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Insights into Gestational Diabetes Mellitus: Prevalence and Risk Factors Among Women - A Cross-Sectional Study

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Abstract
Background: Globally, gestational diabetes mellitus (GDM), is becoming more and more of an issue for expectant mothers and their children.
Objective: The objective of this study was to investigate the prevalence and identify the risk factors associated with GDM among pregnant women
Methodology: The cross-sectional research was out between January–December 2023 at the Hayatabad Medical Complex in Peshawar. In order to gather data, comprehensive questionnaires including demographics, obstetric and medical history, family history of diabetes, and lifestyle variables were given out during normal prenatal appointments. To find independent determinants of GDM, statistical analysis was performed using multivariate logistic regression, prevalence calculation, bivariate analysis, and descriptive statistics.
Results: The results section shows that the prevalence of GDM is 14.17%. There are significant correlations between GDM and factors like obesity (29.4% vs. 9.7%, $p < 0.001$), sedentary lifestyle (36.8% vs. 21.8%, $p = 0.007$), advanced maternal age (26.5% vs. 14.6%, $p = 0.019$), and poor diet (41.2% vs. 26.7%, $p = 0.013$). Higher rates of preterm birth (23.53% vs. 9.7%, $p = 0.002$), macrosomia (19.12% vs. 7.3%, $p < 0.001$), newborn hypoglycemia (13.24% vs. 4.9%, $p < 0.001$), and respiratory distress syndrome (8.82% vs. 2.4%, $p < 0.001$) were among the unfavorable outcomes. The independent predictors of GDM that were verified by multivariate analysis were an advanced maternal age (Adjusted OR: 1.98, $p = 0.019$), obesity (Adjusted OR: 3.18, $p < 0.001$), diabetes (Adjusted OR: 2.36, $p = 0.001$), and sedentary lifestyle (Adjusted OR: 1.75, $p = 0.035$).
Conclusion: This research emphasizes how crucial it is to address modifiable risk factors in order to lessen the negative effects of GDM on the health of expectant mothers and newborns.

Keywords: Gestational Diabetes Mellitus, Prevalence, Risk Factors, Obstetric Outcomes

Introduction

Pregnant women worldwide are impacted by gestational diabetes mellitus (GDM), a serious health problem [1,2]. GDM, which is defined as glucose intolerance first identified during pregnancy, is dangerous for both the health of the mother and the fetus [3]. Its prevalence has been growing consistently over time, globally reflecting the rise in obesity and sedentary lifestyles [4]. In order to influence healthcare measures targeted at minimizing the deleterious consequences of GDM, it is important to have a thorough understanding of its prevalence and related risk factors [5].

Cross-sectional studies conducted recently have provided insight into the incidence of GDM in expectant mothers. These investigations provide insightful information about the epidemiology of GDM, enabling medical professionals to comprehend the condition's extent and consequences [6, 7]. Cross-sectional studies provide a

picture of the incidence of GDM among certain demographics and geographic locations by looking at a large and varied group of pregnant women [8].

There are significant variations in the frequency of GDM across various ethnic groups and communities [9, 10]. Women are more likely to acquire GDM if they have a family history of diabetes, are obese, are older mothers, or belong to a certain ethnicity [11]. This risk is further increased by lifestyle variables such as a sedentary lifestyle, insufficient physical exercise, and poor nutrition [12]. Comprehending these risk variables is essential for prompt detection and management, thereby mitigating the impact of GDM on maternal and fetal health consequences [13].

Moreover, there may be dire repercussions from GDM that is inadequately controlled or left untreated. Preeclampsia, cesarean birth, and a higher chance of type 2 diabetes in later life are examples of maternal difficulties [14]. Neonatal hypoglycemia, respiratory distress syndrome, macrosomia, and delivery traumas are only a few examples of fetal problems [15]. Effective preventative measures are even more crucial given the financial cost of addressing these issues [16].

Research Objective

This research set out to find out how common GDM is in pregnant women and what risk factors are linked to it. This study intends to add to the body of knowledge on GDM epidemiology by thoroughly analyzing demographic, clinical, and lifestyle factors. These understandings are crucial for creating focused treatments and public health regulations meant to lower the prevalence and impact of GDM on the health of mothers and newborns.

