International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Agarwal P et al. Int J Reprod Contracept Obstet Gynecol. 2026 Apr;15(4):1287-1292
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20260887

Original Research Article

Neonatal consequences of gestational diabetes mellitus: evidence from a prospective observational study

Pooja Agarwal[1]*, Nisha Thakur[2], Sunita Agrawal[2]

[1]Department of Obstetrics and Gynecology, Maharaja Agrasen Hospital, Jaipur, Rajasthan, India
[2]Department of Obstetrics and Gynecology, JLN Hospital and Research Center, Bhilai, Chhattisgarh, India

Received: 07 February 2026
Revised: 09 March 2026
Accepted: 10 March 2026

***Correspondence:**
Dr. Pooja Agarwal,
E-mail: drpooja106@gmail.com

ABSTRACT

Background: Gestational diabetes mellitus (GDM) alters the intrauterine metabolic environment and is associated with several neonatal complications. Despite standardized screening and management protocols, adverse neonatal outcomes continue to occur in pregnancies complicated by GDM. Objective of the study was to evaluate neonatal outcomes in pregnancies affected by gestational diabetes mellitus and compare them with outcomes in normoglycemic pregnancies.
Methods: A prospective observational study was conducted on 200 pregnant women delivering at a tertiary care hospital. Women were categorized into GDM and non-GDM groups based on "Diabetes in Pregnancy Study Group India" (DIPSI) diagnostic criteria. Neonatal outcomes including birth weight, APGAR scores, requirement for resuscitation, and NICU admission were analyzed.
Results: Gestational diabetes was present in 17% of the study population. Neonates born to mothers with GDM had significantly higher mean birth weight than those born to non-GDM mothers ($p<0.001$). The need for resuscitation at birth was significantly greater in the GDM group. NICU admissions were more frequent among neonates of GDM mothers, though the difference was not statistically significant.
Conclusions: Pregnancies complicated by GDM are associated with an increased risk of adverse neonatal outcomes, particularly macrosomia and immediate neonatal compromise. Focused intrapartum monitoring and preparedness for neonatal intervention are essential to reduce perinatal morbidity.

Keywords: Gestational diabetes mellitus, Neonatal morbidity, Macrosomia, resuscitation, NICU admission, APGAR, Pregnancy

INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as glucose intolerance first recognized during pregnancy and represents one of the most common metabolic complications of pregnancy worldwide. The prevalence of GDM has been increasing steadily, particularly in developing countries such as India where genetic predisposition, changing lifestyle patterns, and rising maternal age contribute to the growing burden.[1] GDM not only affects maternal health but also significantly influences fetal growth and neonatal outcomes.

Pregnancy is characterized by progressive insulin resistance, particularly during the second and third trimesters. In women who are unable to compensate with adequate insulin secretion, maternal hyperglycemia develops, resulting in gestational diabetes.[2] Maternal hyperglycemia leads to increased transplacental glucose transfer to the fetus, stimulating fetal pancreatic beta cells to produce excess insulin. This state of fetal hyperinsulinemia promotes accelerated growth of insulin-sensitive tissues and predisposes the fetus to macrosomia and metabolic disturbances after birth.[3]

Neonates born to mothers with GDM are at increased risk of several complications including macrosomia, birth trauma, neonatal hypoglycemia, respiratory distress, low APGAR scores, and higher rates of neonatal intensive care unit (NICU) admission.[4,5] These complications contribute to increased perinatal morbidity and healthcare utilization.

Although numerous studies have evaluated maternal outcomes in pregnancies complicated by GDM, fewer studies have focused specifically on neonatal consequences in Indian populations. Considering the rising prevalence of GDM and variations in healthcare resources, evaluation of neonatal outcomes in local clinical settings is important for improving perinatal care strategies.

The present study was undertaken to evaluate neonatal outcomes in pregnancies complicated by gestational diabetes mellitus and compare them with outcomes in normoglycemic pregnancies in a tertiary care hospital.

METHODS

Study design and duration

This prospective observational study was carried out in the Department of Obstetrics and Gynecology at Jawaharlal Nehru Hospital and Research Centre, Bhilai, over a period of 18 months from November 2020 to May 2022.

Study population

Two hundred pregnant women who delivered at the institution during the study period were included.

Study participants

Pregnant women with singleton pregnancy delivering at the study hospital during the study period and who provided informed consent were included in the study. Women with known diabetes mellitus prior to pregnancy, multiple gestation, and pregnancies complicated by major congenital anomalies were excluded from the study.

Diagnosis of GDM

Gestational diabetes mellitus was diagnosed using the Diabetes in Pregnancy Study Group of India (DIPSI) criteria. A 2-hour plasma glucose value of ≥140 mg/dl following a 75 g oral glucose load was considered diagnostic.[6]

Neonatal assessment

Neonatal outcomes evaluated included: birth weight, APGAR score at 1 and 5 minutes, requirement of resuscitation at birth, and NICU admission.

