Impact of Gestational Diabetes on Maternal and Neonatal Outcomes: A Comparative Analysis

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Abstract

Background: Gestational diabetes mellitus (GDM) is the onset or first recognition of hyperglycemia during pregnancy, commonly classified as either diet-controlled (A1GDM) or requiring pharmacological management (A2GDM). GDM is linked to maternal complications such as polyhydramnios, preeclampsia, and preterm labour, as well as foetal complications like macrosomia, neonatal hypoglycaemia, and increased NICU admissions. With the rising global prevalence, understanding GDM's specific risks is essential for improving pregnancy management.

Objectives: This study aimed to assess the impact of GDM on maternal and foetal outcomes compared to a control group of healthy pregnant women.

Methods: A prospective cohort study was conducted from January to September at Basrah city centre hospitals. A total of 100 pregnant women participated, divided into 50 women diagnosed with GDM (case group) based on oral glucose tolerance test (OGTT) results, and 50 healthy controls. Both groups were matched for age, BMI, and parity. Outcomes included maternal (polyhydramnios, preterm delivery, caesarean section) and foetal (macrosomia, NICU admissions, hypoglycaemia, APGAR scores) complications. Statistical significance was set at $p < 0.05$.

Results: The case group had a significantly higher family history of T2DM (52% vs. 28%, $p = 0.014$). GDM was associated with increased rates of polyhydramnios (20% vs. 2%, $p = 0.004$), preterm delivery (20% vs. 6%, $p = 0.037$), and caesarean sections (48% vs. 20%, $p = 0.003$). Foetal complications such as macrosomia (30% vs. 6%, $p = 0.002$), NICU admissions (50% vs. 24%, $p = 0.007$), and neonatal hypoglycaemia (16% vs. 0%, $p = 0.014$) were also more prevalent in the GDM group.

Conclusions: GDM significantly increases the risk of adverse maternal and foetal outcomes. Enhanced monitoring and individualized management for GDM patients are essential to mitigate these risks, particularly among those with a family history of T2DM.

Keywords— Gestational diabetes, maternal outcomes, foetal outcomes, preterm delivery, macrosomia, cesarean section.

INTRODUCTION

The general definition of gestational diabetes mellitus (GDM) is the identification or development of hyperglycemia during pregnancy. It is often categorised into two classes: diet-controlled GDM (class A1GDM) and GDM necessitating pharmacological intervention for hyperglycemia (class A2GDM). [(1)]

The advantages of diagnosing GDM have long been established; several studies have shown that antepartum GDM therapy lowers the likelihood of unfavourable pregnancy outcomes and that women with GDM are at high risk of long-term type 2 diabetes development. [(2)]

It is a prevalent problem during pregnancy. Globally, the International Diabetes Federation has projected that 1 in 6 live newborns received a diagnosis of gestational diabetes mellitus (GDM). [(3)] Approximately 7% of pregnancies in the US were complicated by diabetes of any kind, with GDM accounting for 86% of these instances. [(1)] In Europe, the estimated prevalence of GDM is 10.9%. [(4)]

Maternal complications such preeclampsia, pregnancy-induced hypertension, polyhydramnios, and premature labour are more common in women with gestational diabetes (GDM). In addition, women with GDM are more likely to need caesarean sections because of problems such shoulder dystocia and foetal macrosomia. Furthermore, gestational diabetes

mellitus (GDM) increases the probability of experiencing long-term threats of metabolic syndrome and cardiovascular illnesses. These difficulties underscore the need for meticulous surveillance and postpartum treatment to minimise the risk of unfavourable outcomes. (5)

In addition, women with diabetes exhibiting elevated HBA1c values have around a 22% likelihood of experiencing foetal problems. Congenital deformities are among the major consequences of diabetic embryopathy. Diabetic embryopathy primarily affects the central nervous system and cardiovascular systems, but it can affect any organ. Approximately 8–12% of all pregnancies in individuals with diabetes are linked to abnormalities. (6)

Common central nervous system disorders include neural tube abnormalities, hydrocephalus, and anencephaly, which may result in cognitive impairment. (7) Large vessel transposition, ventricular septum abnormalities, and hypertrophic cardiomyopathy are examples of cardiovascular defects. Although stillbirths are frequent and perinatal mortality is greater, early detection improves outcomes. (8) Additional deformities include craniofacial, auricular, and vertebral defects, along with femoral hypoplasia and renal agenesis. Chronic consequences include an elevated risk of diabetes, metabolic syndrome, polycythaemia, and respiratory distress. Macrosomia may lead to shoulder dystocia, and hypoglycaemia may arise in neonates as a result of maternal hyperinsulinemia. (6)

The medical management of GDM focuses on establishing control over blood glucose levels in GDM patients by testing glucose levels regularly, both at home and using glycosylated haemoglobin. (9) A significant portion of the GDM-impacted population often responds to nutritional management through diet treatment alone; however, the remaining individuals require insulin and dietary modifications. (10) According to recent research, 70%–85% of patients had improved perinatal outcomes when their blood sugar levels were managed with diet and lifestyle changes in GDM patients. (11)

The study aims to assess the maternal and fetal outcomes for women who are diagnosed with GDM.

