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ORIGINAL ARTICLE

Prevalence and Determinants of Gestational Diabetes Mellitus in a Tertiary Care Hospital: A Cross-Sectional Analysis

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ABSTRACT

Background: Gestational Diabetes Mellitus (GDM) is one of the most common metabolic disorders during pregnancy and is associated with adverse maternal and fetal outcomes. Early identification of risk factors is essential for timely intervention. This study aimed to determine the prevalence of GDM and identify associated risk factors among pregnant women attending a tertiary care hospital.

Study Design: A Cross-Sectional study.

Place and Duration of the Study: The study was conducted at the Department of Obstetrics and Gynecology at Mardan Medical Complex, Mardan from January 2023 to June 2023.

Materials &Methods: A hospital-based cross-sectional study was conducted among 178 pregnant women between 24–36 weeks of gestation. Participants were selected using consecutive sampling. Data were collected using a structured questionnaire covering sociodemographic, obstetric, and clinical characteristics. GDM was diagnosed using standard oral glucose tolerance test (OGTT) criteria. Data were analyzed using SPSS version 26.0. Logistic regression analysis was performed to identify independent predictors of GDM. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were calculated, and $p < 0.05$ was considered statistically significant.

Results: The prevalence of GDM was 15.7% (28/178). Higher maternal age (≥35 years) was significantly associated with GDM (AOR = 3.12; 95% CI: 1.08–9.02; p = 0.035). Obesity (AOR = 3.76; 95% CI: 1.41–10.01; p = 0.008), family history of diabetes (AOR = 3.24; 95% CI: 1.32–7.94; p = 0.010), previous history of GDM (AOR = 5.87; 95% CI: 1.78–19.36; p = 0.004), and chronic hypertension (AOR = 2.69; 95% CI: 1.01–7.18; p = 0.048) were independent predictors of GDM. Overweight status and grand multiparity were not statistically significant in the adjusted model.

Conclusion: The prevalence of GDM in this tertiary care setting was moderately high (15.7%). Advanced maternal age, obesity, family history of diabetes, previous GDM, and chronic hypertension were significant risk factors. Routine screening and targeted interventions for high-risk women are recommended to reduce adverse pregnancy outcomes.

Keywords: Gestational diabetes mellitus, prevalence, risk factors, pregnancy, obesity, tertiary care hospital, cross-sectional study.

INTRODUCTION

Gestational Diabetes Mellitus (GDM) is defined as glucose intolerance with onset or first recognition during pregnancy and represents one of the most common metabolic complications of pregnancy worldwide[1]. The global prevalence of GDM has increased substantially over the past two decades, largely due to rising maternal age, urbanization, sedentary lifestyles, and increasing rates of overweight and obesity[2]. Current estimates suggest that GDM affects approximately 7–20% of pregnancies globally, depending on diagnostic criteria and population characteristics[3].

GDM is associated with significant short- and long-term maternal and fetal complications. Maternal risks include pregnancy-induced hypertension, preeclampsia, cesarean delivery, and a markedly increased risk of developing type 2 diabetes mellitus later in life[4]. For the fetus and neonate, GDM increases the risk of macrosomia, birth trauma, neonatal hypoglycemia, respiratory distress syndrome, and long-term metabolic disorders[5]. Furthermore, exposure to hyperglycemia in utero predisposes offspring to obesity and glucose intolerance in adulthood, contributing to the intergenerational transmission of metabolic disease[6].

Several risk factors have been consistently associated with the development of GDM. Advanced maternal age, particularly ≥35 years, has been shown to significantly increase the risk due to progressive insulin resistance and pancreatic β-cell dysfunction[7]. Pre-pregnancy overweight and obesity are among the strongest modifiable risk factors, as excess adiposity contributes to insulin resistance and chronic low-grade inflammation[8]. A family history of diabetes and a previous history of GDM further increase susceptibility, reflecting both genetic predisposition and underlying metabolic vulnerability[9]. Other contributing factors include multiparity, chronic hypertension, polycystic ovarian syndrome (PCOS), and urban lifestyle patterns[10].

