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Risk Factors of Gestational Diabetes Mellitus in Bangladesh

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ABSTRACT

Background & Objective: Gestational diabetes mellitus (GDM), a common metabolic complication of pregnancy, carry an increased risk of adverse pregnancy outcomes for both mothers and their offspring in every population. Although several risk factors are in common for every population, some risk factors differ from population to population. The present study was therefore designed to determine the risk factors of GDM in the context of Bangladeshi population.

Methods: The present case-control study was conducted in the BIRDEM-2 General Hospital, Dhaka over a period of 2 months from November 2021 to December 2021. Pregnant women with confirmed GDM at their 2nd and 3rd trimesters (above 12 weeks of gestation) were taken as case (n = 31) and normal pregnant women at their 2nd and 3rd trimesters were included as control (n = 35). Pre-pregnancy diabetes, multiple gestation, unexplained abnormal pre-pregnancy body mass index, pregnant women in labor, or with chronic diseases, such as, tuberculosis, malignancy, renal failure, congestive heart failure, and advanced liver failure, and any other serious illnesses were excluded from the study. While the outcome variable in the present study was GDM, the exposure variables were grouped into demographic variables (age, residence, occupation and socioeconomic status), BMI, obstetric and reproductive characteristics (gestational age, gravida, parity, age at menarche, age at first pregnancy), pertinent past history (pre-pregnancy obesity, family history of Type-II diabetes), current obstetric history (polyhydramnios and UTI). A 2 h diagnostic 75 g oral glucose tolerance test (OGTT) was performed after an 8–12 hour overnight fast according to WHO Criteria. The diagnosis of GDM was made when at least one of the two oral GTT values were raised: fasting blood glucose > 95 mg/dl (5.3 mmol/L), of 2 h postprandial glucose ≥ 140 mg/dl (7.8 mmol/L).

Result: The present study demonstrated that GDM cases were on an average 3.2 years older than the normal pregnant women (p = 0.010). They were also heavier than the control women in terms of BMI (p = 0.094). The history of Type-II diabetes in the first-degree relatives of GDM women was significantly higher than that in the non-GDM (p < 0.001). Hypertensive disorders in the present pregnancy and previous history of preterm birth showed their significant presence in the GDM group than those in the control group (p = 0.013 and p = 0.044 respectively). The history spontaneous abortion in previous pregnancy was considerably higher in the former group than those in the latter group.

Conclusion: The study concluded that advanced maternal age, overweight and obesity, history of Type-II diabetes in the first-degree relatives of GDM women, hypertensive disorders of pregnancy in the current pregnancy and past history of preterm birth are the significant risk factors for GDM.

Key words: Risk factors, gestational diabetes mellitus etc.

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INTRODUCTION:

Gestational diabetes mellitus (GDM) is one of the common metabolic complications during pregnancy and is associated with an increased risk of adverse pregnancy outcomes for both mothers and their offspring.[1-4] It is defined as any degree of glucose intolerance with onset or first recognition during pregnancy. It more commonly manifests during the 2nd and 3rd trimester, although symptoms may start to be noticed as early as the end of the second trimester. Symptoms include blurred vision, fatigue, regular infections of urinary tract, vagina, and skin; increased thirst, appetite and urination; nausea and vomiting; and loss of weight. Insulin is a blood sugar-regulating hormone and gestational diabetes mellitus occurs either when the pancreas does not produce enough insulin or when the insulin it produces cannot be used efficiently by the body.[5]

The global prevalence of GDM varies widely from 1 to 28% depending on population characteristics, screening methods, and diagnostic criteria.[6] The International Diabetes Federation (IDF)-2015 report showed that about 16.2% of women had some form of hyperglycemia during pregnancy, of which GDM shares 85% of the load.[7] A review revealed the prevalence varies from 5.4% in Europe[8] to 11.5% in Asia.[9] Likewise, the IDF report indicated that there were regional differences in the magnitude of hyperglycemia during pregnancy, for instance, the South-East Asia region had higher (24.2%) prevalence as compared to 10.5% on the African Region. Majority (87.6%) of GDM accounts in low and middle-income countries, where access to maternal care was often limited.[7] However, as the different studies used different screening and diagnostic criteria, the true prevalence of the disease is masked. Risk factors of GDM include excessive body weight, low level of physical activity, consanguineous marriage, previous history of GDM, and history of cardiovascular disease.[10] As the toll of overweight and obese reproductive-age females soars, the risk of developing hyperglycemia in pregnancy increases.[11]

