence of gestational diabetes has increased steadily over the past decade, largely attributed to rising maternal age, obesity and sedentary lifestyles [4,6]. Data from international diabetes surveillance suggest that the burden is particularly pronounced in low- and middle-income countries, where screening and management practices may be inconsistent [4]. Elevated pre-pregnancy body mass index has been consistently identified as a major modifiable risk factor [7]. Furthermore, family history of diabetes and advanced maternal age significantly increase susceptibility to gestational glucose intolerance [3,6].

Maternal hyperglycemia has been associated with a wide spectrum of adverse pregnancy outcomes. A

comprehensive review by McIntyre *et al.,* highlighted that gestational diabetes increases the risk of hypertensive disorders, operative delivery and preterm birth [3]. Similarly, Ye *et al.,* in a systematic review and meta-analysis, demonstrated a significant association between gestational diabetes and increased caesarean section rates, pre-eclampsia and preterm delivery [8].

Neonatal complications remain a central concern. Hyperglycemia-driven fetal hyperinsulinemia contributes to excessive fetal growth, leading to macrosomia and related delivery complications. Liu *et al.,* reported that gestational diabetes significantly increases the risk of abnormal birth weight and neonatal morbidity [9]. Su *et al.,* in a multicenter longitudinal cohort study, observed higher rates of macrosomia and adverse neonatal outcomes among infants born to mothers with gestational diabetes [10]. In addition, neonatal hypoglycemia, respiratory distress and need for neonatal intensive care admission have been frequently documented [8]. Muche *et al.,* found that gestational diabetes substantially elevated the risk of early neonatal complications in a prospective cohort setting [11].

Beyond immediate perinatal outcomes, gestational diabetes carries long-term implications. Women with a history of gestational diabetes have a markedly increased risk of progressing to type 2 diabetes mellitus later in life [12,13]. Moreover, offspring exposed to intrauterine hyperglycemia may face increased risks of metabolic and cardiovascular disorders in later life [14]. These findings underscore the intergenerational impact of gestational hyperglycemia.

Despite extensive global literature, there remains limited prospective data from Bangladesh evaluating the combined maternal and early neonatal outcomes associated with gestational diabetes within tertiary care settings. Variations in demographic characteristics, healthcare access and management protocols may influence observed outcomes. Therefore, context-specific evidence is essential to guide local clinical practice and resource allocation.

The present study aimed to evaluate the impact of gestational diabetes mellitus on mode of delivery, maternal complications and early neonatal outcomes in a tertiary care hospital in Bangladesh, thereby contributing region-specific data to the existing body of evidence.

MATERIALS & METHODS

This prospective observational study was conducted in the Department of Obstetrics and Gynaecology, Rangpur Medical College and Hospital, Rangpur, Bangladesh, from January to December 2025. A total of 150 pregnant women were enrolled, comprising 75 diagnosed with gestational diabetes mellitus and 75 without gestational diabetes mellitus, who were admitted for delivery and fulfilled the eligibility criteria.

Inclusion criteria:

1. Pregnant women aged 18–40 years.
2. Gestational age ≥28 weeks at admission.
3. Diagnosed cases of gestational diabetes mellitus based on standard oral glucose tolerance test criteria.
4. Women without gestational diabetes serve as the comparison group.

Exclusion criteria:

1. Pre-existing type 1 or type 2 diabetes mellitus.
2. Multiple gestation.
3. Known chronic hypertension or renal disease.
4. Autoimmune or significant systemic illness.
5. Congenital fetal anomalies detected antenatally.

Data Collection Procedure

Eligible participants were identified during antenatal visits and at the time of hospital admission for delivery. The diagnosis of gestational diabetes mellitus was established according to standard oral glucose tolerance test criteria documented in hospital records. After a detailed explanation of the study objectives and procedures, informed consent was obtained from all participants. A structured data collection form was used to record socio-demographic characteristics, obstetric history, booking body mass index, family history of diabetes, antenatal complications and mode of delivery. Maternal clinical data were obtained through direct interview, physical examination and review of antenatal and inpatient records. Neonatal outcomes, including birth weight, Apgar score at 5 minutes, hypoglycemia, respiratory distress, jaundice, need for neonatal intensive care unit admission and early neonatal death, were recorded from delivery registers and neonatal charts. Standard definitions were applied uniformly to ensure consistency. Neonatal hypoglycemia was confirmed by capillary or venous blood glucose measurement as per hospital protocol. Data were analyzed using SPSS version 26.0. Descriptive statistics were presented as frequencies and percentages. The chi-square test or Fisher's exact test was applied for categorical variables. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Baseline Socio-Demographic and Obstetric Characteristics

