Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/fe86wn40

IMPACT OF GESTATIONAL DIABETES ON MATERNAL AND FETAL OUTCOMES IN PAKISTANI WOMEN: A PROSPECTIVE STUDY

Adeela Anwar Rana[1*], Mehwish Kharal[2], Partab Puri[3], Musa Mahboob[4], Inam-u-llah[5], Huma Tahir[6]

[1*]Assistant Professor, Department of Obstetrics and Gynaecology, Sheikh Zayed Medical College and Hospital Rahim Yar Khan, 64200, Pakistan
[2]Department of General Medicine,unit I. Lahore General Hospital,affiliated with Post Graduate Medical Institute,Lahore.
[3]Assistant Professor Department of Community Medicine Muhammad Medical College (Ibn-E-Sina University) Mirpurkhas
[4]Department of Public Health, Guizhou Medical University, China
[5]Department of Food Science and Technology, The University of Haripur
[6]Assistant professor, Community dentistry Avicenna dental college, Lahore

***Corresponding author:** Adeela Anwar Rana
*Assistant Professor, Department of Obstetrics and Gynaecology, Sheikh Zayed Medical College and Hospital Rahim Yar Khan, 64200, Pakistan **Email:** adeelaanwar1155@gmail.com

Abstract

Background: Gestational diabetes mellitus (GDM) is a common metabolic disorder that occurs during pregnancy and is associated with poor outcomes for both the mother and the fetus. Despite the disease's increasing prevalence, there is currently a dearth of prospective data on how GDM affects maternal and infant outcomes in Pakistan.

Objective: To evaluate the impact of GDM on maternal and fetal outcomes in Pakistani women.

Methodology: Using non-probability consecutive sampling, 112 pregnant women between 24 and 28 weeks of gestation were included in this prospective cohort study. To diagnose GDM in accordance with WHO guidelines, participants completed an oral glucose tolerance test (OGTT). The mean ± SD was used to summarize continuous variables, whereas frequencies and percentages were used to summarize categorical variables. Results from GDM and non-GDM groups were compared using logistic regression analysis, the independent t-test, and the chi-square test.

Results: Women with GDM were older, had higher BMI, and more frequently had a family history of diabetes. Cesarean delivery was significantly more common among GDM pregnancies, while other maternal complications, such as preeclampsia and pregnancy-induced hypertension, were more frequent but not statistically significant. Infants of GDM mothers had higher birth weights, with increased rates of macrosomia, neonatal hypoglycemia, and NICU admission.

Conclusion: GDM considerably raises the likelihood of unfavorable outcomes for both mothers and newborns. Improving pregnancy outcomes for Pakistani women requires early GDM screening, monitoring, and treatment.

Keywords: Gestational diabetes mellitus, maternal outcomes, fetal outcomes, Pakistan, prospective study, macrosomia

Introduction

One of the most prevalent metabolic conditions that might complicate pregnancy is gestational diabetes mellitus (GDM), which is characterized by glucose intolerance that initially appears or is diagnosed during pregnancy.(1) The condition presents serious hazards to the mother's and the fetus's health, both in the short and long term. GDM raises a mother's risk of preeclampsia, hypertension during pregnancy, cesarean birth, and type 2 diabetes mellitus in later life.(2) Negative consequences for the fetus include preterm birth, shoulder dystocia, macrosomia, neonatal hypoglycemia, and an increased risk of adult obesity and metabolic syndrome.(3) .

Alongside the rising incidence of type 2 diabetes and obesity worldwide, the prevalence of GDM is also rising. The International Diabetes Federation (IDF) estimates that hyperglycemia affects 14% of pregnancies, with GDM accounting for the majority of these cases.(4) The population, ethnicity, and diagnostic criteria all have a significant impact on the prevalence. Women in South Asian cultures are especially vulnerable because of their lower insulin resistance thresholds, nutritional choices, and genetic predisposition.(5)

GDM is becoming more widely acknowledged as a significant obstetric issue in Pakistan. According to studies, prevalence percentages vary by location and diagnostic technique, ranging from 6% to 19%. Maternal obesity, maternal advanced age, maternal sedentary behaviors, and factors limiting mothers' awareness of prenatal care are all contributing factors.(6,7) Lack of prospective data on maternal and fetal outcomes of GDM in Pakistan limits evidence-based policy development and clinical practices, even though GDM incidence continues to increase.