GDM has a global public health burden[12] with both short- and long-term consequences on health.[13] The short-term ramifications of GDM include adverse maternal outcomes like preeclampsia & polyhydramnios with increased risk of cesarean section & adverse neonatal outcome like macrosomia and shoulder dystocia neonatal hypoglycemia, hyperbilirubinemia, and neonatal respiratory distress syndrome,[14] whereas the long-term complications of GDM incorporate the risk of type 2 diabetes mellitus (T2DM) for the mother and the risk of childhood obesity, impaired glucose tolerance, and/or metabolic syndrome for their neonates.[14] Considering the short- and long-term consequences of GDM, it is of utmost need to reduce the risk factors of GDM. Therefore, understanding the risk factors and pathophysiological mechanisms of GDM are of immense significance to identify the women at risk of developing GDM, to develop effective preventive measures against the disease. The present study was therefore intended to determine the risk factors of GDM in the context of Bangladeshi population.

METHODS:

This case-control study was conducted in the BIRDEM-2 General Hospital, Dhaka over a period of 2 months from November 2021 to December 2021. Pregnant women with confirmed GDM at their 2nd and 3rd trimesters were taken as case and normal pregnant women at their 2nd & 3rd trimesters were termed as controls. Pre-pregnancy diabetes, multiple gestation, unexplained abnormal pre-pregnancy body mass index, pregnant women in labor, or with chronic diseases, such as, tuberculosis, malignancy, renal failure, congestive heart failure, and advanced liver failure, and any other serious illnesses were excluded from the study. On approval from the Ethical Review Committee (ERC) and verbal consent from the eligible pregnant women (31 cases and 35 controls) were consecutively included in the study based on predefined eligibility & diagnostic criteria.

While the outcome variable in the present study was GDM, the exposure variables were grouped into demographic variables (age, residence, occupation & socioeconomic status), BMI, obstetric & reproductive characteristics (gestational age, gravida, parity, age at menarche, age at first pregnancy), pertinent past

history (pre-pregnancy obesity, family history of Type-II diabetes), current obstetric history (polyhydramnios and UTI) and biochemical variables (level of haemoglobin, serum calcium and serum creatinine) etc. A 2 h diagnostic 75 g oral glucose tolerance test (OGTT) was performed after an 8–12 hour overnight fast according to WHO Criteria. The diagnosis of GDM was made when at least one of the two oral GTT values were raised: fasting blood glucose > 95 mg/dl (5.3 mmol/L), or 2 h postprandial glucose ≥ 140 mg/dl (7.8 mmol/L).

Collected data were analyzed using SPSS (Statistical Package for Social Sciences) for Windows, version 20.0 (SPSS, Inc, Chicago, IL). The test statistics used to analyze the data were descriptive statistics (frequency, Mean, and SD), Chi-Square (χ^2) Test and Unpaired t-Test. Chi-square (χ^2) Test was used to measure the probability of association between two qualitative attributes, while Unpaired t-Test was done to compare the continuous data between the two study groups. The level of significance was set at 5% and $p < 0.05$ was considered significant.

RESULTS:

Demographic characteristics of the study groups show that cases were significantly older than their control counterparts (p=0.010). Both cases and controls were predominantly urban residents (p= 0.198) and housewife in terms of occupation. Around 60% of both cases and controls belonged to upper middle class (p=0.117). The mean BMI of the case group was higher than that of the control group (p = 0.094) (Table I). The mean gravida was 2 ± 1 in both the study groups (p=780). The age at menarche was also similar between the groups (p=0.660). The mean age at first pregnancy was somewhat higher in the case group than that in the control group, although the difference between the groups was not significant (p=0.081) (Table II). Comparison of pertinent past history revealed that type-II diabetes in the first-degree relatives was staggeringly higher in case group than that in the control group (p < 0.001). The history of GDM in the past pregnancy, past histories of preterm birth, still-birth and spontaneous abortion all were considerably higher in the former group than those in the latter group (Table III).

Hypertensive disorders in the current pregnancy demonstrated their significant presence in the case group than that in the control group (p = 0.013). However, the groups were not significantly different with respect to obesity, UTI and polyhydramnios (p=0.454, p = 0.431 and p = 0.454 respectively) (Table IV).

