Original Article

Association of Gestational Diabetes Mellitus with Adverse Maternal and Neonatal Outcomes

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Abstract

Background: Gestational diabetes mellitus (GDM) is a common metabolic complication of pregnancy characterized by glucose intolerance first recognized during gestation. It is associated with an increased risk of adverse maternal and neonatal outcomes, making early diagnosis, appropriate management, and close obstetric monitoring important.

Objective: To evaluate the association between gestational diabetes mellitus and maternal and neonatal outcomes among pregnant women.

Methods: This prospective clinical study included pregnant women diagnosed with GDM during pregnancy and followed until delivery. Maternal outcomes assessed included pregnancy-induced hypertension, preeclampsia, mode of delivery, preterm birth, and postpartum complications. Neonatal outcomes included birth weight, macrosomia, neonatal hypoglycemia, respiratory distress, jaundice, Apgar score, and admission to the neonatal intensive care unit. Maternal and neonatal outcomes were recorded and analyzed to determine the frequency and clinical significance of complications associated with GDM.

Results: Women with GDM demonstrated an increased occurrence of adverse maternal and neonatal outcomes compared with pregnancies without significant glucose intolerance. Maternal complications included hypertensive disorders of pregnancy and increased rates of cesarean delivery. Neonates born to mothers with GDM showed higher frequencies of macrosomia, neonatal hypoglycemia, respiratory complications, and NICU admission. Effective glycemic control and appropriate antenatal surveillance were associated with improved pregnancy outcomes.

Conclusion: Gestational diabetes mellitus is significantly associated with adverse maternal and neonatal outcomes. Timely screening, adequate glycemic control, nutritional counseling, regular fetal assessment, and appropriate obstetric management may reduce pregnancy-related complications and improve maternal and neonatal health.

Keywords: Gestational diabetes mellitus, maternal outcomes, neonatal outcomes, pregnancy, macrosomia, neonatal hypoglycemia, cesarean delivery, pregnancy complications.

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Introduction

Gestational diabetes mellitus (GDM) is one of the most common metabolic disorders complicating pregnancy and is characterized by glucose intolerance or hyperglycemia first recognized during pregnancy. Its clinical importance extends beyond abnormal glucose levels because maternal hyperglycemia can influence pregnancy progression, fetal growth, delivery outcomes, and neonatal adaptation. The World Health Organization emphasizes that diabetes during pregnancy requires intensified monitoring and appropriate treatment to reduce complications affecting both mothers and newborns [1]. The prevalence of GDM has increased internationally, partly because of rising maternal age, obesity, sedentary lifestyles, and increasing rates of metabolic disorders among women of reproductive age. Although the reported prevalence varies considerably according to population characteristics and diagnostic criteria, the condition represents a substantial public-health burden. Differences in screening strategies and diagnostic thresholds can also influence the number of women classified as having GDM and consequently affect reported maternal and neonatal outcomes [2][3]. A systematic review involving millions of pregnancies demonstrated considerable variation in outcomes according to the diagnostic criteria used for GDM [3].

The physiological changes of pregnancy normally produce progressive insulin resistance, particularly during the second and third trimesters. In women who cannot compensate adequately through increased pancreatic β-cell insulin secretion, maternal hyperglycemia develops. Maternal glucose crosses the placenta, whereas maternal insulin does not, resulting in fetal hyperinsulinemia and increased fetal growth. This metabolic pathway provides an important explanation for the association between GDM and excessive fetal growth, macrosomia, and large-for-gestational-age (LGA) infants [4][5].

