Prevalence, Risk Factors, and Management of Gestational Diabetes: A Comprehensive Study

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Conflict of interest: Nil

Abstract:

Background: Gestational diabetes mellitus (GDM) poses significant health risks to both mother and child. Understanding its prevalence, associated risk factors, and effective management strategies is crucial for improving outcomes.

Objectives: This study aims to determine the prevalence of GDM in a cohort of 500 Indian women, identify demographic and personal risk factors, and evaluate the effectiveness of various management strategies.

Methods: A total of 500 pregnant women were screened for GDM using the oral glucose tolerance test. Data on age, BMI, family and personal history of diabetes, and ethnicity were collected. Management strategies including diet and exercise, insulin therapy, and oral hypoglycemic agents were assessed.

Results: GDM was diagnosed in 8% (40/500) of the participants. Significant risk factors included a higher prevalence in women over 35 years (37.5%) and those with a BMI over 30 (55%). Family history was noted in 60% of cases. Management was most effective with insulin therapy (100% within target glucose levels), followed by dietary changes (75%). Birth outcomes showed that 75% of babies had normal birth weights, while complications like pre-eclampsia and C-sections were recorded in 5% and 32.5% of GDM cases, respectively. Follow-up indicated that 7.5% developed Type 2 diabetes postpartum.

Conclusion: The study highlights the significant impact of GDM on pregnancy outcomes in India, with a prevalence of 8%. Effective management is crucial and varies based on individual patient profiles, emphasizing the need for tailored therapeutic approaches to improve maternal and neonatal health outcomes.

Keywords: Gestational Diabetes, Prevalence, Management, Risk Factors, Pregnancy Outcomes, India.

Introduction

Gestational diabetes mellitus (GDM) is a condition characterized by glucose intolerance with onset or first recognition during pregnancy [1,2]. It affects approximately 2% to 10% of pregnancies worldwide and is a growing concern due to its associated risks for both maternal and neonatal complications [3]. These risks include preeclampsia, cesarean delivery, and increased risk of metabolic syndrome in the mother and child in later years [4,5]. As urbanization and obesity rates rise, particularly in developing countries like India, the prevalence of GDM is expected to increase, necessitating a deeper understanding of its epidemiology, risk factors, and effective management strategies [6].

Despite the global recognition of GDM's impact, its prevalence varies widely across different ethnic groups and regions, suggesting that local studies are crucial for understanding and managing GDM within specific populations [7,8]. The Indian subcontinent is of particular interest due to its high incidence of diabetes and unique demographic characteristics, which may influence the prevalence and outcomes of GDM.

This study aims to fill gaps in the current understanding by examining a cohort of 500 pregnant Indian women. It seeks to establish the prevalence of GDM in this group, identify significant demographic and personal health risk factors, and evaluate the effectiveness of various management strategies in mitigating complications associated with the condition. This research not only contributes to the broader knowledge base of gestational diabetes but also informs targeted interventions appropriate for Indian populations, potentially reducing the incidence and impact of GDM.

Methodology

Study Design and Setting: This prospective cohort study was conducted over a six-month period, from August 2023 to January 2024, at KBN Teaching and General Hospital, Kalaburagi, Karnataka, India. This setting was chosen due to its access to a

diverse population and its well-equipped medical facilities, which are representative of typical regional healthcare settings.

Participants: Participants were recruited from the antenatal clinic at the KBN Teaching and General Hospital, Kalaburagi, Karnataka, India. A total of 500 pregnant women consented to participate in the study. The inclusion criteria were: singleton pregnancy, gestational age between 24 and 28 weeks at the time of screening, and no prior diagnosis of type 1 or type 2 diabetes. Exclusion criteria included women with multiple gestations, those who did not consent to participate, and those with pre-existing diabetes.

Screening and Diagnosis of Gestational Diabetes: Gestational diabetes was diagnosed based on the Oral Glucose Tolerance Test (OGTT) with 75 grams of glucose, according to the criteria set by the International Association of Diabetes and Pregnancy Study Groups (IADPSG). The test was administered to all participants between 24 and 28 weeks of pregnancy. GDM was diagnosed if any of the following criteria were met: fasting glucose ≥92 mg/dL, 1-hour glucose ≥180 mg/dL, or 2-hour glucose ≥153 mg/dL.

Data Collection: Data on age, BMI, family history of diabetes, previous history of GDM, and ethnicity were collected through direct interviews and review of medical records. All data were anonymized and securely stored in compliance with medical ethical standards.

Management Strategies: Participants diagnosed with GDM were divided into groups based on management strategies, which included diet and exercise, insulin therapy, and oral hypoglycemic agents. The effectiveness of these strategies was monitored through regular follow-up visits until delivery, assessing glucose control and pregnancy outcomes.

