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Original Research Article

STUDY ON GESTATIONAL DIABETES MELLITUS AND ITS ASSOCIATED RISK FACTORS IN ANTENATAL CASES

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ABSTRACT

Background: Gestational diabetes mellitus (GDM) is one of the most common metabolic disorders complicating pregnancy, with rising prevalence worldwide due to urbanization, sedentary lifestyles, and dietary changes. India, in particular, shows wide variation in GDM prevalence across regions, reflecting diverse demographic and environmental influences. Early detection of GDM is crucial to prevent adverse maternal and fetal outcomes and to reduce the long-term risk of type 2 diabetes. The objective is to determine the prevalence of gestational diabetes mellitus and to identify associated risk factors among antenatal women attending a tertiary care hospital. **Materials and Methods:** A hospital-based cross-sectional study was conducted among 82 antenatal women attending the obstetrics and gynecology department. Participants underwent screening for GDM using the oral glucose tolerance test (OGTT) as per standard diagnostic criteria. Maternal demographic variables, anthropometric data, and clinical risk factors such as age, gravidity, body mass index (BMI), family history of diabetes, and previous obstetric history were recorded and analyzed. Statistical analysis was performed to evaluate the association between GDM and potential risk determinants. **Result:** The overall prevalence of GDM was 24%, which is higher than that reported in most Indian studies. The occurrence of GDM increased with advancing maternal age, particularly among women aged ≥25 years, and was more frequent in multigravida compared to primigravida women. A strong association was observed between elevated BMI (≥25 kg/m²) and the development of GDM. Additionally, a positive family history of diabetes and a past history of GDM or macrosomic births were significant predictors. Most cases with GDM exhibited elevated fasting, 1-hour, and 2-hour glucose levels on OGTT. **Conclusion:** The study highlights a high prevalence of GDM and identifies advanced maternal age, obesity, multigravidity, and family history of diabetes as key risk factors. Universal screening of all pregnant women, rather than selective screening, is recommended for early diagnosis and timely management. Lifestyle interventions, nutritional counseling, and postpartum follow-up are essential to minimize maternal and neonatal complications and to prevent future type 2 diabetes in this high-risk group.

INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance that is first recognized during pregnancy, regardless of whether insulin therapy or dietary modification is required for management, and irrespective of whether the condition resolves or persists following delivery.[1] It represents the most prevalent metabolic disorder complicating pregnancy and poses significant risks to both maternal and fetal health.[2] The pathophysiology of GDM is primarily linked to placental hormones and increased maternal adiposity, which together induce insulin resistance by interfering with insulin receptor binding and post-receptor signaling. Consequently, this leads to elevated maternal blood glucose levels during gestation.[3]

Globally, GDM affects approximately 15% of pregnant women, with nearly three-quarters of these cases occurring in developing countries.[4] The prevalence varies substantially across regions, ranging from 10.1% in Eastern and Southeastern Asia to 13.6% in Africa.[5] Such variations can be

attributed to differences in screening strategies, diagnostic criteria, population characteristics, and ethnic diversity. In South-East Asia, the reported prevalence is as high as 24.2%, while in India, it ranges widely from 3% to 35%, reflecting regional, genetic, and lifestyle differences. Studies from Pakistan have also shown conflicting prevalence rates, with reports indicating 23.9% in Islamabad, 17.2% in Khyber Pakhtunkhwa (KPK), 13.2% in Sindh, and 11.4% in Punjab.[5]

Furthermore, the risk factors for GDM vary among different populations and regions, influenced by demographic profiles, lifestyle patterns, and genetic predispositions. Variations in study design, sample size, and inclusion criteria across different investigations may also account for these disparities.[6]

The present study aims to determine the prevalence and regional distribution of gestational diabetes mellitus and to identify the associated maternal risk factors among pregnant women, contributing to improved screening and preventive strategies.

MATERIALS AND METHODS

The present study was conducted at the Career Institute of Medical Sciences and Hospital, Lucknow. It was a hospital-based cross-sectional study involving 82 consenting and eligible pregnant women who attended the antenatal clinic during the study period. Data collection was carried out using a pre-structured questionnaire designed to obtain relevant socio-demographic and clinical information. After obtaining informed written consent, each participant underwent a detailed medical history, general physical examination, and systemic assessment. The gestational age was determined based on the last menstrual period and confirmed through clinical evaluation and ultrasonography.

Women fulfilling the inclusion criteria were enrolled, while healthy normoglycemic pregnant women were considered as controls. All participants underwent a Glucose Challenge Test (GCT) at their first antenatal visit, regardless of fasting status. The test was performed by administering 50 grams of glucose dissolved in approximately one glass (250–300 mL) of water. Venous blood (2 mL) was collected after one hour, allowed to clot, and centrifuged at room temperature to separate serum. Samples were stored at 2–8°C until biochemical estimation. Blood glucose levels were determined using the Glucose Oxidase–Peroxidase (GOD-POD) method, a standard enzymatic colorimetric assay widely used for clinical diagnosis .