GDM is associated with several adverse maternal outcomes. Women affected by the condition have increased risks of hypertensive disorders of pregnancy, including gestational hypertension and preeclampsia, and are more likely to undergo cesarean delivery. A large systematic review and meta-analysis of 156 studies involving more than 7.5 million pregnancies found that, after adjustment for relevant confounding factors, GDM was associated with increased odds of cesarean section and preterm delivery [6]. The same analysis reported increased odds of macrosomia and LGA birth, emphasizing that GDM may influence both maternal and fetal outcomes [6]. 3

The neonatal consequences of GDM are particularly important because maternal hyperglycemia can affect fetal growth and metabolic adaptation immediately after birth. Infants born to mothers with GDM may have increased risks of macrosomia, LGA status, neonatal hypoglycemia, respiratory distress syndrome, neonatal jaundice, birth trauma, and admission to a neonatal intensive care unit (NICU) [3][6][7]. Evidence from a meta-analysis of population-based studies showed significantly higher risks of several adverse neonatal outcomes among pregnancies complicated by GDM, including macrosomia, hyperbilirubinemia, respiratory distress, neonatal hypoglycemia, NICU admission, and preterm birth [3]. 2

The timing and severity of GDM may also influence pregnancy outcomes. Earlier diagnosis can identify women with a greater metabolic burden, although the clinical significance of early-onset GDM remains an area of ongoing investigation. A recent systematic review and meta-analysis found that early-onset GDM was associated with higher odds of cesarean delivery, preterm birth, LGA infants, and NICU admission compared with later-onset GDM [8].

Effective management of GDM generally involves dietary modification, physical activity, glucose monitoring, and pharmacological treatment when glycemic targets cannot be achieved through lifestyle measures alone. Appropriate management is intended to reduce excessive fetal growth and other pregnancy complications while maintaining maternal and fetal safety. Recent evidence suggests that conservative lifestyle-based management can improve maternal and neonatal outcomes in appropriately selected women, although treatment decisions should be individualized according to glycemic control and clinical risk [9].

Screening and timely diagnosis are therefore essential components of antenatal care. However, the optimal screening approach continues to be debated. Evidence comparing one-step and two-step screening strategies suggests that the selected diagnostic approach may influence the identification of GDM and subsequent pregnancy outcomes [10]. Importantly, differences in diagnostic thresholds can alter the apparent prevalence of GDM and complicate comparisons between studies and healthcare systems [3][10]. Beyond pregnancy and the immediate neonatal period, GDM is increasingly recognized as an indicator of future maternal metabolic risk. Women with GDM have an elevated likelihood of developing type 2 diabetes and other cardiometabolic disorders later in life. A recent umbrella review synthesizing 27 meta-analyses found convincing or highly suggestive evidence for associations between GDM and several long-term maternal outcomes, including hypertension,

cardiovascular disease, type 2 diabetes, and postpartum metabolic syndrome [11].

Similarly, increasing evidence suggests that offspring exposed to maternal GDM may have metabolic and cardiovascular risks later in life. The intrauterine environment characterized by maternal hyperglycemia, increased fetal insulin concentrations, and altered fetal growth may contribute to long-term susceptibility to obesity and metabolic disease. These observations highlight that the consequences of GDM may extend beyond delivery and represent an important intergenerational health concern [12][13].

Glycemic monitoring is another important component of GDM management. Conventional self-monitoring of blood glucose remains widely used, while continuous glucose monitoring has received increasing attention. Recent evidence indicates that continuous glucose monitoring can improve time spent within the desired glucose range in women with GDM, although its effects on outcomes such as cesarean delivery, LGA, macrosomia, and neonatal hypoglycemia remain uncertain [14].

The relationship between GDM and adverse pregnancy outcomes is consequently multifactorial and may be influenced by maternal age, body mass index, parity, family history of diabetes, ethnicity, diagnostic criteria, treatment modality, and degree of glycemic control. These factors can contribute to heterogeneity among studies and make it important to evaluate outcomes within specific clinical populations [6][15]. Appropriate adjustment for these factors is essential when determining whether GDM independently contributes to adverse maternal and neonatal outcomes.

Current evidence strongly supports the clinical significance of GDM, but the magnitude and pattern of maternal and neonatal complications can differ between populations. Recent comprehensive evidence continues to demonstrate associations between GDM and adverse delivery, maternal, and neonatal outcomes, reinforcing the importance of prevention, screening, monitoring, and individualized treatment [11][16].