Despite growing recognition of the burden of GDM, prevalence rates vary considerably across regions and healthcare settings due to differences in screening practices, diagnostic criteria, and population demographics[3,11]. In many developing and resource-limited settings, routine screening may not be uniformly implemented, leading to underdiagnosis and missed opportunities for intervention[11]. Tertiary care hospitals often serve high-risk populations, making them important sites for assessing the burden and determinants of GDM.

Understanding the local prevalence and associated risk factors of GDM is essential for designing targeted preventive strategies and optimizing antenatal care services. Therefore, this study aimed to determine the prevalence of Gestational Diabetes Mellitus and identify associated risk factors among pregnant women attending a tertiary care hospital.

MATERIALS AND METHODS

Study Design and Setting: A hospital-based cross-sectional study was conducted at the Department of Obstetrics and Gynecology of a tertiary care hospital Mardan Medical Complex, Mardan over a period of six months. The hospital serves as a referral center for both urban and rural populations, providing comprehensive antenatal and obstetric services.

Study Population and Sample Size: The study population comprised pregnant women attending the antenatal clinic during the study period. A total of 178 pregnant women between 24 and 36 weeks of gestation were included in the study. The sample size was determined based on an assumed prevalence of gestational diabetes mellitus (GDM) from previous literature, with a 95% confidence level and 5% margin of error. Participants were recruited using consecutive sampling until the required sample size was achieved.

Inclusion and Exclusion Criteria: Pregnant women aged 18 years and above, with singleton pregnancies and gestational age between 24–36 weeks, were eligible for inclusion. Women with known pre-existing diabetes mellitus (Type 1 or Type 2), multiple

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pregnancies, chronic systemic illness affecting glucose metabolism (other than hypertension), or those unwilling to participate were excluded from the study.

Data Collection Procedure: Data were collected using a structured and pre-tested questionnaire administered through face-to-face interviews. Information obtained included sociodemographic characteristics (age, residence, education, occupation, socioeconomic status), obstetric history (parity, previous GDM, history of macrosomia), and clinical risk factors (family history of diabetes, chronic hypertension, pre-pregnancy body mass index). Anthropometric measurements were recorded, and pre-pregnancy BMI was categorized according to standard WHO classification.

Diagnosis of Gestational Diabetes Mellitus: All participants underwent a standard Oral Glucose Tolerance Test (OGTT) between 24–28 weeks of gestation, or at first presentation if later than 28 weeks. GDM was diagnosed according to standard diagnostic criteria based on fasting and post-glucose plasma glucose values. Participants meeting or exceeding the recommended glucose thresholds were classified as having GDM.

Study Variables: The dependent variable was the presence or absence of GDM. Independent variables included maternal age, residence, education level, parity, pre-pregnancy BMI, family history of diabetes, previous GDM, chronic hypertension, and other selected obstetric factors.

Data Analysis: Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 26.0. Descriptive statistics were used to summarize demographic and clinical characteristics, presented as frequencies and percentages. The prevalence of GDM was calculated as the proportion of diagnosed cases among the total sample. Bivariate analysis was performed to assess associations between GDM and independent variables using chi-square tests. Variables with $p < 0.05$ in bivariate analysis were included in multivariable logistic regression to identify independent predictors of GDM. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were calculated, and statistical significance was set at $p < 0.05$.

Ethical Considerations: Ethical approval was obtained from the Institutional Review Board/Ethics Committee of the MTI Mardan prior to commencement of the study. Written informed consent was obtained from all participants after explaining the study objectives and procedures. Confidentiality of participants' information was strictly maintained, and data were used solely for research purposes.