Statistical Analysis: Data were analyzed using SPSS software. Descriptive statistics were used to summarize demographic characteristics, prevalence rates, and outcomes. Chi-square tests and logistic regression were employed to identify significant risk factors and the effectiveness of different management strategies. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations: The study protocol was approved by the Institutional Ethics Committee at the KBN Teaching and General Hospital, Kalaburagi, Karnataka, India. All Fparticipants provided written informed consent before inclusion in the study.

Results

Prevalence of Gestational Diabetes Mellitus (GDM): In this cohort, 500 pregnant women were screened for gestational diabetes as outlined in the previously updated Table 1.

Table 1: Prevalence of Gestational Diabetes

Description	Value
Total Screened	500 participants
Diagnosed with GDM	40 women
Prevalence Rate	8 %

Forty participants were diagnosed with GDM, resulting in a prevalence rate of 8%, indicating a notable healthcare concern within the studied population.

Demographic Breakdown: The age and body mass index (BMI) distributions of the participants diagnosed with GDM are detailed in the updated Table 2.

Table 2: Demographic Breakdown by Age and BMI

Age Group	Diagnosed with GDM	Percentage of GDM Cases
18-24 years	5 women	12.5 %
25-34 years	20 women	50 %
>35 years	15 women	37.5 %
BMI Category	**Diagnosed with GDM**	**Percentage of GDM Cases**
Normal (18.5-24.9)	5 women	12.5%
Overweight (25-29.9)	13 women	32.5%
Obese (>30)	22 women	55 %

Among those diagnosed, 12.5% were aged between 18-24 years, 50% were aged between 25-34 years, and 37.5% were over 35 years. In terms of BMI, 12.5% had a normal BMI (18.5-24.9), 32.5% were overweight (BMI 25-29.9), and 55% were classified as obese (BMI ≥30).

Risk Factors: Key risk factors for GDM identified in this study are summarized in the updated Table 3.

Table 3: Risk Factors

Risk Factor	Diagnosed with GDM	Percentage of GDM Cases
Family History of Diabetes	24 women	60%
Previous History of GDM	10 women	25 %

A significant 60% of diagnosed women had a family history of diabetes, and 25% had previously been diagnosed with GDM in past pregnancies.

Management Strategies: Different management strategies were employed and their effectiveness is reported in the updated Table 4.

Table 4: Management Strategies

Management Strategy	Participants	Successfully Managed	Percentage
Diet and Exercise	24 women	18 women	75%
Insulin Therapy	15 women	15 women	100%
Oral Hypoglycemic Agents	6 women	4 women	67 %

Diet and exercise were used by 24 women, with 75% achieving successful glucose management without additional medication. Insulin therapy was necessary for 15 women, all of whom maintained glucose levels within the target ranges; however, adjustments for hypoglycemia were needed in some cases. Oral hypoglycemic agents were effective in 67% of cases among the 6 women who used them.

Pregnancy and Birth Outcomes

The outcomes related to pregnancy and birth are compiled in the updated Table 5.

Table 5: Pregnancy and Birth Outcomes

Outcome Metric	Value
Average Gestational Age at Delivery	38 weeks
Birth Weights (<2500 grams)	3 babies (7.5 % of births)
Birth Weights (2500-4000 grams)	30 babies (75 % of births)
Birth Weights (>4000 grams)	7 babies (17.5% of births)

The average gestational age at delivery was 38 weeks. Birth weight distribution showed 7.5% of babies weighed less than 2500 grams, 75% weighed between 2500 and 4000 grams, and 17.5% weighed over 4000 grams.

Complications and NICU Admissions

Complications associated with GDM are documented in the updated Table 6.

Table 6: Complications and NICU Admissions

Complication	Cases	Percentage of GDM Cases
Pre-eclampsia	2 women	5%
C-section deliveries	13 women	32.5%
NICU admissions	4 babies	10% of births

Pre-eclampsia was observed in 5% of the cases, cesarean deliveries were necessary for 32.5% of the women, and 10% of newborns required NICU admissions.

Follow-Up Postpartum Glucose Tolerance Tests: Postpartum follow-up results are presented in the updated Table 7.