Therefore, evaluating maternal and neonatal outcomes among women with GDM is important for identifying the most frequent complications and improving antenatal and perinatal care. The present study was undertaken to assess the maternal and neonatal outcomes associated with GDM, with particular emphasis on hypertensive disorders, mode of delivery, preterm birth, fetal overgrowth, neonatal hypoglycemia, respiratory complications, jaundice, and NICU admission. Such assessment may help clinicians recognize high-risk pregnancies and strengthen strategies

aimed at reducing preventable maternal and neonatal morbidity [17].

Methodology

A **prospective comparative study** was conducted to assess the effect of gestational diabetes mellitus (GDM) on maternal and neonatal outcomes. The study included **200 pregnant women**, comprising 100 women diagnosed with GDM and 100 pregnant women without GDM who served as the comparison group. Participants were recruited from the obstetrics and gynecology department during the study period. Women with singleton pregnancies who attended antenatal care and subsequently delivered at the study hospital were eligible for inclusion. Women with pre-existing type 1 or type 2 diabetes mellitus, multiple pregnancy, major fetal congenital abnormalities, chronic renal disease, or other significant medical disorders that could independently influence pregnancy outcomes were excluded.

GDM was diagnosed according to the glucose tolerance criteria adopted by the study institution. Eligible women underwent routine antenatal assessment, including medical and obstetric history, physical examination, body mass index assessment, blood pressure measurement, and appropriate laboratory investigations. Women diagnosed with GDM received dietary counseling, lifestyle advice, regular blood glucose monitoring, and pharmacological treatment when required to achieve recommended glycemic targets. Maternal participants were followed prospectively until delivery.

Maternal outcomes assessed included **gestational hypertension, preeclampsia, preterm delivery, mode of delivery, and postpartum hemorrhage**. Neonatal outcomes included **birth weight, macrosomia, large-for-gestational-age status, neonatal hypoglycemia, respiratory distress, neonatal jaundice, Apgar score, and neonatal intensive care unit (NICU) admission**. Birth weight was recorded immediately after delivery, and neonatal complications were assessed by the attending pediatric or neonatal team.

Data were collected using a structured data-collection proforma and entered into a statistical database for analysis. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were presented as frequencies and percentages. Differences between the GDM and non-GDM groups were assessed using the independent-samples t-test for continuous variables and the chi-square or Fisher's exact test for categorical variables, as appropriate. A **p-value <0.05** was considered statistically significant. Confidentiality of participant information was maintained throughout the study, and ethical approval and informed consent were obtained before enrollment.

Results

A total of 200 pregnant women were evaluated, including 100 women with gestational diabetes mellitus (GDM) and 100 women without GDM. Maternal characteristics, pregnancy complications, delivery outcomes, and neonatal outcomes were compared between the two groups.

Table 1. Baseline Maternal Characteristics

Characteristics	GDM (n=100)	Non-GDM (n=100)
Mean age (years)	30.8 ± 4.6	28.9 ± 4.3
Age ≥35 years	24 (24.0%)	13 (13.0%)
BMI ≥25 kg/m²	61 (61.0%)	39 (39.0%)
Primigravida	42 (42.0%)	48 (48.0%)
Multigravida	58 (58.0%)	52 (52.0%)
Family history of diabetes	31 (31.0%)	15 (15.0%)
Previous GDM	18 (18.0%)	5 (5.0%)

Women in the GDM group had a higher mean age and a greater frequency of elevated BMI than women in the non-GDM group. A family history of diabetes and previous GDM were also more common among women with GDM.

Table 2. Maternal and Obstetric Outcomes

Outcome	GDM (n=100)	Non-GDM (n=100)
Gestational hypertension	14 (14.0%)	6 (6.0%)
Preeclampsia	10 (10.0%)	4 (4.0%)
Preterm delivery	12 (12.0%)	6 (6.0%)
Cesarean delivery	58 (58.0%)	38 (38.0%)
Vaginal delivery	42 (42.0%)	62 (62.0%)
Postpartum hemorrhage	6 (6.0%)	3 (3.0%)

Maternal complications occurred more frequently among women with GDM. Gestational hypertension and preeclampsia were approximately twice as frequent in the GDM group. Cesarean delivery was also considerably more common among women with GDM compared with women without GDM.

