Original Research Article

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Risk factors and glycemic control patterns in women with gestational diabetes mellitus

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Abstract

Introduction: Gestational diabetes mellitus (GDM) is a common metabolic disorder of pregnancy, characterized by glucose intolerance that is first recognized during gestation. Several maternal factors, such as advanced age, overweight or obesity, and family history of diabetes, contribute to its development. Effective glycemic control during pregnancy is essential to reduce adverse outcomes. This study aimed to identify the maternal risk factors associated with GDM and to evaluate patterns of glycemic control.

Methods: This cross-sectional observational study was conducted in the Department of Obstetrics and Gynecology, at Anwer Khan Modern Medical College and Hospital, Dhaka, Bangladesh, from January 2025 to December 2025, including 58 pregnant women diagnosed with GDM. Data were analyzed using the Statistical Package for the Social Sciences version 26.0.

Result: Overweight/obesity (60.3%), positive family history of diabetes (46.6%), previous GDM (24.1%), and polycystic ovary syndrome (19.0%) were common risk factors. Mean fasting glucose was 101.8 ± 12.6 mg/dL, 1-h OGTT was 188.4 ± 26.3 mg/dL, 2-h OGTT was 164.7 ± 21.9 mg/dL, and glycated hemoglobin was.9 ± 0.6%. Glycemic control was achieved with lifestyle alone in 41.4%, oral agents in 31.0%, and insulin in 27.6%. Overall, 67.2% had adequate control, whereas poor control (32.8%) was associated with higher body mass index, age ≥30 years, family history, and insulin requirement, with post-prandial hyperglycemia more frequent than fasting.

Conclusion: This study demonstrates that GDM is closely linked to advanced maternal age, pre-pregnancy overweight or obesity, a positive family history of diabetes, and unfavorable glycemic patterns during pregnancy. A considerable number of women required pharmacological treatment alongside lifestyle interventions, and almost one-third did not achieve adequate glycemic control, with post-prandial hyperglycemia occurring more frequently than fasting hyperglycemia.

Keywords: Gestational diabetes mellitus, glycemic control, OGTT

Introduction

Gestational diabetes mellitus (GDM) refers to a condition characterized by glucose intolerance that occurs for the 1st time or is initially detected during pregnancy. It is considered one of the most prevalent metabolic disorders among pregnant women globally.[1] Over the last 10 years, the worldwide incidence of GDM has been on the rise. This is mainly because of an increasing maternal age, a higher prevalence of obesity, unhealthy lifestyle habits, and the use of diagnostic criteria that are more sensitive.[2] GDM leads to the mother and child facing both immediate and future health

risks; hence, it is a major public health issue. In fact, the disorder of GDM is mainly the result of increasing insulin resistance during pregnancy due to the effects of placental hormones such as human placental lactogen, estrogen, and progesterone acting in concert with insufficient pancreatic cell compensation.[3] Because of the failure of maternal insulin secretion to meet the increased metabolic requirements of pregnancy, the blood glucose rises, and the abnormal glucose transfer to the fetus takes place.[4] This changed intrauterine milieu leads to fetal hyperinsulinemia, excess fetal growth, and metabolic programming of the offspring, which results in a higher risk of obesity and type 2 diabetes in the future.[5] Instrumental risk factors of the mother have been strongly linked with the occurrence of GDM. The evidence suggests that the risk is significantly increased in advanced maternal age, especially over 30 years, due to the insulin resistance and decreased cell function associated with aging.[6] One of the main reasons for the occurrence of GDM is pre-pregnancy overweight and obesity, as excessive fat accumulation helps worsen insulin resistance and inflammatory pathways.[2] A family history of type 2 diabetes mellitus is an indication of shared genetic susceptibility and certain living habits, which in turn increase the risk of GDM.[7] Multiparity, previous history of GDM, polycystic ovary syndrome (PCOS), and excessive gestational weight gain are some other recognized risk factors for the condition.[6,7] Ethnic and regional differences in GDM prevalence have also been extensively reported. Women of South Asian, Middle Eastern, African, and Hispanic descent have a higher risk of developing GDM as compared to Caucasian populations, even at lower body mass index (BMI) levels.[4] Such differences highlight the need for population-specific studies to determine risk profiles that are pertinent and, hence, help develop customized screening strategies. In low- and middle-income countries, late diagnosis and restricted access to pregnancy care may still be the main factors worsening the problem of GDM and its associated complications.[1] Achieving proper glycemic control before, during, and after pregnancy, especially in women with GDM, is crucial in the effort to cut down on negative outcomes related to mothers and newborns. Poorly controlled blood glucose levels are linked to higher chances of pre-eclampsia, cesarean delivery, macrosomia, shoulder dystocia, neonatal hypoglycemia, and admission to neonatal intensive care units.[8] Glycemic patterns in women with GDM show great variability and are affected by several factors, including baseline insulin resistance, compliance with lifestyle changes, time of diagnosis, and treatment method.[9] This study aimed to identify the maternal risk factors associated with GDM and to evaluate patterns of glycemic control.

