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ORIGINAL ARTICLE

Prevalence and risk factors of gestational diabetes mellitus in pregnant women at a tertiary health centre, Mardan, Pakistan

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A B S T R A C T

Introduction: Gestational diabetes mellitus (GDM) is characterized as impaired glucose tolerance that first occurs during pregnancy. GDM can lead to serious complications for both mother and fetus if undiagnosed or untreated. This study investigates the prevalence and risk factors of GDM among pregnant women at a tertiary health center in Mardan, Pakistan.

Methodology: A cross-sectional study was conducted from January 9, 2023, to December 8, 2023, at Swat Medical College and Women's Hospital Mardan. A total of 320 pregnant women were screened using glucose challenge tests followed by oral glucose tolerance tests if initial results were abnormal. Data on socio-demographic factors, BMI, gravida status, and clinical history were collected and analyzed using SPSS version 23.0.

Results: The prevalence of GDM in the study population was 24%. Advanced maternal age, higher BMI, and multigravida status were significant risk factors for GDM. Women aged over 35 years had the highest prevalence (48%). Overweight and obese women had prevalences of 30% and 32%, respectively. Multigravida women had a GDM prevalence of 32% compared to 22% in primigravida women. Family history of diabetes mellitus and history of GDM were the most common risk factors among GDM patients.

Conclusion: The high prevalence of disease and its association with factors such as age, BMI, gravida status, and family history underscores the need for targeted screening and prevention strategies. Health education and lifestyle interventions should be prioritized to mitigate the impact of GDM on maternal and fetal health.

Keywords: *Gestational diabetes mellitus (GDM), Maternal age, Body mass index (BMI), Family history, Pregnancy complications.*

Introduction

Gestational diabetes mellitus (GDM) is characterized as impaired glucose tolerance (IGT) that initially develops throughout pregnancy.[1] During pregnancy, there are two different types of diabetes: overt (FBS ≥126 mg/dl, HbA1c ≥6.5, or random blood sugar ≥200 mg/dl) and gestational diabetes mellitus (FBS ≥92 mg/dl but <126 mg/dl, 1 hour ≥ 180 mg/dl, or 2 hours ≥153 mg/dl). Undetected or untreated gestational diabetes can cause serious difficulties for both the mother and the fetus. GDM can lead to maternal problems such as polyhydramnios, pre-eclampsia, protracted labor, obstructed labor, cesarean delivery, uterine atony, postpartum hemorrhage, infection, and retinopathy development. Genetic abnormalities, intrauterine growth restrictions (IUGR), macrosomia, organ/growth complications, and stillbirth/intrauterine fetal death (IUFD) are all possible outcomes for the fetus.[2] In Pakistan, the frequency of GDM is reported to be 10-14.3%. GDM has a prevalence of 17.8% in urban zones, 13.8% in semi-urban regions, and 9.9% in rural regions.[3]

Preventing challenges by maternal euglycemia is a key strategy.[4] GDM has both immediate and long-term clinical impacts, contributing to a rise in noncommunicable disease burden in many nations. This cross-sectional study evaluated the prevalence and risk markers of GDM and its relationship with socio-demographic factors such as age, economic position, family history, parity, education, physical activity, and diet.

Methodology

The study was conducted in Swat Medical College and Women's Hospital Sheikh Maltoon TownMardan, Pakistan from 9 January 2023 to 8 December 2023 after taking approval from Institutional Review Board and Ethical Committee Ref. No. RC-EA-2023/083. The study sample was estimated using a 10% prevalence of GDM and a 95% confidence level. The assessment was conducted in a rural environment on prenatal patients at SVMCH and RC. This research will screen 164 consenting competent women throughout their hospital visits. This hospitalized descriptive research aims to collect data. The study was entirely quantitative and observational.[5-6]

The data was taken from a single hospital. Participants filled out the supplied questionnaires to provide the required information. Patients who met the eligibility criteria for the study were assessed, their gestational age was estimated, and informed consent was obtained. The patient had a comprehensive history, basic inspection, systemic testing, and routine investigation. Healthy patients were utilized as controls. At the initial appointment, all patients underwent a glucose challenge test. If GCT was regular, it was repeated between 24-28 weeks and again at 32 weeks of pregnancy.[7-8]

A blood sugar test was conducted using 50 g of glucose mixed in one glass of water, regardless of the fasting condition. Blood was drawn from patients via venipuncture (2 ml), permitted to coagulate, and then purified by Centrifugation at room temperature. Serum was kept at 2-8°C until use. GOD-POD was employed for calculating blood glucose levels. A blood sugar level of ≥140 mg/dl was used to determine GDM. If the glucose test was inappropriate, a 2-hour oral glucose tolerance test was administered. Blood was obtained after an 8-hour fast. After testing, 75 g of oral glucose was dissolved in 300 ml of water, and blood glucose levels were determined after 1–2 hours. If vomiting happens within 30 minutes of ingesting glucose, the test is carried out the following day. If vomiting happened after 30 minutes, the test proceeded. The pregnancy was tracked and documented.[9-10]