A plasma glucose concentration ≥140 mg/dL was taken as the cut-off value for a positive GCT, consistent with WHO and ADA recommendations. Participants with an abnormal GCT result were subsequently subjected to a 2-hour Oral Glucose Tolerance Test (OGTT) using 75 grams of glucose dissolved in approximately 300 mL of water after an overnight fast of at least 8 hours. Blood samples were collected at fasting, 1 hour, and 2 hours post-glucose intake for plasma glucose estimation. If vomiting occurred within 30 minutes of glucose ingestion, the test was repeated the next day; however, if vomiting occurred after 30 minutes, the test was continued as per protocol.

Participants with normal GCT results were retested between 24–28 weeks of gestation and again at 32 weeks, following the standard screening protocol for GDM. The course of each pregnancy was carefully monitored and documented, including follow-up visits and any obstetric or metabolic complications observed during the study period.

RESULTS

A total of 82 pregnant women were screened for gestational diabetes mellitus (GDM), with an overall prevalence of 24.4%. The occurrence of GDM increased with maternal age, being absent in women below 20 years and most common among those aged 30–34 years. Multigravida women showed a higher prevalence (17.07%) compared to primigravida (7.3%). GDM was strongly associated with higher body mass index; none of the women with normal BMI developed GDM, while 12.2% of overweight and 12.2% of obese women were affected.

Among risk factors, 12.2% of participants had a family history of diabetes, 9.8% had a past history of GDM, and a smaller proportion had previous macrosomia, stillbirth, or premature delivery. Overall, 15.9% had identifiable risk factors, while 84.1% developed GDM without any known risk factor.

In glucose testing, 78% had normal glucose levels on the 50 g glucose challenge test, while 22% showed elevated levels. On fasting plasma glucose testing, 79.2% were normal, 18.3% showed impaired fasting glucose, and 2.4% had diabetic levels. During the 75 g oral glucose tolerance test, 22% had raised 1-hour levels and 23.2% had raised 2-hour levels, indicating a notable proportion of abnormal glucose tolerance among pregnant women.

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Table 1: Distribution of study participants according to age, gravida status, and body mass index (BMI) in relation to gestational diabetes mellitus (GDM)

Parameter	Total participants (n)	GDM cases (n)	Percentage
Age (years)			
< 20	3	0	0%
21–24	29	3	3.65%
25–29	26	6	7.32%
30–34	17	8	9.15%
≥ 35	7	3	3.65%
Total	82	20	
Gravida status			
Primigravida	33	6	7.3
Multigravida	49	14	17.07
Total	82	20	24.39
BMI (kg/m²)			
18.5–24.9 (Normal)	45	0	0
25.0–29.9 (Overweight)	23	10	12.20
≥ 30 (Obese)	14	10	12.20

Table 2: Distribution of participants according to risk factors and associated conditions for GDM

Risk factor	Number of participants (n)	Percentage (%)
Family history of diabetes mellitus	10	12.2
Previous macrosomia / large for gestational age (LGA) baby	3	3.7
Past history of GDM	8	9.8
Previous unexplained fetal or neonatal loss / stillbirth	2	2.4
Previous premature delivery	1	1.2
Previous pregnancy with congenital anomaly	1	1.2
Any risk factor present	13	15.9
No identifiable risk factor	69	84.1

Table 3: Plasma glucose profile

Test Glucose level (mg/dL)	Participants (n)	Percentage (%)
50 g Glucose Challenge Test (1-hour)		
<140	64	78
≥ 140 – 200	15	18.3
> 200	3	3.7
Fasting Plasma Glucose (FPG)		
< 92	65	79.2
92 – 125	15	18.3
≥ 126	2	2.4
75 g OGTT (1-hour)		
< 180	64	78
≥ 180	18	22
75 g OGTT (2-hour)		
< 153	63	76.8
≥ 153	19	23.2

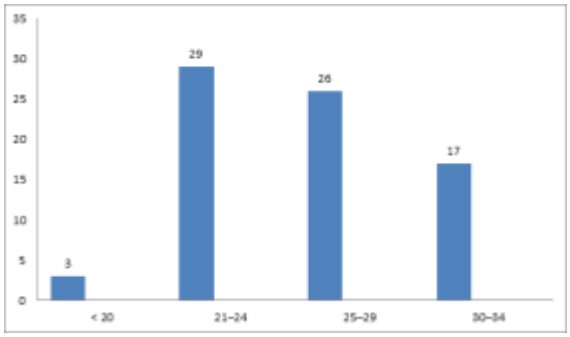

Figure 1: Age distribution

DISCUSSION

The prevalence of gestational diabetes mellitus (GDM) has shown a consistent upward trend globally, largely due to rapid urbanization, sedentary behavior, reduced physical activity, and unhealthy dietary habits as major contributing factors.[7] In India, GDM prevalence varies widely—from 3.8% to 21% across regions—with a distinctly higher burden in urban compared to rural populations. The national prevalence has risen markedly from 2% in 1982 to 7.62% in 1991, reflecting the growing public health challenge.[8] The World Health Organization (WHO) projects that by 2025, India will have nearly 300 million individuals with type 2 diabetes, underscoring the escalating metabolic health crisis. Variability in GDM prevalence across studies is attributed to differences in geography, demographic profiles, sample size, and diagnostic criteria used.