Material and Methods

Study Design and Settings:

This cross-sectional study was conducted at Hayatabad Medical Complex, Peshawar, over a period of one year, from January to December 2023. In Peshawar, Pakistan, Hayatabad Medical Complex is a tertiary care facility that provides treatment to a wide range of local residents. The research used a cross-sectional methodology to examine the frequency and risk variables linked to GDM in expectant mothers who visit the hospital's prenatal clinics.

Inclusion and Exclusion Criteria:

Pregnant women who attended prenatal clinics at Hayatabad Medical Complex in Peshawar from January to December 2023 and were at least eighteen years of age were among the participants. Women who could provide informed permission, had full medical records, and were proven to be pregnant between 20 and 36 weeks' gestation were eligible to participate. Women having a history of infertility treatment, numerous gestations, substantial medical comorbidities, insufficient medical records, refusal to participate, or concurrent involvement in other research projects were among the exclusion criteria.

Sample Size:

The cross-sectional research sample size was established by the use of a method designed to estimate proportions. Based on prior research, an estimated 15% of pregnant women had GDM. A sample size of 480 participants was determined, with a target accuracy of 5% and a confidence level of 95%. This sample size provided enough statistical power to identify variations in risk variables and prevalence across demographic subgroups.

Data Collection:

A standardized questionnaire that was given out by qualified healthcare workers was used to gather data. The questionnaire included demographic data, medical history, obstetric history, family history of diabetes, and lifestyle elements including food and exercise routines. To guarantee high participation rates and minimize participant annoyance, data collection was carried out during usual prenatal appointments.

Statistical Analysis:

The research population's clinical and demographic features were compiled using descriptive statistics. A 95% confidence interval was computed for the prevalence of GDM. To evaluate the relationship between putative risk variables and the existence of GDM, bivariate analysis was performed. After adjusting for confounding factors, multivariate logistic regression analysis was used to find independent predictors of GDM. At $p < 0.05$, statistical significance was established.

Results

The obstetric and demographic features of the research participants are shown in Table 1. In all, 480 patients were examined in this study. The participants' average age was 28.54 years (SD = 4.20). In terms of age distribution, the bulk of participants (182 patients, or 37.92%) belonged to the 25–29 age group. This was followed by patients in

the 18–24 age group (118 patients, or 24.58%), patients in the 30-34 age group (116 patients, or 24.17%), and patients in the 35+ age group (64 patients, or 13.33%). There were 28.92 weeks of gestation on average (SD = 3.63). 290 individuals (60.42%) were multiparous, while 190 participants (39.58%) were nulliparous. In terms of educational attainment, the bulk of participants (237 patients, 49.38%) had finished college or university, followed by secondary school (151 patients, 31.46%), and elementary school (92 patients, 19.17%).

Table 1: Study Participants' Obstetric and Demographic Details

Characteristic	**Frequency (n=480)**	**Percentage**
Age (years)		
Mean ± SD	28.54 ± 4.20	
Age Group		
18-24 years	118	24.58
25-29 years	182	37.92
30-34 years	116	24.17
35 years and above	64	13.33
Gestational age (weeks)		
Mean ± SD	28.92 ± 3.63	
Parity		
Nulliparous	190	39.58
Multiparous	290	60.42
Education Level		
Primary School	92	19.17
Secondary School	151	31.46
College/University	237	49.38

The frequency of GDM among research participants is shown in Figure 1. 68 individuals, or 14.17% of the total 480 patients included in the research, had a diagnosis of GDM. Of the participants, 412 people (85.83%) did not have GDM, making up the majority.