Methods

This was a cross-sectional observational study that was carried out in the Department of Obstetrics and Gynecology, at Anwer Khan Modern Medical College and Hospital, Dhaka, Bangladesh, from January 2025 to December 2025, involving 58 pregnant women with GDM according to the IADPSG criteria (fasting glucose 92 mg/dL, 1 h 180 mg/dL, or 2 h 153 mg/dL).[1] Patients with pre-existing diabetes, multiple gestations, or chronic systemic diseases were not considered. Maternal age, parity, gestational age at diagnosis, pre-pregnancy BMI, family history of diabetes, previous GDM, history of macrosomia, PCOS, and hypertension were part of the demographic, obstetric, and clinical data obtained. Assessments of glycemia involved fasting plasma glucose, 1 h and 2 h post-OGTT, and glycated hemoglobin (HbA1c), whereas glycemic control at follow-up was classified as adequate or poor depending on the fasting and post-prandial targets used. All the subjects were put on medical nutrition therapy (MNT), and if the glycemic targets were not attained, then oral hypoglycemic drugs or insulin were added. The data were processed using the Statistical Package for the Social Sciences version 26.0, with continuous variables being presented as mean, SD, and categorical variables as number and percentage; the Chi-square test was used to determine the association, and $P < 0.05$ was considered statistically significant. The study was

given the green light by the Institutional Review Board, and informed consents was obtained from participants.

Results

The average age of the study participants was 29.6 with a standard deviation of 4.8 years. More than half of the participants (53.4%, 31 out of 58) were 30 years old. The majority of the study population were multigravida women (58.6%, 34 out of 58). The diagnosis of GDM was at a mean gestational age of 26.8 weeks with a standard deviation of 3.5 weeks, and 62.1% of the participants came from urban areas [Table 1]. Overweight or obesity (BMI 25 kg/m) was the most common risk factor, which was manifested in 60.3% (35 out of 58) of the women. A positive family history of diabetes was experienced by 46.6% (27 out of 58). One out of four (24.1%) had a previous history of GDM, whereas 19.0% (11 out of 58) had PCOS [Table 2]. The mean fasting plasma glucose at diagnosis was 101.8 ± 12.6 mg/dL, whereas the mean 1 h and 2 h OGTT values were 188.4 26.3 mg/dL and 164.7 21.9 mg/dL, respectively. The mean HbA1c level was 5.9 0.6%, which corresponds to mild-to-moderate hyperglycemia at diagnosis [Table 3]. Dietary modification alone was enough to bring the glycemic level back to normal in 41.4% (n = 24) of the women. Oral hypoglycemic agents were used by 31.0% (n = 18), and 27.6% (n = 16) required insulin in addition to MNT [Table 4]. The study found that 67.2% (n = 39) of the patients had achieved adequate glycemic control during the follow-up period. There were, however, 32.8% (n = 19) of patients whose glycemic control remained poor. Post-prandial hyperglycemia (36.2%) was one of the most frequent types of hyperglycemia seen, more so than isolated fasting hyperglycemia (25.9%) [Table 5]. There was a significant difference in the distribution of poor glycemic control between the groups depending on BMI or age. 42.9% of women with a BMI of 25 kg/m had poor glycemic control as against 21.7% of those with a BMI <25 (P = 0.02). More women who were 30 years of age (45.2%) had poor glycemic control as compared to 22.7% of those who were <30 years old (P = 0.03). Having a positive family history of diabetes turned out to be a factor significantly associated with poor control (P = 0.04). Requirement of insulin was one

Table 1: Demographic and obstetric characteristics of the study population (n=58)

Variable	Frequency (%)/mean±SD
Age (years)	29.6±4.8
Age ≥30 years	31 (53.4)
Primigravida	24 (41.4)
Multigravida	34 (58.6)
Gestational age at diagnosis (weeks)	26.8±3.5
Urban residence	36 (62.1)
Rural residence	22 (37.9)

SD: Standard deviation

Table 2: Distribution of maternal risk factors for GDM (n=58)

Risk factor	Frequency (%)
Pre-pregnancy BMI ≥25 kg/m^2	35 (60.3)
Family history of diabetes	27 (46.6)
Previous history of GDM	14 (24.1)
History of macrosomia	9 (15.5)
Polycystic ovary syndrome	11 (19.0)
Hypertension in pregnancy	13 (22.4)

GDM: Gestational diabetes mellitus, BMI: Body mass index

Table 3: Baseline glycemic parameters at diagnosis (n=58)

Glycemic parameter (mg/dL)	Mean±SD
Fasting plasma glucose	101.8±12.6
1-h post-OGTT	188.4±26.3
2-h post-OGTT	164.7±21.9
HbA1c (%)	5.9±0.6

SD: Standard deviation, HbA1c: Glycated hemoglobin

Table 4: Treatment modalities used for glycemic control (n=58)

Treatment modality	Frequency (%)
Medical nutrition therapy (MNT) only	24 (41.4)
MNT+oral hypoglycemic agents	18 (31.0)
MNT+insulin therapy	16 (27.6)

of the variables most strongly associated with poor glycemic control (81.3%, $P < 0.001$) [Table 6].