In South Asian populations, where genetic predisposition, rising obesity rates, and lifestyle changes contribute to its increasing prevalence, gestational diabetes mellitus (GDM) has become a major public health concern.(8-10) Despite the known risks, many pregnancies in Pakistan remain unscreened or poorly managed, leading to ‘preventable maternal and neonatal complications’. Limited prospective data from the region make it challenging to develop targeted interventions or evidence-based clinical guidelines. The majority of existing studies provide limited generalizability and have a retrospective and/or hospital-based design. There is an urgent need for a prospective assessment of maternal and neonatal outcomes of GDM to provide context-specific evidence. The study aimed to conduct a prospective assessment of the consequences of GDM on maternal and fetal outcomes of Pakistani women.

Methodology

This observational cohort study with a prospective design was conducted at Islamabad over a period of six months, from 1st January 2025 to 30th June 2025**.** A total of 112 participants were enrolled, with the sample size calculated using OpenEpi software based on the prevalence of GDM documented in previous Pakistani research. According to a study conducted among pregnant women in Karachi, the prevalence of GDM was reported to be 45%.(11) Using this estimate with a 95% confidence interval, 80% study power, and 5% margin of error, the required sample size was determined to ensure adequate statistical validity.

Pregnant women between the ages of 18 and 45 who were pregnant, had a gestational age of 24 to 28 weeks at the time of recruitment, and gave written, informed consent were all eligible to participate. The exclusion criteria involved those with pre-existing type 1 or type 2 diabetes mellitus, multiple pregnancies, known chronic conditions affecting glucose metabolism, such as renal or hepatic disease, corticosteroid use, or any evidence of significant fetal abnormalities identified on ultrasound before recruitment.

Data was gathered using a standardized proforma. After obtaining informed consent, ‘baseline data were recorded, including age, parity, body mass index, socioeconomic status, family history of diabetes, and obstetric history’. After an overnight fast, all recruited patients conducted a 75-gram oral glucose tolerance test (OGTT) between weeks 24 and 28 of pregnancy. The WHO criteria were used to diagnose GDM. (12) According to hospital guidelines, women with GDM were treated with insulin treatment or dietary changes. Pregnancy-induced hypertension, preeclampsia, delivery method, and postpartum problems were among the maternal outcomes evaluated. Maternal age at

delivery, birth weight, low birth weight, macrosomia, newborn hypoglycemia, Apgar scores, NICU admission, and perinatal mortality were among the fetal and neonatal outcomes.
All of the data was entered and analyzed using SPSS version 26. Continuous data, such as maternal age and birth weight, were summarized as mean ± standard deviation, whereas categorical factors, such as the presence of GDM, the delivery mode, and issues with infants, were expressed as frequencies and percentages. The 'independent t-test for continuous variables and the chi-square test for categorical variables were used to compare' women with and without GDM. The association between GDM and adverse maternal and fetal outcomes was assessed using logistic regression analysis after adjusting for potential confounders such as maternal age and BMI. Statistical significance was defined as P-values below 0.05.

Results

Women in the GDM group were generally older and had a higher body mass index compared to their non-GDM counterparts, and a family history of diabetes was more frequently observed among them. While a greater proportion of non-GDM women were primigravida, and slightly more participants in the GDM group belonged to a lower socioeconomic status, these differences were not statistically significant.(Table 1)

Table 1. Baseline Characteristics of Study Participants (n = 112)

Variable	GDM Group (n = 38)	Non-GDM Group (n = 74)	p-value
Maternal age (years)	31.6 ± 5.8	27.9 ± 4.5	0.012
BMI (kg/m²)	27.8 ± 3.5	25.4 ± 3.1	0.003
Primigravida	10 (26.3%)	29 (39.2%)	0.18
Family history of diabetes	21 (55.3%)	19 (25.7%)	0.004
Low socioeconomic status	17 (44.7%)	29 (39.2%)	0.58

Cesarean delivery was significantly more common among the GDM group, while vaginal deliveries predominated in the non-GDM group. Although pregnancy-induced hypertension and preeclampsia were observed more frequently in GDM pregnancies, these differences did not reach statistical significance. The incidence of postpartum hemorrhage was low and comparable between the two groups, indicating that GDM primarily influenced the mode of delivery rather than postpartum complications in this cohort. (Table 2)

Table 2. Maternal Outcomes by GDM Status

Maternal Outcome	GDM Group (n = 38)	Non-GDM Group (n = 74)	p-value
Pregnancy-induced hypertension	6 (15.8%)	4 (5.4%)	0.08
Preeclampsia	5 (13.2%)	3 (4.1%)	0.09
Mode of delivery			
Vaginal	15 (39.5%)	53 (71.6%)	
Cesarean	23 (60.5%)	21 (28.4%)	0.002
Postpartum hemorrhage	2 (5.3%)	2 (2.7%)	0.60

