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Gestational diabetes mellitus prevalence and estimating maternal and foetal outcomes in a tertiary care centre, Madhya Pradesh, India

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Abstract:
Incidence of gestational diabetes mellitus (GDM) and maternal and neonatal outcomes in pregnant women who receive antenatal care is a serious health issue. Hence, a prevalence of 18.6% was found, with 40 of them diagnosed with GDM out of 215 women who participated in the study. The women with GDM were older, had a higher body mass index, more menstrual irregularity and underwent the OGTT at a later gestational age than women without GDM. Neonatal outcomes were worse in the GDM group, with a higher NICU admission, much higher average birth weight and the prevalence of macrosomia being observed only in infants born to mothers with GDM. Thus, we show the need to screen, risk-assess and closely monitor high-risk pregnant women during antenatal care to minimise complications related to GDM.

Keywords: Gestational diabetes mellitus (GDM), pregnancy outcomes, neonatal outcomes, maternal body mass index, macrosomia, NICU admission

Background:
Gestational diabetes mellitus (GDM) is a medical condition that is one of the most prevalent conditions observed in pregnancy. It occurs when the body fails to respond to the increased insulin demand of pregnancy, resulting in abnormal glucose intolerance initially identified during the antenatal period. Over the last few years, GDM has become a significant issue in public health due to the rising maternal age at conception, the rising prevalence of overweight and obesity and the fact that many women are going into pregnancy with insulin resistance. Literature evidence demonstrates that GDM is not just a temporary pregnancy disorder, but a condition that can have long-term impacts on the health of a mother and a child. Women who had GDM are more likely to develop type 2 diabetes and metabolic disease in the future and babies born to affected mothers are more likely to have excessive birth weight, neonatal metabolic complications and cardiometabolic issues in later life **[1-4].** The morbidity of GDM is particularly significant in India. Indian research has recently demonstrated that GDM is unevenly distributed across regions and healthcare institutions. Such variation is determined by differences in ethnicity, dietary patterns, body mass index, family history, socioeconomic conditions and screening criteria across studies **[5, 6].** Evidence at the national and regional level indicates that GDM is a significant burden among pregnant women in India and thus it is a significant maternal health challenge. Due to India's large and heterogeneous population, local hospital-based studies can still be useful for understanding the actual disease trends in a particular area and devising an appropriate screening and management plan **[7, 8].** GM is clinically significant as it is related to a number of unfavourable maternal and fetal outcomes. Inadequate glycaemic regulation can predispose to hypertensive disorders, operative delivery, preterm birth and delivery complications. In the case of the foetus and infant, GDM can result in macrosomia, birth trauma, respiratory issues, hypoglycaemia, NICU hospitalisation and perinatal mortality **[9, 10].** Therefore, it is of interest to report the prevalence of GDM and its maternal and foetal outcomes in a tertiary care centre in Madhya Pradesh.

Methodology:

Study design and setting:
The present study was a prospective interventional study conducted in the Department of Obstetrics and Gynaecology, Government Bundelkhand Medical College, Sagar, Madhya Pradesh. The study was carried out over a one-year period from January 2024 to January 2025 after obtaining approval from the Institutional Ethics Committee. Expectant mothers who visited the antenatal outpatient department and those who were admitted to the labour room were eligible.

Population and sample size of the study:
The study sample comprised 215 pregnant women with gestational ages of 24-28 weeks. The sample size was calculated using N = 4pq/d^2 and the appropriate participants were recruited after providing informed written consent. The purpose of the study was to determine the prevalence of gestational diabetes mellitus and to assess the maternal and foetal outcomes associated with the condition at the chosen tertiary care facility.

Inclusion and exclusion criteria:
Gestating women within the gestational age range of 24 to 28 weeks, willing to take part, were captured. Women who already had diabetes mellitus, or were already diagnosed with GDM and were under treatment were not allowed to participate, nor were those with major medical conditions like chronic hypertension, overt thyroid disease, or cardiac disease. This helped establish a more consistent study group to evaluate GDM-related outcomes.

Study procedure:
Screening for GDM was performed on all enrolled women using the single-step 75g oral glucose tolerance test, as indicated in the thesis protocol. The test was performed regardless of fasting status. Venous blood glucose was measured 2 hours after oral glucose intake and a value of 140 mg/dL or higher was considered diagnostic of GDM. Following the screening, the participants were categorised into GDM-positive and GDM-negative. A structured pro forma was used to enter relevant demographic, clinical and obstetric data. Mothers and foetal outcomes were followed from conception to delivery, including significant maternal and neonatal outcomes.

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Statistical analysis:
Data were entered into Microsoft Excel and SPSS version 21.0 was used to analyse the data. Mean and standard deviation were used to summarise quantitative data and frequency and percentage were used to summarise qualitative variables. The comparison was done by using appropriate statistical tests, such as the chi-square test and Kruskal-Wallis test, with post-hoc analysis where necessary. A p-value < 0.05 was considered statistically significant.