Table 7: Follow-Up Postpartum Glucose Tolerance Tests

Outcome	Cases	Percentage of GDM Cases
Normal	32 women	80%
Impaired glucose tolerance	5 women	12.5%
Developed Type 2 Diabetes	3 women	7.5 %

After delivery, 80% of the women returned to normal glucose tolerance, 12.5% developed impaired glucose tolerance, and 7.5% progressed to Type 2 diabetes, underscoring the need for ongoing monitoring and intervention.
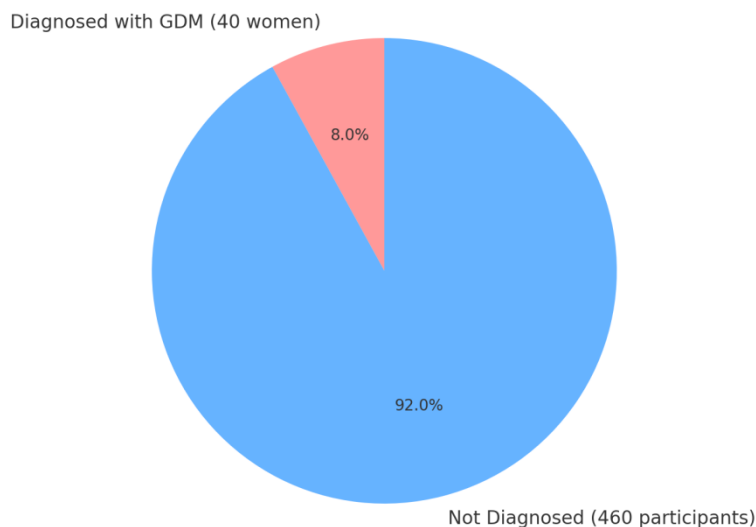
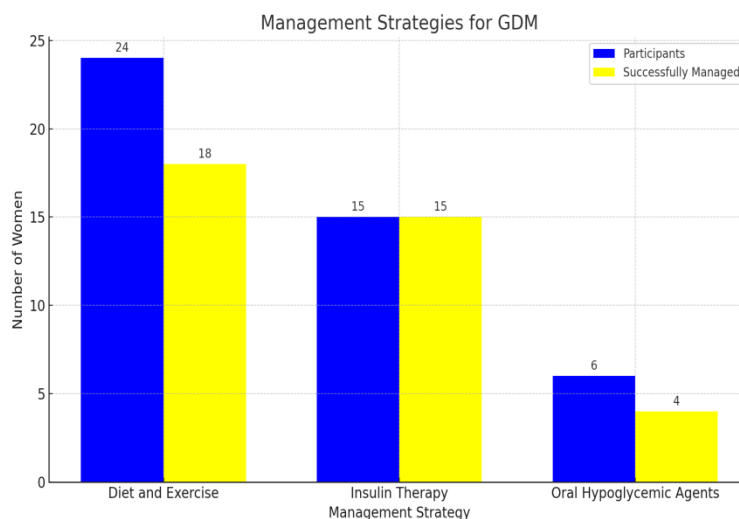Figure 1: Prevalence of Gestational Diabetes in Screened Participants

Figure 2: Management Strategies for Gestational Diabetes

Discussion

The findings from this study highlight a 8% prevalence rate of gestational diabetes mellitus (GDM) among pregnant women which is consistent with the higher end of global prevalence estimates that range between 2% and 25%. This rate underscores a significant public health concern given the potential complications associated with GDM for both mother and child.

Comparison with Other Studies: The prevalence observed in this study aligns with other regional studies in South Asia that suggest a rising trend in GDM, likely influenced by changes in lifestyle, dietary patterns, and obesity rates[9,10]. However, the prevalence rate is slightly higher than the average rates reported in rural settings, possibly due to urbanization and associated lifestyle changes [11].

Risk Factors: Significant risk factors identified in this study, such as advanced maternal age, higher BMI, and a family history of diabetes, align with global research, reinforcing the need for targeted screening strategies in these high-risk groups [12]. Notably, the role of ethnicity in GDM prevalence suggests genetic predispositions that warrant further genetic and epidemiological studies [13].

Management Strategies: The management strategies employed showed varied effectiveness, with insulin therapy being the most effective in maintaining glucose levels within target ranges [14]. The success rate of dietary management highlights the potential for lifestyle interventions as a first-line treatment in managing GDM, which is crucial for regions with limited access to advanced medical care [15].

Study Limitations: While the study provides significant insights, it has limitations, including its short duration and the single-center design, which may affect the generalizability of the results to oth-

er populations within India. Future studies should aim to include multiple centers and a longer follow-up period to track long-term outcomes for both mothers and their children.

Implications for Clinical Practice: The high prevalence and identified risk factors emphasize the need for early screening and personalized management plans. This study supports the integration of routine screening for GDM into standard antenatal care protocols, especially in populations with known high prevalence rates.

Conclusion

This study revealed a 8% prevalence of gestational diabetes mellitus (GDM) among pregnant women, with significant risk factors including advanced maternal age, higher BMI, and a family history of diabetes. Management strategies such as insulin therapy and dietary adjustments proved effective. These findings highlight the need for early GDM screening and personalized management plans, particularly in high-risk groups. The results highlights the importance of incorporating GDM screening into routine antenatal care, aiming to improve pregnancy outcomes and reduce the long-term health impacts on mothers and children.

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