RESULTS

The demographic and clinical profile of the 178 pregnant women shows that the majority were aged 25–29 years (33.7%), followed by 30–34 years (27.0%), while 18.0% were ≥35 years. Most participants resided in urban areas (58.4%) and had secondary (32.6%) or tertiary education (33.7%). A large proportion were homemakers (74.2%) and belonged to the middle socioeconomic class (48.3%). Regarding nutritional status, 34.8% were overweight and 32.6% were obese, indicating that more than two-thirds had elevated BMI. More than half were multiparous (53.9%), and the largest group was enrolled between 28–31 weeks of gestation (42.7%). Early antenatal booking (≤12 weeks) was observed in only 25.8%, while 32.6% booked after 20 weeks. Among identified risk factors, 24.7% had a family history of diabetes, 12.4% had chronic hypertension, 11.2% had hypothyroidism, and 7.9% reported previous GDM, whereas other risk factors such as previous macrosomia (10.1%), stillbirth (6.7%), PCOS (5.6%), and tobacco use (3.4%) were less common. Overall, the study population demonstrates a substantial presence of recognized metabolic and obstetric risk factors for GDM.

The comparative analysis between GDM and non-GDM groups demonstrates significant associations with several key risk factors. A higher proportion of women with GDM were aged ≥30 years, particularly ≥35 years (35.7% vs 14.7%), and maternal age showed a statistically significant association with GDM ($p = 0.006$). Pre-pregnancy BMI was strongly associated with GDM ($p < 0.001$), with more than half of GDM cases being obese (57.1%) compared to 28.0% in the non-GDM group. Family history of diabetes was significantly more common among women with GDM (50.0% vs 20.0%; $p = 0.001$), while previous GDM showed a very strong association, reported in 28.6% of GDM cases compared to only 4.0% of non-GDM women ($p < 0.001$). Chronic hypertension was also significantly higher among GDM women (28.6% vs 9.3%; $p = 0.004$). Although grand multiparity appeared more frequent among GDM cases (28.6% vs 14.7%), parity overall did not reach statistical significance ($p = 0.080$). Overall, increasing maternal age, obesity, family history of diabetes, previous GDM, and chronic hypertension were significantly associated with the occurrence of GDM in this study population.

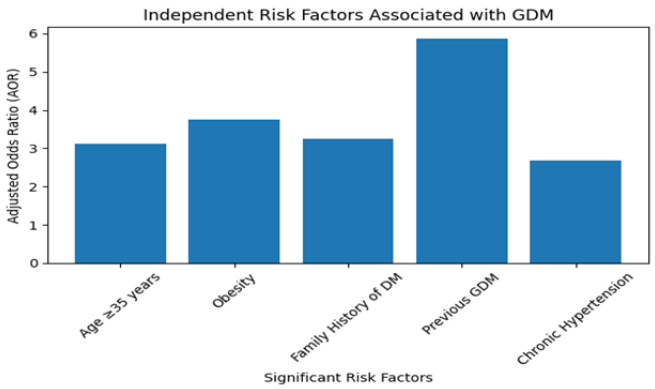

Figure1: Independent Risk Factors Associated with GDM

Table 1: Demographic, obstetric and baseline characteristics of participants (N=178)

Variable	Category	n	%
Maternal age (years)	18–24	38	21.3
	25–29	60	33.7
	30–34	48	27.0
	≥35	32	18.0
Residence	Urban	104	58.4
	Rural	74	41.6
Education level	No formal schooling	24	13.5
	Primary	36	20.2
	Secondary	58	32.6
	Tertiary	60	33.7
Occupation	Homemaker	132	74.2
	Employed (any)	46	25.8
Socioeconomic status	Low	62	34.8
	Middle	86	48.3
	High	30	16.9
Pre-pregnancy BMI	Normal (18.5–24.9)	58	32.6
	Overweight (25.0–29.9)	62	34.8
	Obese (≥30.0)	58	32.6
Parity	Nulliparous (0)	52	29.2
	Multiparous (1–4)	96	53.9
	Grand multiparous (≥5)	30	16.9
Gestational age at enrollment	24–27 weeks	40	22.5
	28–31 weeks	76	42.7
	32–36 weeks	62	34.8
Gestational age at first booking	≤12 weeks	46	25.8
	13–20 weeks	74	41.6
	>20 weeks	58	32.6
Selected risk factors (Yes)	Family history of diabetes (1st-degree)	44	24.7
	History of GDM in previous pregnancy	14	7.9
	Previous macrosomic baby (≥4.0 kg)	18	10.1
	Previous stillbirth/neonatal loss	12	6.7
	Chronic hypertension	22	12.4
	PCOS (pre-pregnancy diagnosis)	10	5.6
	Hypothyroidism	20	11.2
	Tobacco use (current)	6	3.4