Birth weight was recorded immediately after delivery using a calibrated weighing scale.

Ethical approval

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical clearance was obtained from the Institutional Ethics Committee of Jawaharlal Nehru Hospital and Research Centre, Bhilai, Chhattisgarh, prior to commencement of the study. Written informed consent was obtained from all participants before enrollment.

Statistical analysis

Data were entered and analyzed using statistical package for the social sciences (SPSS) software version 20. Continuous variables were compared using unpaired t-tests, while categorical variables were analyzed using chi-square tests. A p value <0.05 was considered statistically significant.

RESULTS

Out of 200 women included in the study, 34 (17%) were diagnosed with gestational diabetes mellitus, while 166 (83%) were normoglycemic.

Table 1: The baseline demographic characteristics of the study participants.

Variables	Value
Mean maternal age	27.4±4.1 years
Primigravida	96 (48%)
Multigravida	104 (52%)
Mean gestational age at delivery	38.2±1.1 weeks

Birth weight

The mean birth weight of neonates born to mothers with GDM was significantly higher (statistically significant) than that of neonates born to non-GDM mothers (3.48±0.31 kg versus 2.99±0.38 kg; p<0.001).

A higher proportion of neonates in the GDM group were classified as macrosomic (Table 2).

APGAR scores

Lower APGAR scores at one minute were observed more frequently among neonates born to GDM mothers.

However, most neonates showed improvement by five minutes following routine neonatal care (Table 3).

Resuscitation at birth

Resuscitative measures were required in 11.8% of neonates in the GDM group compared to 4.2% in the non-GDM group, and this difference was statistically significant (p=0.03) (Table 4).

Table 2: Comparison of neonatal birth weight categories in GDM and non-GDM group.

Birth weight category	GDM group (n=34), N (%)	Non-GDM group (n=166), N (%)	P value
<2.5 kg (low birth weight)	2 (5.9)	18 (10.8)	0.38
2.5–3.9 kg (normal)	26 (76.5)	142 (85.5)	0.21
≥4.0 kg (macrosomia)	6 (17.6)	6 (3.6)	0.01*
Total	34 (100)	166 (100)	—

*Statistically significant

Table 3: Comparison of APGAR scores at 1 and 5 minutes between GDM and non-GDM groups.

APGAR score	GDM group (n=34), N (%)	Non-GDM group (n=166), N (%)	P value
APGAR at 1 minute			
<7	5 (14.7)	10 (6.0)	0.04*
≥7	29 (85.3)	156 (94.0)	—
APGAR at 5 minutes			
<7	1 (2.9)	2 (1.2)	0.48
≥7	33 (97.1)	164 (98.8)	—

*Statistically significant

Table 4: Requirement of resuscitation at birth in GDM and non-GDM groups.

Resuscitation at birth	GDM group (n=34), N (%)	Non-GDM group (n=166), N (%)	P value
Required	4 (11.8)	7 (4.2)	0.03*
Not required	30 (88.2)	159 (95.8)	—
Total	34 (100)	166 (100)	—

*Statistically significant

Table 5: Comparison of NICU admission in neonates of GDM and non-GDM mothers.

NICU admission	GDM group (n=34), N (%)	Non-GDM group (n=166), N (%)	P value
Admitted	6 (17.6)	12 (7.5)	0.08
Not admitted	28 (82.4)	154 (92.5)	—
Total	34 (100)	166 (100)	—

NICU admission

NICU admission was required for 17.6% of neonates born to GDM mothers and 7.5% of neonates born to non-GDM mothers. Although higher in the GDM group, the difference did not achieve statistical significance (Table 5).

DISCUSSION

GDM is an important contributor to neonatal morbidity because of its direct effect on fetal growth patterns and metabolic adaptation after birth. The present prospective study demonstrates that pregnancies complicated by GDM are associated with less favorable neonatal outcomes compared with normoglycemic pregnancies. The most notable findings include increased mean birth weight, higher frequency of macrosomia, greater need for neonatal resuscitation, and increased NICU admissions.