METHODS

First A prospective cohort study was conducted at Basrah city centre hospitals from January 1st to September 30th. One hundred pregnant women were followed from enrolment through the postpartum period, divided into two groups. Group 1 (cases) included fifty women diagnosed with gestational diabetes mellitus (GDM) by a 75g oral glucose tolerance test (OGTT75). GDM diagnosis was confirmed when a participant's glucose levels met or exceeded any of the following thresholds:

1. ≥ 0.92 g/L (5.1 mmol/L) for fasting blood glucose,
2. ≥ 1.80 g/L (10 mmol/L) at one hour,
3. ≥ 1.53 g/L (8.5 mmol/L) at two hours.

Group 2 (controls) comprised fifty healthy pregnant women without GDM. Both groups were matched for age, BMI, and parity. The participants were recruited during antenatal visits and screened for GDM in the second trimester (24-28 weeks), after which they were classified into exposed (GDM) and non-exposed (control) groups. Both groups were followed up until postpartum.

Eligibility criteria included singleton pregnancy, age between 18 and 54, and confirmed diagnosis of GDM for cases, while healthy pregnancies formed the control group. Exclusion criteria encompassed pre-existing diabetes (Type 1 or Type 2), multiple pregnancies, other chronic diseases (e.g., hypertension, heart disease), and fasting blood glucose ≥ 1.26 g/L or glycosylated hemoglobin (HbA1c) ≥ 6.5% in the first trimester. At enrolment, data collection included:

- **Sociodemographics:** Age, BMI, and parity.
- **Medical History:** Diabetes, hypertension, prior pregnancy complications, and family history of diabetes.

During follow-up to delivery, comprehensive obstetric examinations and vital checks were conducted. Data collected at delivery included:

- **Maternal outcomes:** Gestational age at delivery, mode of delivery, and postpartum complications.

- **Foetal outcomes:** Birth weight (macrosomia), 1- and 5-minute APGAR scores, and neonatal complications, including hypoglycaemia, jaundice, and NICU admissions.

Informed and written consent was obtained from all participants.

RESULTS

The study included 100 women, with 50 women diagnosed with gestational diabetes mellitus (GDM) in the case group and 50 healthy pregnant women in the control group. The mean age of the women was 31.6 years in the case group and 30.8 years in the control group. The mean BMI was 32.7 for the case group and 31.4 for the control group. There was no statistically significant difference between the groups in terms of age, residency, BMI, and parity, as indicated by a p-value greater than 0.05.

However, a family history of type 2 diabetes mellitus (T2DM) was reported by 52% of women in the case group, compared to 28% in the control group. This difference was statistically significant, with a p-value of 0.014, as shown in Table 1.

Table 1: The demographic and clinical characteristics

Variable		Group 1 (no=50)	Group 2 (no =50)	p-value
Age		31.6 ± 1.9	30.8 ± 2.01	0.754
Rural residency		13 (26.0)	10 (20.0)	0.475
BMI		32.7 ± 3.8	31.4 ± 1.9	0.633
Gravida	Primi	11 (22.0)	10 (20.0)	0.810
	1-4	25 (50.0)	23 (46.0)	
	>4	14 (28.0)	17 (34.0)	
Family history of T2DM		26 (52.0)	14 (28.0)	0.014

Table 2 presents the maternal outcomes for the two groups. Statistically significant differences were observed between the groups in terms of polyhydramnios (20% in the GDM group vs. 2% in the control group, p = 0.004), preterm delivery (20% vs. 6%, p = 0.037), and cesarean delivery rates (48% vs. 20%, p = 0.003).