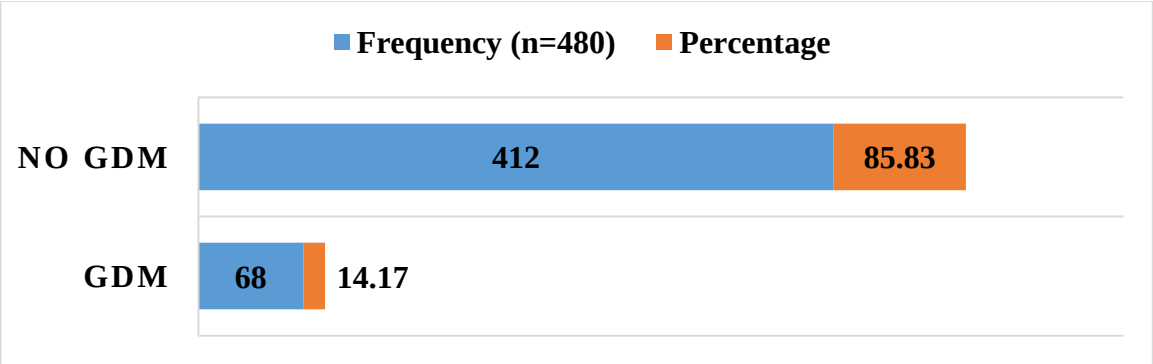

Figure 1: Prevalence of GDM

The clinical traits and risk variables for research participants with and without GDM are shown in Table 2. A family history of diabetes was present in 32 (47.1%) of the 68 patients with GDM, a substantially greater percentage than in the 100 (24.3%) individuals without GDM ($p < 0.001$). Similarly, 20 (29.4%) GDM patients and 40 (9.7%) non-GDM patients had obesity (BMI > 30 kg/m2) ($p < 0.001$). 18 (26.5%) GDM patients and 60 (14.6%) non-GDM patients had advanced maternal age (≥ 35 years) ($p = 0.019$). Poor diet and sedentary lifestyle were also substantially linked to GDM; among GDM patients, 28 (41.2%) had poor eating habits compared to 110 (26.7%) non-GDM patients ($p = 0.013$), and 25 (36.8%) had a sedentary lifestyle compared to 90 (21.8%) non-GDM patients ($p = 0.007$). These results emphasize how critical it is to take these risk factors into account while managing and preventing GDM.

Table 2: Study Participants' Clinical Features and Risk Factors

Characteristic	GDM (n=68)	No GDM (n=412)	p-value
Family history of diabetes	32 (47.1%)	100 (24.3%)	<0.001
Obesity (BMI ≥ 30 kg/m²)	20 (29.4%)	40 (9.7%)	<0.001
Advanced maternal age (≥ 35 years)	18 (26.5%)	60 (14.6%)	0.019
Sedentary lifestyle	25 (36.8%)	90 (21.8%)	0.007
Poor diet	28 (41.2%)	110 (26.7%)	0.013

The research examined the obstetric and pregnancy outcomes in 412 instances without GDM and 68 cases with GDM (table 3). Cesarean delivery was carried out in 35.29% of instances (24 patients) among those with GDM, which is much greater than the 17.0% (70 patients) seen in the non-GDM group ($p < 0.001$). Preterm birth was also more common in GDM cases (23.53%; 16 patients) than in non-GDM cases (9.7%; 40 patients) ($p = 0.002$). Additionally, a greater prevalence of macrosomia was linked to GDM, affecting 19.12% (13 patients) as opposed to 7.3% (30 patients) in the non-GDM group ($p < 0.001$). Additionally, 13.24% (9 patients) of newborns delivered to women with GDM had neonatal hypoglycemia, compared to 4.9% (20 patients) in the non-GDM group ($p < 0.001$). Furthermore, 8.82% (6 patients) of the GDM cases had respiratory distress syndrome, which was much greater than the 2.4% (10 patients) in the non-GDM group ($p < 0.001$).

Table 3: Results of Pregnancy and Obstetrics Among Research Participants

Outcome	GDM (n=68)	No GDM (n=412)	p-value
Cesarean delivery	24 (35.29%)	70 (17.0%)	<0.001
Preterm delivery	16 (23.53%)	40 (9.7%)	0.002
Macrosomia	13 (19.12%)	30 (7.3%)	<0.001
Neonatal hypoglycemia	9 (13.24%)	20 (4.9%)	<0.001
Respiratory distress syndrome	6 (8.82%)	10 (2.4%)	<0.001

The multivariate logistic regression analysis (MLRA) findings for the risk variables linked to GDM are shown in Table 4. The results are shown as adjusted odds ratios (OR) with matching 95% confidence intervals (CI) and p-values. According to the research, there was a 2.36-fold increase in the likelihood of acquiring GDM (95% CI: 1.41–3.95, $p = 0.001$) if there was a family history of diabetes. Similarly, an adjusted OR of 3.18 (95% CI: 1.87–5.42, $p < 0.001$) indicated a significantly increased risk of GDM in those who were obese, defined as having a BMI > 30 kg/m². A significant risk factor for GDM was also found to be advanced maternal age (≥ 35 years), with an adjusted OR of 1.98 (95% CI: 1.12–3.51, $p = 0.019$). Furthermore, it was shown that leading a sedentary lifestyle increases the risk of GDM by 1.75 times (95% CI: 1.04–2.95, $p = 0.035$). These findings emphasize how crucial it is to address these modifiable risk factors in order to prevent and treat GDM in expectant mothers.