Infants born to mothers with GDM had significantly higher birth weights, and the incidence of macrosomia was markedly greater. Neonatal hypoglycemia and NICU admissions were also significantly more frequent among GDM infants. Although low birth weight, preterm delivery, low Apgar scores, and perinatal mortality occurred more often in the GDM group, these differences were not statistically significant. Overall, the results indicate that GDM has a considerable impact on fetal growth and immediate neonatal health, particularly in terms of macrosomia, hypoglycemia, and the need for intensive care. (Table 3)

Table 3. Fetal and Neonatal Outcomes by GDM Status

Fetal/Neonatal Outcome	GDM Group (n = 38)	Non-GDM Group (n = 74)	p-value
Birth weight (kg)	3.48 ± 0.62	3.02 ± 0.54	0.001
Macrosomia (>4 kg)	6 (15.8%)	2 (2.7%)	0.014
Low birth weight (<2.5 kg)	4 (10.5%)	7 (9.5%)	0.87
Preterm delivery (<37 weeks)	7 (18.4%)	6 (8.1%)	0.13
Neonatal hypoglycemia	8 (21.1%)	4 (5.4%)	0.017
Apgar <7 at 5 minutes	3 (7.9%)	2 (2.7%)	0.20
NICU admission	9 (23.7%)	7 (9.5%)	0.048
Perinatal mortality	2 (5.3%)	1 (1.4%)	0.27

Women with GDM had over three times higher odds of undergoing cesarean delivery compared to non-GDM women. Similarly, the likelihood of delivering a macrosomic infant was nearly six times higher in the GDM group, while the odds of neonatal hypoglycemia were over four times greater. Although crude analyses suggested increased risks of preeclampsia and NICU admission among GDM pregnancies, these associations were not statistically significant after adjustment. These findings underscore the substantial impact of GDM on both maternal and neonatal health, particularly in relation to delivery mode, fetal overgrowth, and immediate neonatal complications. (Table 4)

Table 4. Logistic Regression Analysis: Association of GDM with Adverse Outcomes

Outcome	Crude OR (95% CI)	Adjusted OR* (95% CI)	p-value
Cesarean delivery	3.86 (1.67–8.93)	3.12 (1.29–7.55)	0.011*
Preeclampsia	3.57 (0.83–15.3)	2.98 (0.66–13.4)	0.15
Macrosomia	6.71 (1.27–35.5)	5.84 (1.05–32.2)	0.043*
Neonatal hypoglycemia	4.74 (1.34–16.7)	4.10 (1.10–15.2)	0.035*
NICU admission	2.93 (1.05–8.13)	2.56 (0.88–7.44)	0.08

Discussion

According to several studies, the frequency of GDM in Pakistan varies significantly, ranging from 4.41% to 57.90%.(13) This discrepancy can be explained by variations in the population's characteristics, diagnostic standards, and study design. In Lahore, a prevalence of 36.8% was observed by Siddique et al. (2023), underscoring the growing burden of GDM in urban environments. The results of our study are similar to the typical risk factors, a family history of diabetes, a high body mass index (BMI), and older maternal age.(14)

As reported by Shaikh et al. (2022), those with GDM underwent a higher rate of cesarean sections than women without GDM.(15) Also, our study found that women with GDM were more likely to have the diagnosis of preeclampsia, consistent with Khan et al. (2024) and Elgazzaz et al. (2024) findings that there is a higher rate of preeclampsia with GDM.(16,17) In our study, infants delivered to mothers who have GDM experienced a significant increase in mean birth weight and also had increased incidence of macrosomia and neonatal hypoglycemia. Khan et al. (2025) found similar results with the conclusion that GDM significantly increases risk of complications for infants and macrosomia. (18) Finally, our study found a higher incidence of NICU admission; this finding aligns with the previous findings of Anthony et al. (2021) and Ghosh et al. (2021), both investigating rates of NICU admission for GDM.(19,20)

Khan et al. (2025) found that GDM significantly increases the risk of persistent metabolic dysfunction in mothers postpartum, highlighting the enduring implications of this disease.(18) This relates to the essential need for early detection and effective treatment for GDM to prevent long-term health issues in mothers. Similar negative maternal and fetal outcomes have been linked to GDM in international research. GDM was linked to an increased risk of prenatal hypertension, preeclampsia, polyhydramnios, cesarean delivery, preterm birth, and large for gestational age

(LGA) newborns, according to studies by Li et al. (2023), Wang et al. (2025), and Saleem et al. (2025).(21-23) These results support our research and demonstrate the importance of GDM as a major global public health concern.