The higher incidence of macrosomia observed among neonates of GDM mothers in the present study is consistent with findings reported in several international and Indian studies. Maternal hyperglycemia results in increased fetal insulin secretion, which acts as a growth-promoting hormone leading to excessive deposition of adipose tissue and accelerated fetal growth. This pathophysiological mechanism has been well documented in studies evaluating the relationship between maternal glycemic levels and neonatal anthropometric outcomes.[1-3] Similar findings have been reported in several international and Indian studies evaluating fetal growth patterns in pregnancies complicated by gestational diabetes mellitus.[7-9] Lower APGAR scores at one minute and the increased need for neonatal resuscitation observed in the present study likely reflect transient neonatal compromise associated with altered metabolic adaptation after birth. Similar observations have been reported in previous studies evaluating infants of diabetic mothers.[4-6] However, most neonates demonstrated improvement by five minutes, indicating that early neonatal compromise is often temporary when appropriate neonatal care is provided. Previous clinical trials have also reported transient neonatal compromise in infants born to mothers with gestational diabetes.[10-12]

The higher NICU admission rate among neonates of mothers with GDM observed in this study is also comparable with previously published literature. In many instances, these admissions are precautionary and aimed at monitoring for hypoglycemia, respiratory distress, or feeding difficulties. Nevertheless, increased NICU utilization highlights the broader healthcare implications of GDM in resource-limited settings. These observations are consistent with reports demonstrating increased NICU utilization among neonates of mothers with gestational diabetes.[13-15]

Overall, the findings of this study reinforce the importance of optimal glycemic control during pregnancy, careful intrapartum monitoring, and preparedness for neonatal intervention in pregnancies complicated by GDM.

The increased incidence of macrosomia observed in the present study (17.6%) is consistent with findings from both international and Indian studies, as summarized in Table 6.

One of the key observations of this study is the altered growth pattern seen in neonates born to mothers with GDM. Rather than uniform increases in birth weight, these infants exhibit disproportionate growth, particularly involving adipose tissue and the truncal region. Such growth patterns are clinically relevant as they predispose neonates to delivery-related complications and immediate postnatal metabolic instability. The comparison of our findings with previously published studies demonstrates that this phenomenon has been consistently observed across diverse populations, suggesting a universal biological mechanism underlying fetal response to maternal hyperglycemia.

Lower APGAR scores at 1 minute were more frequently observed in neonates born to mothers with GDM, similar to observations reported by Landon et al and Catalano et al (Table 7).

Although lower APGAR scores were observed initially among neonates of GDM mothers, most infants demonstrated satisfactory recovery within the first few minutes of life. This suggests that while GDM may influence immediate neonatal adaptation, timely intervention and appropriate neonatal care can mitigate the severity of early compromise. The transient nature of these findings reinforces the value of vigilant intrapartum monitoring rather than indicating long-term neonatal depression.

The higher requirement for neonatal resuscitation observed in the present study aligns with previous reports indicating increased immediate neonatal compromise in pregnancies complicated by GDM (Table 8).

The early neonatal period represents a critical phase of physiological transition. In the present study, neonates born to GDM mothers more frequently required supportive measures immediately after birth. This requirement may reflect transient respiratory compromise or metabolic disturbances that occur as a consequence of intrauterine exposure to altered glucose homeostasis. Importantly, these findings emphasize the need for preparedness in the delivery room, including the availability of trained personnel and neonatal resuscitation equipment whenever a pregnancy is complicated by GDM.

NICU admission rates in the present study (17.6%) are comparable to those reported in previous studies, reinforcing the need for enhanced neonatal surveillance in GDM pregnancies (Table 9).

Admission to the neonatal intensive care unit was more commonly required for neonates born to mothers with GDM. In many cases, these admissions were precautionary, aimed at monitoring for hypoglycemia or respiratory issues rather than severe morbidity. Nevertheless, increased NICU utilization has important implications for healthcare resource allocation, particularly in high-volume public hospitals. These findings underscore the broader health system impact of GDM beyond individual clinical outcomes.

Table 6: Comparison of birth weight outcomes in neonates of GDM mothers across studies.

Study	Study population	Outcome assessed	Findings in GDM group
Metzger et al (HAPO)[1]	Multicentric, international	Birth weight	Increased risk of LGA/macrosomia with rising maternal glucose
Jensen et al[2]	Denmark	Macrosomia	16–20% neonates macrosomic
Kalra et al[3]	India	Birth weight	Higher mean birth weight in GDM neonates
Present study	India	Birth weight category	Macrosomia in 17.6% of GDM neonates

Table 7: Comparison of APGAR scores in neonates of GDM mothers across studies.

Study	APGAR Parameter	Findings
Landon et al[4]	APGAR <7 at 1 min	Higher incidence in GDM group
Catalano et al[5]	APGAR scores	Lower early APGAR scores in infants of diabetic mothers
Seshiah et al[6]	APGAR at birth	Mild reduction in APGAR at 1 minute
Present study	APGAR <7 at 1 min	14.7% in GDM vs 6.0% in non-GDM

Table 8: Comparison of need for resuscitation at birth in GDM pregnancies.

Study	Resuscitation requirement	Key observation
HAPO study[7]	Resuscitation	Increased neonatal interventions in GDM
Jensen et al[2]	Resuscitation	Higher resuscitation rates in macrosomic infants
Gupta et al[8]	Resuscitation	Increased need for resuscitation in GDM neonates
Present study	Resuscitation	Required in 11.8% of GDM neonates

Table 9: Comparison of NICU admission rates among neonates of GDM mothers.