Variable		GDM (n=75) n (%)	Non-GDM (n=75) n (%)	p-value
Age Group (years)	<25	11 (14.7%)	18 (24.0%)	0.032
	25–29	25 (33.3%)	30 (40.0%)	
	30–34	27 (36.0%)	19 (25.3%)	
	≥35	12 (16.0%)	8 (10.7%)	
Parity	Primigravida	33 (44.0%)	36 (48.0%)	0.611
	Multigravida	42 (56.0%)	39 (52.0%)	
BMI at Booking	Normal (18.5–24.9)	23 (30.7%)	44 (58.7%)	0.001
	Overweight (25–29.9)	31 (41.3%)	21 (28.0%)	
	Obese (≥30)	21 (28.0%)	10 (13.3%)	
Family History of Diabetes		34 (45.3%)	18 (24.0%)	0.006

Table 1 presents the baseline socio-demographic and obstetric characteristics of the study participants. Women with gestational diabetes were more frequently aged 30–34 years (36.0%) and ≥35 years (16.0%) compared to the non-gestational diabetes group, with a statistically significant difference in age distribution (p=0.032). Parity distribution was comparable between groups, with primigravida accounting for 44.0% in the gestational diabetes group and 48.0% in the non-gestational diabetes group (p=0.611). A significantly higher proportion of women with gestational diabetes were overweight (41.3%) or obese (28.0%) at booking compared to controls (p=0.001). Family history of diabetes was more common among women with gestational diabetes (45.3%) than those without (24.0%), showing statistical significance (p=0.006).

Table 2: Mode of Delivery and Maternal Outcomes

Outcome	GDM (n=75) n (%)	Non-GDM (n=75) n (%)	p-value
Mode of Delivery			
Spontaneous Vaginal Delivery	30 (40.0%)	46 (61.3%)	0.01
Assisted Vaginal Delivery	6 (8.0%)	5 (6.7%)	0.753
Caesarean Section	39 (52.0%)	24 (32.0%)	0.015
Maternal Complications			
Pregnancy-Induced Hypertension	14 (18.7%)	6 (8.0%)	0.048
Pre-eclampsia	9 (12.0%)	4 (5.3%)	0.138
Preterm Delivery (<37 weeks)	16 (21.3%)	7 (9.3%)	0.037
Polyhydramnios	8 (10.7%)	2 (2.7%)	0.047
Postpartum Hemorrhage	6 (8.0%)	3 (4.0%)	0.303

Table 2 shows the mode of delivery and maternal outcomes. Spontaneous vaginal delivery was less frequent among women with gestational diabetes (40.0%) compared to the non-gestational diabetes group (61.3%), whereas caesarean section was more common in the gestational diabetes group (52.0% vs. 32.0%), with significant differences (p=0.01 and p=0.015, respectively). The rate of assisted vaginal delivery was similar between groups (p=0.753). Pregnancy-induced hypertension (18.7% vs. 8.0%, p=0.048), preterm delivery (21.3% vs. 9.3%, p=0.037) and polyhydramnios (10.7% vs. 2.7%, p=0.047) were significantly higher in the gestational diabetes group. Pre-eclampsia and postpartum hemorrhage were more frequent in the gestational diabetes group, although these differences were not statistically significant.

Table 3: Neonatal Outcomes (Early Neonatal Period)

Outcome	GDM (n=75) n (%)	Non-GDM (n=75) n (%)	p-value
Birth Weight			0.637
Low Birth Weight (<2.5 kg)	11 (14.7%)	9 (12.0%)	
Normal (2.5–3.9 kg)	47 (62.6%)	60 (80.0%)	
Macrosomia (≥4 kg)	17 (22.7%)	6 (8.0%)	0.015
Apgar Score at 5 min <7	10 (13.3%)	4 (5.3%)	0.089
Neonatal Hypoglycemia	14 (18.7%)	3 (4.0%)	0.004
Respiratory Distress	12 (16.0%)	5 (6.7%)	0.071
NICU Admission	18 (24.0%)	7 (9.3%)	0.016

Outcome	GDM (n=75) n (%)	Non-GDM (n=75) n (%)	p-value
Neonatal Jaundice	16 (21.3%)	8 (10.7%)	0.081
Early Neonatal Death	2 (2.7%)	1 (1.3%)	0.559

Table 3 describes early neonatal outcomes. The overall distribution of birth weight categories was not significantly different between groups (p=0.637); however, macrosomia was significantly more common among neonates born to mothers with gestational diabetes (22.7% vs. 8.0%, p=0.015). Low birth weight rates were comparable. Neonatal hypoglycemia (18.7% vs. 4.0%, p=0.004) and neonatal intensive care unit admission (24.0% vs. 9.3%, p=0.016) were significantly higher in the gestational diabetes group. Although Apgar score <7 at 5 minutes, respiratory distress, neonatal jaundice and early neonatal death were more frequent among neonates of mothers with gestational diabetes, these differences did not reach statistical significance.