There are certain limitations to our investigation. Our findings may not be as broadly applicable to the general population due to the single-center design. Furthermore, selection and recollection biases may be introduced by the study's retrospective design. To confirm our findings and investigate the underlying processes connecting GDM to worse outcomes, multicenter prospective studies are required in the future. The results of this study highlight how crucial it is to screen for and diagnose GDM in Pakistani women as soon as possible. Routine glucose screening at 24–28 weeks of gestation should be encouraged, especially for women with advanced maternal age, high BMI, or a family history of diabetes, as these conditions are associated with significantly higher rates of cesarean delivery, macrosomia, neonatal hypoglycemia, and NICU admissions.

Adverse maternal and fetal outcomes can be lessened with the use of efficient management techniques, such as medical nutrition treatment, blood glucose monitoring, and prompt pharmacologic therapies when necessary. Additionally, teaching expectant mothers about nutritional advice, physical activity, and lifestyle changes may lessen the prevalence and severity of GDM. In order to expand prenatal care coverage and standardize GDM screening practices throughout Pakistani urban and rural healthcare facilities, this study highlights the need for policy-level measures from a public health perspective. Early intervention may reduce both the long-term consequences of type 2 diabetes in mothers and metabolic complications in offspring, as well as alleviate short-term issues for mothers and newborns.

The results of the investigation allow for the creation and execution of standardized national guidelines for the detection, identification, and treatment of gestational diabetes mellitus (GDM) in order to ensure uniform care across medical centers in both urban and rural areas. To enhance maternal and fetal outcomes related to GDM in Pakistan, early and universal testing for GDM should be carried out for all pregnant women between 24 and 28 weeks of gestation, with additional early screening for high-risk women, such as those with advanced maternal age, obesity, or a family history of the disease. Patient education focusing on healthy dietary practices, physical activity, and self-monitoring of blood glucose is crucial to prevent or reduce the severity of GDM and its associated complications. Establishing multidisciplinary antenatal clinics involving obstetricians, endocrinologists, dietitians, and diabetes educators can improve individualized management and monitoring of GDM pregnancies.

Long-term postpartum follow-up for women with a history of GDM is recommended to screen for type 2 diabetes and implement early interventions, given their increased risk for metabolic disorders. Finally, public health initiatives, including community-based awareness programs, should target women of reproductive age to educate them about the risk factors, prevention strategies, and the importance of early engagement with healthcare services. Implementing these recommendations may substantially improve both immediate pregnancy outcomes and long-term maternal and child health.

Conclusion

Maternal diabetes mellitus in Pakistani women increases the risk of cesarean birth, macrosomia, infant hypoglycemia, and neonatal intensive care unit admission, among other serious complications for both mother and fetus. Important risk factors include maternal parity, positive family history of diabetes, age of the mother, and maternal BMI. Early recognition and effective management of GDM are crucial to reducing adverse health outcomes for the mother and child, and the risks can be mitigated by implementing standardized screening protocols, patient education, and individualized monitoring during pregnancy. Further multicenter and prospective studies are needed to establish effective approaches to prevent and manage gestational diabetes mellitus in diverse populations in Pakistan.