Statistical analysis was conducted using SPSS software version 23.0, particularly chi-square and Fisher's exact tests. A reverse logistic regression model was used to analyze related risk variables for GDM. This study centered just on GDM as the variable of interest, with every other risk factor being independent. The results were presented as the mean standard deviation for quantifiable data as well as a percentage for qualitative information. Logistic regression analysis was carried out using the odds ratio (OR) with 95% confidence interval. P-values <0.05 were deemed significant.

Results

The current study was conducted on 320 randomly selected pregnant females visiting the Swat Teaching Hospital and Women's University Mardan, Pakistan. The results in Table 1 have shown the comprehensive distribution of patients with gestational diabetes based on age, body mass index (BMI), gravida status, and the presence of its associated potential risk factors. Age-wise distribution showed that females below 20 years of age have no increase in sugar level during pregnancy but when the age is 21 to 24 years, 3 out of 3 females (5%) found diabetic. This frequency was increased up to 19% (14 out of 79 females) when the age was 25 to 29 years. It is noted that in the age group between 30 to 34 years and above 35 years, the prevalence of GBM was 28% and 48 (29 out of 61 pregnant females). The overall rate out of 320 females was 24% with high blood sugar levels during pregnancy.

If the data was collected according to the body weights, the Females with normal BMI in the range of 18.5 to 2.9 kg/m^2 have a very low prevalence (10%) only 8 out of 79. But when females' weight crosses the normal index prevalence of GDM was seen as high at 30% i.e. 46 out of 151 patients. When the patients were obese, 32% of females were diagnosed with high sugar levels in their blood.

Table 1: Age and BMI-wise distribution of patients with GDM

Variables	No. of cases	GDM cases and Percentage
Age (years) distribution of patients with GDM		
<20	4	0 (0%)
21-24	63	3 (5%)
25-29	79	14 (19%)
30-34	113	32 (28%)
>35	61	29 (48%)
Total	320	78 (24%)
BMI (kg/m2) wise distribution of patients with GDM		
18.5-24.9	79	8 (10%)
25.0-29.9	151	46 (30%)
>30	90	29 (32%)
Total	320	83 (26%)
Gravida-wise distribution of patients with GDM		
Primigravida	124	27 (22%)
Multigravida	196	62 (32%)
Total	320	89 (28%)
Associated risk factors for GDM		
Absent	96	12 (12%)
Present	224	53 (24%)
Total	320	

When the females conceived for the first time, then data from current research related to primigravida patients have shown that 27 of 124 females i.e. 22% were suffering from GDM, and in the case of multigravida prevalence of the disease was 32%. During the current study, data related to associated clinical manifestations was also collected. 24% of females have associated risk factors along with GDM during pregnancy that can have an impact on worsening their conditions. So, higher age, multiple pregnancies with very little gap, and associated risk factors can notably become the risk of GDM.

Table 2 outlines the prevalence of specific risk factors among patients with gestational diabetes mellitus (GDM). A total of 53 patients were evaluated for the presence of these risk factors. The most common risk factor observed is a family history of DM, with 39 out of 53 patients (73%) having this background. This suggests a strong genetic predisposition to developing GDM among these patients. 6 patients (11%) had babies that were large for their gestational age. This risk factor is less prevalent but still notable. A significant number of patients, 44 out of 53 (83%), had a previous history of GDM, indicating that past occurrences of GDM are a strong predictor for recurrence in subsequent pregnancies. 5 patients (9%) had experienced neonatal loss or stillbirth previously, which is a relatively rare but critical risk factor. 7 patients (13%) had a history of delivering a premature baby, indicating a link between premature births and GDM. The least common risk factor was a previous pregnancy with congenital anomalies, found in 2 out of 53 patients (4%).

Table 3 presents the distribution of plasma glucose levels in the study population (n=320) at the 1-hour mark post-glucose intake, alongside fasting plasma glucose levels. <140 mg/dL: 62 patients (19%) had plasma glucose levels below 140 mg/dL, indicating normal glucose tolerance in a minority of the study population. ≥140 mg/dL: A substantial portion, 141 patients (44%), had plasma glucose levels equal to or exceeding 140 mg/dL but less than 200 mg/dL, suggesting impaired glucose tolerance or potential GDM.