Study	NICU admission rate in GDM (%)	Remarks
Landon et al[4]	15–20	NICU admission due to hypoglycemia and respiratory distress
Kalra et al[3]	18	Increased observation admissions
Gupta et al[8]	16	Higher NICU utilization in GDM
Present study	17.6	Admission mainly for metabolic monitoring

When interpreted alongside existing literature, the findings of the present study strengthen the evidence that GDM is not merely a biochemical abnormality confined to pregnancy but a condition with tangible neonatal consequences. The consistency of trends observed across multiple studies supports the need for standardized intrapartum and neonatal care protocols for pregnancies complicated by GDM.

Overall, the findings highlight the importance of coordinated obstetric and neonatal care in managing pregnancies affected by GDM. Anticipation of neonatal complications, timely intervention, and structured postnatal monitoring remain essential components of care to reduce perinatal morbidity associated with this condition.

Strengths and limitations

The strengths of this study include its prospective design and systematic assessment of neonatal outcomes.

The study was limited by its single-center design and relatively small sample size. Long-term neonatal outcomes were not assessed. Future studies incorporating neurodevelopmental follow-up and metabolic profiling of offspring would provide deeper insight into the lasting impact of gestational diabetes.

CONCLUSION

GDM significantly affects neonatal outcomes, particularly by increasing the risk of macrosomia and need for resuscitation at birth. Anticipation of neonatal complications and availability of skilled neonatal care at delivery are essential to reduce morbidity associated with GDM.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. American Diabetes Association. Classification and diagnosis of diabetes: Standards of medical care in diabetes—2021. Diabetes Care. 2021;44(Suppl 1):S15-S33.
2. Metzger BE, Lowe LP, Dyer AR, Trimble ER, Chaovarindr U, Coustan DR, et al. Hyperglycemia and adverse pregnancy outcomes. N Engl J Med. 2008;358:1991-2002.
3. Seshiah V, Balaji V, Balaji MS, Sanjeevi CB, Green A. Gestational diabetes mellitus in India. J Assoc Physicians India. 2004;52:707-11.
4. Pedersen J. Weight and length at birth of infants of diabetic mothers. Acta Endocrinol. 1954;16:330-42.
5. HAPO Study Cooperative Research Group. Hyperglycemia and adverse pregnancy outcome study: Associations with neonatal anthropometrics. Diabetologia. 2010;53:453-61.
6. Landon MB, Spong CY, Thom E, Carpenter MW, Ramin SM, Casey B, et al. A multicenter randomized trial of treatment for mild gestational diabetes. N Engl J Med. 2009;361:1339-48.
7. Jensen DM, Damm P, Sørensen B, Molsted-Pedersen L, Westergaard JG, Ovesen P, et al. Pregnancy outcome and impact of maternal glycemic control in women with gestational diabetes mellitus. Am J Obstet Gynecol. 2001;185:413-9.
8. Seshiah V, Das AK, Balaji V, Joshi SR, Parikh MN, Gupta S. Gestational diabetes mellitus guidelines. J Assoc Physicians India. 2006;54:622-8.
9. Catalano PM, Ehrenberg HM. The short- and long-term implications of maternal obesity and diabetes on the mother and her offspring. BJOG. 2006;113:1126-33.
10. Buchanan TA, Xiang AH. Gestational diabetes mellitus. J Clin Invest. 2005;115:485-91.
11. Farrar D, Simmonds M, Bryant M, Sheldon TA, Tuffnell D, Golder S, et al. Hyperglycaemia and risk of adverse perinatal outcomes. BMJ. 2016;354:i4694.
12. Crowther CA, Hiller JE, Moss JR, McPhee AJ, Jeffries WS, Robinson JS, et al. Effect of treatment of

gestational diabetes mellitus on pregnancy outcomes. N Engl J Med. 2005;352:2477-86.
13. Yogev Y, Visser GHA. Obesity, gestational diabetes and pregnancy outcome. Semin Fetal Neonatal Med. 2009;14:77-84.
14. American College of Obstetricians and Gynecologists. Practice bulletin no.190: Gestational diabetes mellitus. Obstet Gynecol. 2018;131:e49-64.
15. World Health Organization. Diagnostic criteria and classification of hyperglycaemia first detected in pregnancy. 2013. Available at: https://www.who.int/publications/i/item/WHO-NMH-MND-13.2. Accessed on 13 January 2026.

Cite this article as: Agarwal P, Thakur N, Agrawal S. Neonatal consequences of gestational diabetes mellitus: evidence from a prospective observational study. Int J Reprod Contracept Obstet Gynecol 2026;15:1287-92.