Table 3. Neonatal Outcomes

Neonatal outcome	GDM (n=100)	Non-GDM (n=100)
Mean birth weight (kg)	3.42 ± 0.51	3.12 ± 0.44
Macrosomia (>4 kg)	16 (16.0%)	6 (6.0%)
Large for gestational age	19 (19.0%)	8 (8.0%)
Neonatal hypoglycemia	15 (15.0%)	5 (5.0%)
Respiratory distress	10 (10.0%)	5 (5.0%)
Neonatal jaundice	13 (13.0%)	8 (8.0%)
NICU admission	14 (14.0%)	6 (6.0%)
Apgar score <7 at 5 min	7 (7.0%)	3 (3.0%)

Neonates born to mothers with GDM had a higher mean birth weight and increased frequencies of macrosomia and LGA. Neonatal hypoglycemia was observed in 15% of infants in the GDM group compared with 5% in the non-GDM group. NICU admission and respiratory complications were also more frequent among infants born to mothers with GDM.

Table 4. Overall Comparison of Adverse Maternal and Neonatal Outcomes

Overall outcome	GDM (n=100)	Non-GDM (n=100)
Any maternal complication	31 (31.0%)	15 (15.0%)
Any neonatal complication	35 (35.0%)	17 (17.0%)
Cesarean delivery	58 (58.0%)	38 (38.0%)
Macrosomia/LGA	24 (24.0%)	10 (10.0%)
NICU admission	14 (14.0%)	6 (6.0%)
Composite adverse outcome	42 (42.0%)	22 (22.0%)

Overall, adverse outcomes were substantially more frequent among women with GDM and their newborns. Maternal complications occurred in 31% of the GDM group compared with 15% of the non-GDM group, while neonatal complications occurred in 35% and 17%, respectively. The composite adverse outcome was also higher in the GDM group (42% versus 22%), indicating an overall greater burden of pregnancy-related morbidity among women with GDM.

Note: These are **hypothetical values** intended for manuscript formatting. They should not be presented as actual study findings unless they match your collected data.

Discussion

Gestational diabetes mellitus (GDM) is an important pregnancy-related metabolic disorder that can adversely influence both maternal and neonatal health. The present study evaluated maternal and neonatal outcomes among pregnancies complicated by GDM and demonstrated that affected women were more likely to experience adverse obstetric and neonatal events. These findings are consistent with the growing body of evidence indicating that maternal hyperglycemia is associated with increased pregnancy-related morbidity. A large systematic review and meta-analysis involving more than 7.5 million pregnancies reported significant associations between GDM and several adverse maternal and neonatal outcomes, even after adjustment for potential confounding factors [1]. ([BMJ][1

One of the important maternal outcomes associated with GDM is hypertensive disease, particularly preeclampsia. The metabolic abnormalities underlying GDM, including insulin resistance, hyperinsulinemia, and endothelial dysfunction, may contribute to the development of hypertensive complications during pregnancy. Recent pooled evidence has demonstrated increased odds of hypertensive disorders among women with GDM, supporting the observation that these conditions frequently coexist [2]. ([Central (PMC)][2

The present findings also support an association between GDM and increased cesarean delivery. Excessive fetal growth, suspected macrosomia, obstetric complications, and concerns regarding shoulder dystocia may influence decisions regarding operative delivery. In a large meta-analysis, GDM was associated with an adjusted odds ratio of 1.16 for cesarean delivery in studies where insulin was not used, while broader analyses also demonstrated increased cesarean rates among women with GDM [1]. ([BMJ][3 Therefore, careful fetal growth assessment and appropriate glycemic management may help reduce unnecessary obstetric intervention while maintaining maternal and fetal safety.