Table 2: The maternal outcome among the participants

Variable		Group 1	Group 2	p-value
Polyhydramnios		10 (20.0)	1 (2.0)	0.004
PE		8 (16.0)	3 (6.0)	0.110
Preterm delivery		10 (20.0)	3 (6.0)	0.037
c-section		24 (48.0)	10 (20.0)	0.003
Postpartum complications	PPH	5 (10.0)	4 (8.0)	0.726
	Infection	4 (8.0)	1 (2.0)	0.169

Table 3 summarizes the foetal outcomes for both groups. Macrosomia was observed in 30% of neonates in the GDM group compared to 6% in the control group, a statistically significant difference (p = 0.002). Similarly, NICU admissions were significantly higher in the GDM group (50% vs. 24%, p = 0.007). Hypoglycaemia occurred in 16% of neonates in the GDM group, while no cases were reported in the control group, which was also statistically significant (p = 0.014).

The incidence of jaundice was similar between groups, while a higher percentage of neonates in the GDM group had a 1-minute APGAR score of <7 (10% vs. 4%), though this difference did not reach statistical significance (p = 0.239).

Table 3: The fetal outcome among the participants

Variable	Group 1	Group 2	p-value
Macrosomia	15 (30.0)	3 (6.0)	0.002
NICU admission	25 (50.0)	12 (24.0)	0.007
Hypoglycemia	8 (16.0)	0 (0.0)	0.014
Jaundice	11 (22.0)	9 (18.0)	0.617
1 min APGAR score <7	5 (10.0)	2 (4.0)	0.239
5 min APGAR score <7	1 (2.0)	0 (0.0)	0.558

DISCUSSION

This study investigated the maternal and foetal outcomes among pregnant women with gestational diabetes mellitus (GDM) compared to healthy pregnant women, focusing on the prevalence of adverse outcomes and risk factors

in each group. The findings reveal a significantly higher prevalence of complications associated with GDM, consistent with the existing literature that suggests gestational diabetes significantly impacts pregnancy outcomes. [13]

The results indicate that women with GDM had a higher rate of polyhydramnios (20% vs. 2%, p = 0.004), preterm delivery (20% vs. 6%, p = 0.037), and caesarean section (48% vs. 20%, p = 0.003) compared to the control group. These findings align with previous studies that report increased risks for polyhydramnios and preterm labour among GDM patients due to hyperglycaemia's effects on foetal size and amniotic fluid levels. [14-16].

Elevated caesarean delivery rates among GDM patients also corroborate the findings by Gascho et al. (2017), who reported increased surgical delivery rates among women with GDM, possibly due to macrosomia and foetal distress. [17]

For foetal outcomes, significant differences were found in the incidence of macrosomia, NICU admissions, and neonatal hypoglycaemia in the GDM group compared to the control. Macrosomia, seen in 30% of GDM cases compared to 6% in the control group, is a common complication in GDM due to excess foetal growth from hyperglycemia. This result is consistent with findings by Kc and colleagues (2017), who report similar risks of foetal overgrowth among GDM patients. [18]

Additionally, NICU admissions were higher in the GDM group (50% vs. 24%, p = 0.007), which supports previous studies suggesting increased neonatal morbidity linked to maternal hyperglycemia. [19, 20] The rate of neonatal hypoglycaemia was also significantly higher in the GDM group (16% vs. 0%), a finding corroborated by Cao et al. (2023), who noted that infants born to mothers with GDM are at heightened risk for hypoglycaemia post-delivery due to insulin level fluctuations. [21]

Although most results are consistent with previous research, some findings were not statistically significant. For example, there was a higher incidence of jaundice and low APGAR scores among neonates in the GDM group, though these differences were not statistically significant, suggesting that these outcomes may be influenced by other variables not accounted for in this study.

This study has some limitations that should be acknowledged. The sample size, though comparable to similar studies, is relatively small and may not capture the full spectrum of complications associated with GDM. Additionally, the study was conducted in a single geographic area, which may limit the generalizability of the results. Variability in treatment regimens for GDM, which was not accounted for, could have impacted maternal and fetal outcomes. Furthermore, other comorbid conditions, such as obesity, that may independently influence adverse outcomes were not stratified in the analysis.

CONCLUSION AND RECOMMENDATIONS

In conclusion, this study highlights the increased maternal and foetal risks associated with GDM, emphasizing the need for early diagnosis, effective glycaemic control, and comprehensive management to minimize adverse outcomes. Women with a family history of type 2 diabetes (T2DM) appear to be at a higher risk of GDM, underscoring the importance of targeted screening in this population. Based on these findings, healthcare providers should prioritize regular monitoring, dietary counselling, and individualized treatment plans for pregnant women diagnosed with GDM. Future research with larger sample sizes and multicentre approaches is recommended to validate these findings and explore other potential risk modifiers for adverse outcomes in GDM.

Conflicts of Interests: None

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Ethical Approval: Ethical approval was obtained from the Institutional Review Board.

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