Table 2: Prevalence of GDM and association with selected risk factors (N=178)

Variable	Category	GDM (n=28) n (%)	Non-GDM (n=150) n (%)	p-value
Maternal age (years)	18–24	2 (7.1)	36 (24.0)	0.006
	25–29	6 (21.4)	54 (36.0)	
	30–34	10 (35.7)	38 (25.3)	
	≥35	10 (35.7)	22 (14.7)	
Pre-pregnancy BMI	Normal	4 (14.3)	54 (36.0)	<0.001
	Overweight	8 (28.6)	54 (36.0)	
	Obese	16 (57.1)	42 (28.0)	
Parity	Nulliparous	6 (21.4)	46 (30.7)	0.080
	Multiparous (1–4)	14 (50.0)	82 (54.7)	
	Grand multiparous (≥5)	8 (28.6)	22 (14.7)	
Family history of diabetes	Yes	14 (50.0)	30 (20.0)	0.001
	No	14 (50.0)	120 (80.0)	
Previous GDM	Yes	8 (28.6)	6 (4.0)	<0.001
	No	20 (71.4)	144 (96.0)	
Chronic hypertension	Yes	8 (28.6)	14 (9.3)	0.004
	No	20 (71.4)	136 (90.7)	

Table 3: Multivariable Logistic Regression Analysis of Factors Associated with GDM (N=178)

Variable	Category (Reference)	Adjusted Odds Ratio (AOR)	95% CI	p-value
Maternal Age (years)	≥35 vs 18–24	3.12	1.08 – 9.02	0.035
	30–34 vs 18–24	2.48	0.86 – 7.15	0.092
	25–29 vs 18–24	1.42	0.45 – 4.43	0.550
Pre-pregnancy BMI	Obese vs Normal	3.76	1.41 – 10.01	0.008
	Overweight vs Normal	1.98	0.68 – 5.72	0.210
Family History of Diabetes	Yes vs No	3.24	1.32 – 7.94	0.010
Previous GDM	Yes vs No	5.87	1.78 – 19.36	0.004
Chronic Hypertension	Yes vs No	2.69	1.01 – 7.18	0.048
Grand Multiparity (≥5)	Yes vs Multiparous (1–4)	1.89	0.67 – 5.36	0.230
Urban Residence	Urban vs Rural	1.36	0.61 – 3.04	0.450

The multivariable logistic regression analysis identified several independent predictors of GDM. Women aged ≥35 years had significantly higher odds of developing GDM compared to those aged 18–24 years (AOR = 3.12; 95% CI: 1.08–9.02; p = 0.035), while the associations for ages 30–34 and 25–29 years were not statistically significant. Pre-pregnancy obesity was a strong independent risk factor, with obese women nearly four times more likely to develop GDM than women with normal BMI (AOR = 3.76; 95% CI: 1.41–10.01; p = 0.008), whereas overweight status was not significant after adjustment. A positive family history of diabetes significantly increased the odds of GDM by more than threefold (AOR = 3.24; 95% CI: 1.32–7.94; p = 0.010). Previous history of GDM emerged as the strongest predictor, with nearly sixfold increased odds (AOR = 5.87; 95% CI: 1.78–19.36; p = 0.004). Chronic hypertension was also independently associated with GDM (AOR = 2.69; 95% CI: 1.01–7.18; p = 0.048). In contrast, grand multiparity and urban residence were not significantly associated with GDM after controlling for confounders. Overall, advanced maternal age, obesity, family history of diabetes, previous GDM, and chronic hypertension were significant independent risk factors in this study.