Preterm birth is another clinically relevant outcome. Maternal metabolic abnormalities and associated complications such as hypertension and preeclampsia may contribute to medically indicated or spontaneous preterm delivery. Ye et al. reported an adjusted odds ratio of 1.51 for preterm delivery among women with GDM in studies without insulin use [1]. ([BMJ][4 Similarly, a systematic review examining different diagnostic criteria found that preterm birth was consistently more frequent among pregnancies affected by GDM [3]. 5

Among neonatal outcomes, macrosomia and large-for-gestational-age (LGA) birth are particularly important consequences of maternal hyperglycemia. Increased maternal glucose availability results in greater fetal glucose exposure and stimulates fetal insulin secretion, promoting fat deposition and excessive fetal growth. The present findings are consistent with previous evidence demonstrating significantly higher risks of macrosomia and LGA among infants born to mothers with GDM. Ye et al. reported adjusted odds ratios of 1.70 for macrosomia and 1.57 for LGA in studies involving women who did not receive insulin [1]. ([BMJ][4

Neonatal hypoglycemia is another important complication associated with GDM. During pregnancy, persistent maternal hyperglycemia can stimulate fetal pancreatic β-cell activity and produce fetal hyperinsulinemia. After delivery, maternal glucose supply abruptly stops while neonatal insulin concentrations may remain elevated, resulting in hypoglycemia. Evidence indicates that neonatal hypoglycemia is substantially more common among infants born following GDM pregnancies [3]. 5 This finding highlights the importance of early postnatal glucose monitoring, particularly among infants who are LGA or whose mothers had poorly controlled GDM.

The increased requirement for neonatal intensive care observed in association with GDM may reflect the combined effects of prematurity, macrosomia, hypoglycemia, respiratory complications, and other neonatal morbidities. The large BMJ meta-analysis found that infants of women with GDM had increased odds of NICU admission, with an adjusted odds ratio of 2.29 in studies involving insulin-treated populations [1]. ([BMJ][4 More recent evidence likewise demonstrates an association between GDM and NICU admission, emphasizing the importance of antenatal glycemic control and appropriate neonatal preparedness [2]. ([Central (PMC)][2

Importantly, treatment of GDM can modify several adverse outcomes. Evidence synthesized for the US Preventive Services Task Force showed that treatment of GDM was associated

with lower risks of macrosomia, LGA birth, shoulder dystocia, and NICU admission compared with untreated GDM [4]. ([JAMA Network][6 These findings emphasize that identification of GDM should not be viewed simply as a diagnostic exercise; rather, diagnosis should lead to appropriate dietary counseling, physical activity, glucose monitoring, pharmacological therapy when required, and careful fetal and maternal surveillance.

Overall, the findings demonstrate that GDM represents a significant risk factor for adverse maternal and neonatal outcomes. The consistency of the present observations with large systematic reviews supports the importance of universal or risk-based screening according to applicable guidelines, timely diagnosis, and effective glycemic management. Early recognition of women at increased risk may allow clinicians to intensify antenatal surveillance and reduce preventable complications. Nevertheless, the magnitude of risk may vary according to diagnostic criteria, maternal characteristics, treatment modality, and degree of glycemic control. Therefore, individualized management and multidisciplinary obstetric-neonatal care remain essential.

Conclusion

Gestational diabetes mellitus is associated with an increased risk of adverse maternal and neonatal outcomes. Women with GDM demonstrated higher frequencies of hypertensive disorders, cesarean delivery, and preterm birth, while their newborns had greater risks of macrosomia, large-for-gestational-age birth, neonatal hypoglycemia, respiratory complications, and NICU admission. Early screening, timely diagnosis, appropriate glycemic control, nutritional counseling, and close maternal and fetal surveillance are essential to minimize these complications. Effective multidisciplinary management of GDM can contribute substantially to improved pregnancy and neonatal outcomes.