DISCUSSION

This study demonstrates that gestational diabetes mellitus is associated with a higher burden of adverse maternal and early neonatal outcomes compared with non-gestational diabetes pregnancies. Women with gestational diabetes in this cohort were more frequently overweight or obese and had a stronger family history of diabetes, reinforcing established risk profiles reported by Yuan *et al.,* and Sweeting *et al.,* who identified maternal adiposity and genetic predisposition as key contributors to gestational glucose intolerance [15]. The observed age distribution, with a higher proportion of women aged 30 years and above in the gestational diabetes group, is consistent with epidemiological trends described by Wang *et al.,* indicating increasing susceptibility with advancing maternal age [4].

Mode of delivery differed significantly between groups, with caesarean section being notably more frequent among women with gestational diabetes. This finding aligns with the systematic review by Ye *et al.,* which reported a consistently elevated caesarean section rate in gestational diabetes pregnancies due to concerns over fetal size and intrapartum complications [8]. Chiu *et al.,* similarly demonstrated increased operative delivery among women with gestational diabetes, even after adjusting for confounding factors [16]. Reduced rates of spontaneous vaginal delivery in the present study likely reflect clinical decision-making influenced by suspected macrosomia and associated obstetric risks.

Maternal complications were more common among women with gestational diabetes, particularly pregnancy-induced hypertension, preterm delivery and polyhydramnios. These findings parallel those of McIntyre *et al.,* who emphasized the shared pathophysiological mechanisms linking hyperglycemia, endothelial dysfunction and hypertensive disorders in pregnancy [3]. The higher rate of preterm delivery observed in this study is consistent with results from Muche *et al.,* who reported increased spontaneous and indicated preterm births in gestational diabetes pregnancies [11,17]. Polyhydramnios, likely driven by fetal hyperglycemia-induced osmotic diuresis, has also been frequently documented in gestational diabetes cohorts.

Regarding neonatal outcomes, macrosomia was significantly more prevalent among neonates born to mothers with gestational diabetes. This observation supports the classical Pedersen hypothesis and is consistent with findings from Su *et al.,* and Karcz and Krolak-Olejnik, who demonstrated a strong association between maternal hyperglycemia and excessive fetal growth [10,18]. Although overall birth weight distribution did not differ significantly, the increased proportion of macrosomic infants underscores the impact of altered intrauterine metabolic environment.

Neonatal hypoglycemia emerged as a prominent complication in the gestational diabetes group. This finding is concordant with reports by Adamkin *et al.,* and Harris *et al.,* who highlighted fetal hyperinsulinemia as a key mechanism underlying postnatal glucose instability in infants of diabetic mothers [19,20]. The higher rate of neonatal intensive care unit admission observed in this study further reflects the increased need for postnatal monitoring and intervention in this population. Similar trends have been reported by Feleke *et al.,* and Gupta *et al.,* emphasizing the clinical and resource implications of gestational diabetes-associated neonatal morbidity [21,22].

Although rates of respiratory distress, low Apgar scores, neonatal jaundice and early neonatal death were higher among neonates of mothers with gestational diabetes, these differences did not reach statistical significance. Nonetheless, the direction of these findings is consistent with meta-analytic evidence by Li *et al.,* and Karkia *et al.,* which demonstrated elevated risks of respiratory morbidity and composite neonatal complications in gestational diabetes pregnancies [23,24]. The lack of statistical significance in the present study may be related to sample size rather than absence of a true association.

Overall, the findings of this study corroborate existing international literature while providing valuable context-specific evidence from a tertiary care setting in Bangladesh. The observed maternal and neonatal risks associated with gestational diabetes highlight the importance of early identification, optimal glycemic control and vigilant peripartum management to mitigate adverse outcomes.

LIMITATIONS AND RECOMMENDATIONS

The single-center design and moderate sample size may limit generalizability. Larger multicenter studies are recommended to validate these findings. Strengthening universal screening and standardized management protocols may reduce gestational diabetes–related adverse outcomes.

CONCLUSION

Gestational diabetes mellitus was associated with increased operative delivery, hypertensive disorders, preterm birth, macrosomia, neonatal hypoglycemia and higher neonatal intensive care admission rates. These findings highlight the substantial maternal and neonatal burden of gestational diabetes and underscore the need for timely diagnosis, effective glycemic management and coordinated peripartum care to improve pregnancy outcomes.

Funding: None.

Conflicts of Interest: There are no conflicts of interest.

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