In the present study involving 82 pregnant women, a 24% prevalence of GDM was observed, a rate notably higher than most previously reported estimates from India and other countries, where the prevalence typically ranges between 5–15%.[9] In Delhi and surrounding regions, several studies have reported GDM prevalence between 10% and 14%.[10] A recent multicenter investigation across India identified maternal age, body mass index (BMI), and

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coexisting comorbidities as major determinants of GDM risk.[11]

Consistent with earlier findings, maternal age was found to be a significant predictor of GDM in this study. The risk increased among women aged ≥25 years, supporting prior evidence that advancing maternal age is associated with impaired glucose tolerance.[12] Populations with older maternal age distributions naturally exhibit higher GDM rates. A hospital-based study by Rajasekar et al. from Vellore reported a 14% prevalence of GDM, noting a significant increase with advancing maternal age and higher odds of GDM development.[13] Similarly, Basu et al. documented a 17.2% prevalence and identified maternal age as a strong risk factor.[14] In contrast, a community-based study by Kaliany et al. on 300 pregnant women found a lower prevalence of 8.33%, although age-related trends persisted.[15]

One of the strongest associations identified in the present study was with elevated BMI (≥25 kg/m²), aligning with numerous studies that establish overweight and obesity as key modifiable risk factors.[16] Excess adiposity promotes insulin resistance through inflammatory mechanisms, altered adipokine release, and impaired glucose utilization, thereby predisposing pregnant women to hyperglycemia.[17]

A positive family history of diabetes and prior history of GDM or macrosomic births were also more common among women who developed GDM, findings that closely resemble national and global trends. These factors likely represent underlying metabolic or genetic susceptibility, unmasked by the physiological insulin resistance of pregnancy. In the present study, 10 women reported a family history of diabetes, and 8 with prior GDM again developed GDM during the current pregnancy. Comparable observations were made by Rajput et al. in a community-based study in rural Haryana, where a 13.9% GDM prevalence was reported, with family history of diabetes and prior macrosomic delivery as significant predictors.[18] Similarly, Basu et al,[14] observed a 17.2% prevalence with family history as a key risk factor, while Rajasekar et al.[13] also reported a significant association between family history of diabetes and GDM. In an urban hospital-based study, Jali et al,[19] found that women with poor obstetric history were at particularly high risk. Furthermore, a systematic review and meta-analysis by Lee et al.[20] confirmed a high prevalence of GDM among Asian women, especially those with a previous history of GDM, macrosomia, or congenital anomalies.

The pattern of glucose elevation observed in both screening (50 g GCT) and confirmatory tests (fasting and OGTT) closely paralleled established diagnostic profiles, though the proportion of abnormal values was higher, reflecting the elevated overall prevalence. During pregnancy, insulin resistance increases physiologically due to placental hormones such as human placental lactogen, estrogen, and progesterone. In women with limited β-cell compensatory capacity, this leads to glucose intolerance and GDM. Genetic and epigenetic mechanisms are increasingly recognized in GDM pathogenesis, with polymorphisms in genes like TCF7L2, IRS1, and KCNQ1 linked to β-cell dysfunction and altered insulin signalling.[17] Additionally, lifestyle factors such as physical inactivity, diets high in refined carbohydrates, and psychological stress further exacerbate this predisposition.

The high GDM prevalence identified in this study highlights the urgent need for universal screening rather than selective, risk-based screening approaches, particularly in high-risk populations. Early detection followed by dietary counseling, structured physical activity, and regular glucose monitoring can significantly lower maternal and fetal complications, including macrosomia, preeclampsia, and cesarean delivery. Furthermore, postpartum follow-up is crucial, as women with GDM are at an increased risk of developing type 2 diabetes later in life. In resource-constrained environments, targeted preventive strategies emphasizing weight management before and during early pregnancy may help mitigate the future risk of GDM and related metabolic disorders.

CONCLUSION

This study demonstrated a high prevalence of GDM (24%) among pregnant women, with strong associations observed with increasing maternal age, higher BMI, multigravida status, and positive family history of diabetes. These findings highlight the growing public health importance of GDM and support the implementation of universal screening protocols during pregnancy. Strengthening awareness, promoting healthy weight before and during pregnancy, and ensuring regular antenatal screening can significantly reduce GDM-related complications. Future large-scale studies incorporating lifestyle, dietary, and socioeconomic factors are warranted to better understand and prevent gestational diabetes in Indian women.

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