References

1. World Health Organization. (2025). *WHO recommendations on care for women with diabetes during pregnancy*. WHO. ([World Health Organization][1

2. American Diabetes Association Professional Practice Committee. (2026). Management of diabetes in pregnancy. *Diabetes Care*.

3. Ramezani Tehrani, F., Saei Ghare Naz, M., Bidhendi-Yarandi, R., & Behboudi-Gandevani, S. (2022). Effect of different types of diagnostic criteria for gestational diabetes mellitus on adverse neonatal outcomes: A systematic review, meta-analysis, and meta-regression. *Diabetes & Metabolism Journal, 46*(4), 605–619. 2

4. Plows, J. F., Stanley, J. L., Baker, P. N., Reynolds, C. M., & Vickers, M. H. (2018). The pathophysiology of gestational diabetes mellitus.

International Journal of Molecular Sciences, 19(11), 3342.

5. Kampmann, U., Madsen, L. R., Skajaa, G. O., Iversen, D. S., Moeller, N., & Ovesen, P. (2015). Gestational diabetes: A clinical update. *World Journal of Diabetes, 6*(8), 1065–1072.

6. Ye, W., Luo, C., Huang, J., Li, C., Liu, Z., & Liu, F. (2022). Gestational diabetes mellitus and adverse pregnancy outcomes: Systematic review and meta-analysis. *BMJ, 377*, e067946. 3

7. Wendland, E. M., Torloni, M. R., Falavigna, M., Trujillo, J., Dode, M. A., Campos, M. A., et al. (2012). Gestational diabetes and pregnancy outcomes: A systematic review of the World Health Organization. *BMC Pregnancy and Childbirth, 12*, 17.

8. Mei, G., Xia, Y., Gan, J., & Chen, B. (2026). Early-onset versus late-onset gestational diabetes mellitus: A systematic review and meta-analysis of maternal, perinatal and neonatal outcomes. *Diabetes, Obesity and Metabolism, 28*(9), 7849–7863. 4

9. Ikwuanusi, C., et al. (2025). The impact of conservative versus pharmacological management on maternal and neonatal outcomes in gestational diabetes: A systematic review and meta-analysis. *Cureus*. 5

10. One-step vs 2-step gestational diabetes mellitus screening and pregnancy outcomes: An updated systematic review and meta-analysis. (2024). *American Journal of Obstetrics & Gynecology MFM*. 6

11. Kang, J., Kim, H. J., Jo, Y., et al. (2026). Gestational diabetes mellitus and adverse maternal and neonatal health outcomes: An umbrella review of meta-analyses. *Obesity Reviews, 27*(7), e70102. 7

12. Damm, P., Houshmand-Oeregaard, A., Kelstrup, L., Lauenborg, J., Mathiesen, E. R., & Clausen, T. D. (2016). Gestational diabetes mellitus and long-term consequences for mother and offspring. *Diabetes Research and Clinical Practice, 122*, 108–114.

13. Lowe, W. L., Jr., Scholtens, D. M., Kuang, A., Linder, B., Lawrence, J. M., Lebenthal, Y., et al. (2018). Hyperglycemia and adverse pregnancy outcome follow-up study. *Diabetes Care, 41*(8), 1648–1655.

14. Suvarna, R., & Shetty, S. (2026). Effectiveness of continuous glucose monitoring on maternal and neonatal outcomes in gestational diabetes mellitus: A systematic review and meta-analysis. *BMC Pregnancy and Childbirth, 26*, 204. 9

15. Chiefari, E., Arcidiacono, B., Foti, D., & Brunetti, A. (2017). Gestational diabetes mellitus: An updated overview. *Journal of Endocrinological Investigation, 40*, 899–909.

16. Kang, J., et al. (2026). Gestational diabetes mellitus and adverse maternal and neonatal health outcomes: An umbrella review of meta-analyses. *Obesity Reviews, 27*(7), e70102. 10

17. American College of Obstetricians and Gynecologists. (2018). Gestational diabetes

mellitus. *ACOG Practice Bulletin No. 190*.
Obstetrics & Gynecology, 131(2), e49–e64.