>200 mg/dL: A significant number, 117 patients (36%), exhibited plasma glucose levels exceeding 200 mg/dL, which is diagnostic of GDM. <92 mg/dL: 57 patients (18%) had fasting plasma glucose levels below 92 mg/dL, falling within the normal range. 92-125 mg/dL: The majority, 153 patients (48%), had fasting plasma glucose levels between 92 and 125 mg/dL, which is indicative of impaired fasting glucose or GDM. >126 mg/dL: 110 patients (34%) had fasting plasma glucose levels above 126 mg/dL, consistent with a diagnosis of GDM.

Table 2: Distribution of patients with risk factors for GDM (n=53)

Risk factors	GDM cases and Percentage
Family history of DM	39 (73%)
large for gestational age (LGA)	6 (11%)
Past History of GDM	44 (83%)
neonatal loss or stillbirth previously	5 (9%)
Previous premature baby	7 (13%)
Previous pregnancy with congenital anomalies	2 (4%)

Table 3: Plasma glucose levels in the study population at 1 hour, n=320

mg/dl	N GDM cases and Percentage o. cases
<140	62 (19%)
≥140	141 (44%)
>200	117 (36%)
Fasting Plasma glucose levels	
<92	57 (18%)
92-125	153 (48%)
>126	110 (34%)
Plasma glucose levels in the study population	
1-hour value <180	127
1-hour value >180	37
2 hours value <153	125
2 hours value >153	39

Discussion

The prevalence of gestational diabetes mellitus (GDM) in this study was found to be 24%, which aligns with previous studies indicating that the prevalence of GDM in Pakistan ranges between 10% and 14.3% in various settings.[10] The high prevalence observed in our study population may reflect the particular socio-demographic and clinical characteristics of the women attending Swat Medical College and Women's Hospital, Mardan, Pakistan.

Age was a significant risk factor for GDM in this study. Younger women, particularly those under 20, exhibited no cases of GDM, while the prevalence significantly increased with age.[11-12] Women aged 21-24 years had a prevalence of 5%, which rose to 19% in those aged 25-29 years, and further to 48% in those aged over 35 years.[13] This trend suggests that advanced maternal age is a strong risk factor for GDM, which is consistent with global findings that indicate increasing maternal age is associated with a higher risk of GDM. This can be attributed to age-related changes in glucose metabolism and insulin sensitivity.[14-15]

Our study demonstrated a strong association between BMI and the risk of GDM. Women with a normal BMI (18.5-24.9 kg/m²) had a low prevalence of GDM (10%), whereas overweight (BMI 25.0-29.9 kg/m²) and obese (BMI >30 kg/m²) women had significantly higher prevalence's of 30% and 32%, respectively.[16] These findings align with the well-established link between increased BMI and GDM risk, as excess adipose tissue contributes to insulin resistance and impaired glucose metabolism.[17]

Gravida status also influenced the prevalence of GDM, with multigravida women showing a higher prevalence (32%) compared to primigravida women (22%). This could be due to the cumulative effect of multiple pregnancies on glucose metabolism and the potential for residual metabolic changes from previous pregnancies.[18] Family history of diabetes mellitus (DM) was the most common risk factor among women with GDM, with 73% of GDM cases having a positive family history. This underscores the genetic predisposition to GDM. Additionally, 83% of women with GDM had a history of GDM, highlighting the high recurrence risk in subsequent pregnancies.[9] Other risk factors included a history of delivering large-for-gestational-age babies (11%), neonatal loss or stillbirth (9%), previous premature delivery (13%), and previous pregnancy with congenital anomalies (4%). These findings suggest that a comprehensive clinical history is crucial for identifying women at high risk for GDM.[5,7]

The distribution of plasma glucose levels in the study population further substantiates the prevalence of impaired glucose metabolism.[11,14] A significant proportion of women had plasma glucose levels ≥140 mg/dL at 1 hour post-glucose intake, and fasting plasma glucose levels ≥92 mg/dL. These findings highlight the importance of regular glucose monitoring during pregnancy to identify and manage GDM early, thereby preventing adverse maternal and fetal outcomes.[12]

The high prevalence of GDM and its strong association with factors such as age, BMI, gravida status, and family history underscores the need for targeted screening and prevention strategies. Health education and lifestyle interventions, particularly aimed at weight management and glucose monitoring, should be prioritized in antenatal care programs. Additionally, women with a history of GDM should receive counseling and close monitoring in subsequent pregnancies.

Conclusion

This study highlights a significant burden of GDM among pregnant women in Mardan, Pakistan, with advanced maternal age, higher BMI, multigravida status, and family history of DM being key risk factors. These findings emphasize the need for early screening, risk factor modification, and appropriate management to mitigate the impact of GDM on maternal and fetal health. Further research is warranted to explore the underlying mechanisms and to develop effective prevention and intervention strategies tailored to the local population.

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