Table 4: MLRA of Risk Factors for GDM

Risk Factor	Adjusted OR	95% CI	p-value
Family history of diabetes	2.36	1.41–3.95	0.001
Obesity (BMI ≥ 30 kg/m²)	3.18	1.87–5.42	<0.001
Advanced maternal age (≥ 35 years)	1.98	1.12–3.51	0.019
Sedentary lifestyle	1.75	1.04–2.95	0.035

Discussion

The incidence of GDM, which is rising in tandem with increases in obesity and sedentary lifestyles, is still a major worldwide health issue for mothers [17]. Current cross-sectional studies, which provide a snapshot of prevalence and related risk factors within particular groups, have made significant contributions to our understanding of its epidemiology [18]. Given the serious effects of untreated or improperly managed GDM on both maternal and fetal health outcomes, an understanding of these variables is essential for early detection and management [19].

Different cultures and ethnic groups have different prevalence rates of GDM, which are impacted by things like advanced maternal age, obesity, family history of diabetes, and lifestyle choices [20]. These results are supported by our research, which shows a strong correlation between these risk variables and GDM. In particular, we discovered that a poor diet, sedentary lifestyle, advanced maternal age, obesity, and a family history of diabetes were all strongly linked to GDM, which is consistent with other studies when compared to no GDM. (Abnormal diet: 41.2% vs. 26.7%, $p = 0.013$; advanced maternal age: 26.5% vs. 14.6%, $p = 0.019$; sedentary lifestyle: 36.8% vs. 21.8%, $p = 0.007$; Family history of diabetes: 47.1% vs. 24.3%, $p < 0.001$; Obesity: 29.4% vs. 9.7%, $p < 0.001$) [21–23]. The significance of taking these variables into account in clinical practice and public health programs targeted at GDM prevention and treatment is highlighted by these findings.

Furthermore, our research emphasizes the significant influence of GDM on pregnancy and obstetric outcomes. Compared to mothers without GDM, infants born to mothers with GDM had higher rates of respiratory distress syndrome, preterm delivery, macrosomia, neonatal hypoglycemia, and Cesarean delivery (35.29% vs. 17.0%, $p < 0.001$; preterm delivery: 23.53% vs. 9.7%, $p = 0.002$; Macrosomia: 19.12% vs. 7.3%, $p < 0.001$; neonatal hypoglycemia: 13.24% vs. 4.9%, $p < 0.001$; respiratory distress syndrome: 8.82% vs. 2.4%, $p < 0.001$) [24–28]. These results highlight the need of thorough prenatal treatment and vigilant observation of pregnancies impacted by GDM in order to reduce the risk of harm to women and their unborn children.

The independent predictors of GDM were further clarified by multivariate logistic regression analysis, which highlighted the importance of modifiable risk variables. Even after controlling for confounding variables, a number of significant risk factors for GDM were found, including having a family history of diabetes (Adjusted OR: 2.36, 95% CI: 1.41–3.95, $p = 0.001$), obesity (Adjusted OR: 3.18, 95% CI: 1.87–5.42, $p < 0.001$), advanced maternal age (Adjusted OR: 1.98, 95% CI: 1.12–3.51, $p = 0.019$), and leading a sedentary lifestyle (Adjusted OR: 1.75, 95% CI: 1.04–2.95, $p = 0.035$) [29–31]. These findings emphasize the need of focused treatments during pregnancy that target these modifiable risk factors via behavioral and lifestyle changes.

Conclusion

Our cross-sectional research provides insight into the incidence of GDM and related risk factors in expectant mothers who visit prenatal clinics. Significant correlations were seen between GDM and variables such obesity, advanced maternal age, sedentary lifestyle, poor nutrition, and family history of diabetes. Furthermore, there is a connection between GDM and unfavorable obstetric and pregnancy outcomes, which highlights the need of thorough prenatal care and vigilant observation. The significance of focused interventions to lessen the impact of GDM on maternal and newborn health was underscored by multivariate analysis, which also demonstrated the independent predictive value of modifiable risk variables. Preventive measures targeted at lowering the prevalence and unfavorable consequences of GDM are informed by these data, which provide insightful information on the epidemiology of the disease.

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