Discussion

In this study, the average age of mothers was 29.6 4.8 years, and 53.4% of women were aged 30 years. 58.6% of the women were multigravida. Tobias *et al.* reported the mean age of 31.2–5.1 years among women with GDM in a large cohort study, where the risk of GDM increased significantly after 30 years of age.[6] Likewise, Li *et al*., through pooled analyses, found that women aged 30 years had a 1.62.4 fold higher risk of GDM than younger women.[10] The majority of multigravida women in our study is consistent with the work of Zhang and Ning, who reported 61% of multigravidity among GDM cases and suggested that with each successive pregnancy, the metabolic stress accumulates.[7] Before pregnancy, more than half of the women in our study (60.3%) were overweight or obese (BMI 25 kg/m), and almost half (46.6%) had a family history of diabetes. In contrast, Catalano and Shankar, who reported obesity in 55, 65% of women with GDM, pointed out that fatness is the main cause of insulin resistance.[5] Guariguata *et al*. stated that 40–50% of GDM cases worldwide have a positive family history of diabetes, which is consistent with our findings.[2] A history of GDM was reported in 24.1% of our patients, which is in line with the 20–30% recurrence rates reported by Kim *et al*. in longitudinal studies.[11] At the time of diagnosis, the average fasting plasma glucose in our study was 101.8–12.6 mg/dL, with mean 1-h and 2-h OGTT values of 188.4–26.3 mg/dL and 164.7–21.9 mg/dL, respectively. Metzger *et al*. showed in the HAPO study that women who met the GDM criteria had average fasting glucose levels of 95, 105 mg/dL, and 2-h levels were approximately 160, 170 mg/dL.[12] In our study, 41.4% of patients met glycemic targets through MNT only, 31.0% needed oral hypoglycemic drugs, and 27.6% required insulin therapy. According to Crowther *et al*., about 45% of women with GDM were able to adequately control their condition through lifestyle changes only, whereas 20–30% needed insulin treatment.[9] 67.2% of women got their glycemia under control, whereas 32.8% had poor control. Post-prandial hyperglycemia (36.2%) was more common than isolated fasting hyperglycemia (25.9%). Hernandez *et al*. found that post-prandial glucose excursions occurred in 35–40% of GDM patients even when fasting glucose levels were at an acceptable level, thus highlighting post-meal monitoring's clinical relevance.[13] Poor glycemic control was found to be highly associated with BMI ≥25 kg/m (42.9%), age ≥30 years (45.2%), family history of diabetes (44.4%), and insulin administration (81.3%). Hedderson *et al*. revealed that obese women with GDM were nearly twice as likely to have unsatisfactory glycemic control compared to women of normal weight.[14] In the same way, advanced maternal age and the necessity of insulin have been recognized as indicators of more severe insulin resistance and cell dysfunction, which is in agreement with our findings.

Table 5: Glycemic control status during follow-up (n=58)

Glycemic control status	Frequency (%)
Adequate glycemic control	39 (67.2)
Poor glycemic control	19 (32.8)
Fasting hyperglycemia	15 (25.9)
Post-prandial hyperglycemia	21 (36.2)

Table 6: Association between selected risk factors and poor glycemic control (n=58)

Risk factor	Poor control *n* (%)	*P*-value
BMI ≥25 kg/m^2	15/35 (42.9)	0.02
Age ≥30 years	14/31 (45.2)	0.03
Family history of diabetes	12/27 (44.4)	0.04
Insulin requirement	13/16 (81.3)	<0.001

BMI: Body mass index

Limitations of the study

The study was conducted in a single hospital with a small sample size. Hence, the results may not represent the whole community.

Conclusion

This study highlights that GDM is strongly associated with advanced maternal age, pre-pregnancy overweight or obesity, positive family history of diabetes, and adverse glycemic patterns during pregnancy. A substantial proportion of women required pharmacological therapy in addition to lifestyle modification, and nearly one-third failed to achieve optimal glycemic control, with post-prandial hyperglycemia being more prevalent than fasting abnormalities. Poor glycemic control was significantly linked to higher BMI, older age, family history of diabetes, and insulin requirement.

Recommendation

Early identification of women at high risk for GDM through routine antenatal screening, particularly among those with advanced maternal age, elevated BMI, and a family history of diabetes, is strongly recommended. Emphasis should be placed on timely lifestyle counseling, regular monitoring of both fasting and post-prandial glucose levels, and individualized treatment plans to achieve optimal glycemic control.

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