DISCUSSION

This hospital-based cross-sectional study assessed the prevalence of Gestational Diabetes Mellitus (GDM) and its associated risk factors among pregnant women attending a tertiary care hospital. The overall prevalence of GDM in the present study was **15.7%**, which indicates a moderately high burden of disease in this population. This prevalence is comparable to findings from other tertiary care settings in South Asia and the Middle East, where GDM prevalence ranges between 12% and 18% depending on diagnostic criteria used[11,12]). However, it is slightly higher than reports from some European populations (6–10%)[13], and lower than certain urban Asian cohorts reporting prevalence exceeding 20%[14]. These variations may be attributed to differences in ethnicity, maternal age distribution, obesity rates, and screening strategies[15].

Advanced maternal age (≥35 years) was significantly associated with GDM in our study. Women aged ≥35 years had more than three times higher odds of developing GDM compared to younger women. Similar associations have been reported in previous studies, where maternal age has consistently emerged as an independent risk factor[16]. Increasing age is associated with progressive insulin resistance and diminished pancreatic β-cell reserve, which may explain the higher susceptibility to glucose intolerance during pregnancy[17].

Pre-pregnancy obesity was another strong predictor of GDM in the present study. Obese women had nearly fourfold increased odds of developing GDM compared to women with normal BMI. This finding aligns with multiple international studies identifying obesity as one of the most important modifiable risk factors for GDM[14,18]. Excess adipose tissue contributes to systemic inflammation, altered adipokine secretion, and increased insulin resistance, thereby predisposing pregnant women to hyperglycemia[18]. The growing prevalence of overweight and obesity among women of reproductive age may therefore partially explain the increasing global burden of GDM[15].

A significant association was also observed between family history of diabetes and GDM. Women with a first-degree relative with diabetes were more than three times more likely to develop GDM. This is consistent with previous research highlighting the role of genetic predisposition and shared environmental factors in the pathogenesis of GDM[12,19]. Similarly, previous history of GDM emerged as one of the strongest predictors in our study, with nearly sixfold increased odds. Recurrence of GDM has been widely documented in the literature, with recurrence rates reported between 30% and 80% in subsequent pregnancies[20]. This underscores the importance of close monitoring and early screening in women with prior GDM.

Chronic hypertension was independently associated with GDM in our analysis. This association has been observed in other studies, where metabolic syndrome components—including hypertension and obesity—often coexist and share common pathophysiological mechanisms such as endothelial dysfunction and insulin resistance[21]. Although grand multiparity showed increased odds, it did not reach statistical significance after adjustment, which is similar to findings from some studies that suggest parity alone may not independently predict GDM once age and BMI are controlled[16].

The findings of this study highlight the substantial burden of GDM in tertiary care settings and reinforce the importance of routine screening, particularly among high-risk groups such as older, obese women and those with a family or previous history of diabetes. Early identification and management are essential to reduce maternal and neonatal complications.

Strengths and Limitations: This study provides valuable insight into the prevalence and determinants of GDM in a tertiary care hospital setting. However, certain limitations should be acknowledged. The cross-sectional design limits causal inference. The study was conducted in a single center, which may limit generalizability to the broader population. Additionally, lifestyle factors such as diet and physical activity were not extensively evaluated. Despite these limitations, the study contributes important local data to the growing body of evidence on GDM.

CONCLUSION

The prevalence of Gestational Diabetes Mellitus (GDM) in this study was 15.7%, indicating a substantial burden among pregnant women in this tertiary care setting. Advanced maternal age, obesity, family history of diabetes, previous GDM, and chronic hypertension were significant risk factors. Early screening and targeted management of high-risk women are essential to reduce adverse maternal and neonatal outcomes.

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AUTHORS CONTRIBUTION

Concept & Design of Study: Hemasa Gul

Drafting: Huma Gul

Data Analysis: Fatima Rehman

Critical Review: Huma Gul, Fatima Rehman

Final Approval of Version:Hemasa Gul

All authors have reviewed and approved the final manuscript.

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