References

1. Modzelewski R, Stefanowicz-Rutkowska MM, Matuszewski W, Bandurska-Stankiewicz EM. Gestational diabetes mellitus—recent literature review. Journal of clinical medicine. 2022;11(19):5736.
2. Nakshine VS, Jogdand SD. A comprehensive review of gestational diabetes mellitus: impacts on maternal health, fetal development, childhood outcomes, and long-term treatment strategies. Cureus. 2023 Oct 23;15(10).
3. Lewandowska M, Więckowska B, Sajdak S. Pre-pregnancy obesity, excessive gestational weight gain, and the risk of pregnancy-induced hypertension and gestational diabetes mellitus. Journal of clinical medicine. 2020;9(6):1980.
4. Eltoony LF, Ibrahem SA, Hafez MZE-d, Ali OM, Elsewify WAE. Prevalence and risk factors for gestational diabetes in Aswan, Egypt according to International Association of the Diabetes and Pregnancy Study Groups (IADPSG). The Egyptian Journal of Hospital Medicine. 2021;82(4):701-7.
5. Read SH, Rosella LC, Berger H, Feig DS, Fleming K, Ray JG, et al. BMI and risk of gestational diabetes among women of South Asian and Chinese ethnicity: a population-based study. Diabetologia. 2021;64(4):805-13.
6. Uzair M, Arshad Z, Sehar T, Haider T, Bibi A. Prevalence of Gestational Diabetes among Pregnant Women. International Journal of Healthcare Professions. 2025.
7. Kasi FK, Nawaz M, Khan MA, Muhammad B, Ullah S, Ahmed S. Frequency and Prevalence of Diabetes Mellitus in Pregnant Women of Quetta District, Balochistan, Pakistan. Pakistan's Multidisciplinary Journal for Arts & Science. 2024:13-25.
8. Naseer N, Shaw I, Adams G. Effect of lifestyle and Diet on Gestational Diabetes (GDM) in South Asian women: a systematic review. J Diabetes Metab Syndr. 2020;3(10).
9. Lamri A, Limbachia J, Schulze KM, Desai D, Kelly B, de Souza RJ, Paré G, Lawlor DA, Wright J, Anand SS. The genetic risk of gestational diabetes in South Asian women. Elife. 2022 Nov 22;11:e81498.
10. Read SH, Rosella LC, Berger H, Feig DS, Fleming K, Ray JG, Shah BR, Lipscombe LL. BMI and risk of gestational diabetes among women of South Asian and Chinese ethnicity: a population-based study. Diabetologia. 2021 Apr;64(4):805-13.
11. Jamal WZ, Khan FR, Zuberi N, Kazmi SMR, Rozi S. Association of periodontal disease with gestational diabetes mellitus among postpartum women at a private tertiary care hospital of Karachi, Pakistan: a cross-sectional study. Scientific Reports. 2024;14(1):9951.
12. Scheuer CM, Jensen DM, McIntyre HD, Ringholm L, Mathiesen ER, Nielsen CP, Nolsöe RL, Milbak J, Hillig T, Damm P, Overgaard M. Applying WHO2013 diagnostic criteria for gestational diabetes mellitus reveals currently untreated women at increased risk. Acta Diabetologica. 2023 Dec;60(12):1663-73.
13. Adnan M, Aasim M. Prevalence of gestational diabetes mellitus in Pakistan: a systematic review and meta-analysis. BMC Pregnancy and Childbirth. 2024;24(1):108.
14. Siddique E, Saddique H, Batool S. Prevalence of gestational diabetes and associated maternal factor: prevalence of gestational diabetes. Pakistan Journal of Health Sciences. 2023:253-8.
15. Shaikh HA, Khan S, Mustafa A, Depar AA, Mateen B, Shaikh MTA. Outcome of Gestational Diabetes during Pregnancy and at Delivery. Pakistan Journal of Medical & Health Sciences. 2022;16(09):811-.
16. Khan AD, Ghani N, Khan S, Jan HA. Frequency and Risk of Preeclampsia in Women with Gestational Diabetes Mellitus: Frequency of Preeclampsia in Gestational Diabetes Mellitus Women. Pakistan Journal of Health Sciences. 2024:139-43.
17. Elgazzaz M, Woodham PC, Maher J, Faulkner JL. Implications of pregnancy on cardiometabolic disease risk: preeclampsia and gestational diabetes. American Journal of Physiology-Cell Physiology. 2024;327(3):C646-C60.
18. Khan AA, Javed S, Noreen S, Chaudhry MR, Afridi S. Impact of Gestational Diabetes on Neonatal Birth Weight and Maternal Postpartum Metabolic Changes. Cureus. 2025;17(6).

19. Anthony N, Ahmad A, Bibi C, Amirzadah W, Humayun S, Sajid M, et al. Feto-maternal outcomes and treatment compliance in metformin versus insulin-treated gestational diabetic and non-diabetic patients at the Rehman Medical Institute, Peshawar. Cureus. 2021;13(8).
20. Ghosh C, Wojtowycz M. Effect of gestational disorders on preterm birth, low birthweight, and NICU admission. Archives of Gynecology and Obstetrics. 2021;303(2):419-26.
21. Li J, Yan J, Ma L, Huang Y, Zhu M, Jiang W. Effect of gestational diabetes mellitus on pregnancy outcomes among younger and older women and its additive interaction with advanced maternal age. Frontiers in Endocrinology. 2023;14:1158969.
22. Wang P, Yu Z, Hu Y, Li W, Xu L, Da F, et al. BMI modifies the effect of pregnancy complications on risk of small-or large-for-gestational-age newborns. Pediatric Research. 2025;97(1):301-10.
23. Saleem F, Yasmin T, Awan FR. Assessment of Gestational Diabetes Mellitus Among Primigravidas. Indus Journal of Bioscience Research. 2025;3(3):427-32.