Results:
A total of 215 pregnant women were included in the study. Of these, 40 women were diagnosed with gestational diabetes mellitus (GDM), giving an overall prevalence of 18.6%, while 175 women did not have GDM. For article presentation, the findings are consolidated into two tables: the first summarises the baseline clinical and obstetric profile and the second presents maternal and neonatal outcomes. The results indicated that GDM was more prevalent among older women and those with higher BMI, as shown in **Table 1.** The majority of women with GDM were between 26 and 30 years old (one-fifth were 31-35 years old), which was significantly increased compared to non-GDM. The average age of the mothers in the GDM group had a significant difference. The same trend was observed with body mass index. The majority of women with GDM were overweight and the mean BMI was evidently higher than that of women without GDM. The GDM group also had a higher incidence of menstrual irregularity. Besides that, the average age at which the women had their first OGTT was much greater in GDM women and it might indicate that most of them were diagnosed later in pregnancy. In our study, the negative neonatal outcomes were more common in women with GDM, as seen in **Table 2**. Even though the total difference in pregnancy outcome and mode of birth had no statistical significance, the number of stillbirths and LSCS had higher numeric values in the group with GDM. Neonatal outcomes showed the greatest differences. There was a significant difference in the NICU admissions between babies born to mothers with GDM. The mean birth weight was also significantly greater in the GDM group and nearly half of the babies born had a low birth weight of 3.5-3.9 kg. Macrosomia was observed only in the GDM group. In general, the findings indicate that GDM in this research was closely linked to greater maternal weight, older maternal age and poorer newborn outcomes, in particular, higher birth weight and a higher likelihood of NICU admission.

Table 1: Baseline clinical and obstetric profile of the study population according to GDM status

Variable	GDM positive (n=40)	GDM negative (n=175)	p value
Overall prevalence	40/215 (18.6%)	175/215 (81.4%)	—
Age group (years)			
21–25	10 (25.0%)	111 (63.4%)	0.002*
26–30	22 (55.0%)	57 (32.6%)	
31–35	8 (20.0%)	7 (4.0%)	
Mean age (years)	27.4 ± 3.4	24.1 ± 3.6	0.003*
BMI category (kg/m²)			
18.5–24.9	1 (2.5%)	162 (92.6%)	<0.001*
25.0–29.9	34 (85.0%)	11 (6.3%)	
≥30.0	5 (12.5%)	2 (1.1%)	
Mean BMI (kg/m²)	27.2 ± 3.2	22.6 ± 2.4	<0.001*
Menstrual cycle			
Regular	20 (50.0%)	133 (76.0%)	<0.01*
Irregular	20 (50.0%)	42 (24.0%)	
Gestational age at first OGTT (weeks)	26.9 ± 4.9	23.6 ± 7.6	0.019*

**Significant*

Table 2: Maternal and neonatal outcomes according to GDM status

Outcome	GDM positive	GDM negative	p value
Pregnancy outcome			
Live birth	29/40 (72.5%)	147/175 (84.0%)	0.073
Stillbirth	6/40 (15.0%)	13/175 (7.4%)	
Abortion	5/40 (12.5%)	15/175 (8.6%)	
Mode of delivery (excluding abortions)			
Normal vaginal delivery	19/35 (54.3%)	100/160 (62.5%)	0.356
LSCS	16/35 (45.7%)	60/160 (37.5%)	
NICU admission (live births only)	13/29 (44.8%)	24/147 (16.3%)	<0.001*
Birth weight (kg) (excluding abortions)	3.55 ± 0.46	2.80 ± 0.33	<0.001*
Birth weight category (excluding abortions)			
2.5–2.9 kg	4/35 (11.4%)	89/159 (56.0%)	<0.001*
3.0–3.4 kg	12/35 (34.3%)	57/159 (35.8%)	
3.5–3.9 kg	17/35 (48.6%)	13/159 (8.2%)	
≥4.0 kg	2/35 (5.7%)	0/159 (0.0%)	
Macrosomia (>4 kg)	2/35 (5.7%)	0/159 (0.0%)	0.002*

**Significant*

Discussion:
The current study revealed a GDM prevalence of 18.6, indicating a high burden in the antenatal population under study. This is generally consistent with current literature that indicates that GDM is prevalent in South Asian and urban Indian populations, but the prevalence is not uniform based on screening strategy, gestational age at which it is tested and background metabolic risk **[11-13].** Recent reviews have also indicated that further maternal age progression and augmenting adiposity are still among the most powerful foretellers of GDM, which substantiates the current observation of much greater age and BMI in the GDM group **[12-14]**. The other significant result was that menstrual irregularity occurred more often and the mean gestational age at the initial OGTT was later in women with GDM. This can indicate insulin resistance and a late diagnosis in women who are already at risk of metabolic disorders. The paper by Punnose *et al.* in Asian Indian women also stressed that GDM diagnosed in the early stages of pregnancy might still be related to adverse pregnancy outcomes even with treatment, which is why screening is not a complete solution until accompanied by close monitoring and timely glycemic control **[15].** The current results thus justify the importance of screening at an early age and more so in overweight women and women with suggestive reproductive histories **[12, 14 and 5]**. In terms of outcomes, the current study revealed that NICU admission and mean birth weight were significantly higher and macrosomia

occurred only in the GDM group. These findings are in line with recent meta-analytic and cohort data indicating that GDM predisposes fetal overgrowth and neonatal morbidity and increased demand of intensive neonatal care **[15-19].** The same associations have been found in multinational cohorts and recent retrospective studies, where maternal diabetes was associated with increased neonatal complications and extended hospital duration **[16-18]**. Although there was no statistically significant difference in live birth rate and mode of delivery in the current research, the GDM group nevertheless had numerically higher stillbirth and LSCS rates. This implies that overall obstetric management likely minimised some significant maternal events, but neonatal risk was also significant **[15-17].** When combined, the results indicate that GDM in this cohort was better indicated by neonatal compromise compared to gross maternal outcome measures. This highlights the need to diagnose the disease early, control weight, ensure rigorous antenatal glycemic control, perform serial fetal surveillance and have integrated intrapartum and neonatal planning to minimise preventable complications.

Conclusion:

GDM was found to occur in almost one out of five women and was strongly linked to advanced maternal age, obesity, abnormal menstrual cycle and subsequent tests of OGTTs. The state of affairs had an evident negative impact on the neonatal outcomes, especially NICU admission, increased birth weight and macrosomia. This data shows the importance of early screening and close antenatal care for high-risk pregnant women to improve perinatal outcomes.

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