Table I: Comparison of Demographic characteristics between groups

Demographic characteristics	Group		p-value
	Case (n = 31)	Control (n = 35)	
Age (years)#	30.8 ± 5.1	27.6 ± 4.6	0.010
Residence**			
Urban	28(90.3)	35(100.0)	0.198
Rural	3(9.7)	1(2.8)	
Occupation*			
Housewife	23(74.2)	31(88.6)	
Service-holder	8(25.8)	3(8.6)	0.121
Others	0(0.0)	1(2.9)	
Socioeconomic status*			
Lower middle class		3(9.7)	0(0.0)
Middle class	9(29.0)	15(42.9)	0.117
Upper middle class	19(61.3)	20(57.1)	
BMI (kg/m2)#	29.5 ± 5.2	27.5 ± 4.1	0.094

Figures in the parentheses indicate corresponding %;
***Chi-squared Test** (χ^2) was done to analyzed the data;
****Fishers Exact Test** was employed to analyze the data.
#Data were analyzed using **Unpaired t-Test** and were presented as **mean ± SD**.

Table II: Comparison of obstetric & reproductive characteristics between groups

Obstetric & reproductive characteristics#	Group		p-value
	Case (n = 31)	Control (n = 35)	
Gravida	2 ± 1	2 ± 1	0.780
Age at menarche (years)	12.2 ± 0.8	12.3 ± 1.3	0.660
Age at first pregnancy (years)	25.8 ± 6.3	23.4 ± 4.6	0.081

#Data were analyzed using **Unpaired t-Test** and were presented as **mean ± SD.**

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Table III: Comparison of pertinent past history between groups

Pertinent past history	Group		p-value
	Case (n = 31)	Control (n = 35)	
Obesity before pregnancy**	2(6.5)	0(0.0)	0.217
Type II diabetes in the first-degree relatives*	21(67.7)	7(20.0)	< 0.001
GDM history in the previous pregnancy**	4(12.9)	2(5.7)	0.280
Past history of preterm birth**	5(16.1)	1(2.9)	0.044
Past history of stillbirth**	3(9.7)	1(2.9)	0.262
Past history of spontaneous abortion*	13(41.9)	7(20.0)	0.112

Figures in the parentheses indicate corresponding %; ***Chi-squared Test** (χ^2) was done to analyzed the data; ****Fisher's Exact Test** was done to analyzed the data.

Table IV: Comparison of current obstetric history between groups

Current obstetric history**	Group		p-value
	Case (n = 31)	Control (n = 35)	
Obesity during pregnancy	2(6.5)	1(2.9)	0.454
Hypertensive disorders of pregnancy	7(22.6)	1(2.9)	0.013
UTI	4(12.9)	3(8.6)	0.431
Polyhydramnios	2(6.5)	1(2.9)	0.454

Figures in the parentheses indicate corresponding %; ****Fisher's Exact Test** was done to analyzed the data.

DISCUSSION:

The present study demonstrated that GDM cases were on an average 3.2 years older and 2 kg/m^2 heavier than the normal pregnant women. The history of Type-II diabetes in the first-degree relatives of GDM women was commendably higher than that in the non-GDM women. Hypertensive disorders in the current pregnancy and past history of preterm birth demonstrated their significant presence in the GDM group than those in the control group. The history of spontaneous abortion in previous pregnancy was considerably higher in the former group than that in the latter group. Studies conducted in different corners of the world have demonstrated several risk factors to be implicated in the development of GDM. These are generally similar to the factors associated with overt diabetes and include increased maternal age, obesity, ethnic background, family history of T2DM and a previous history of GDM.[16] In a nested case-control study, women who presented an increasing weight at a rate of 2.3-10.0 kg/year had a 2.5-times increased risk for GDM.[17] Other reported risk factors include essential hypertension or gestational hypertension and multiple pregnancies.[18]

In a large prospective study (GDM, n = 39 and Non-GDM, = 776), conducted in Trabzon province of Turkey, the incidence of GDM was found to be moderate (4.8%) and it was positively associated with advanced maternal age, pre-pregnancy body mass index, cessation of cigarette smoking, weight gain of more than 8 kg during pregnancy, and a history of diabetes in first-degree relatives of pregnant women.[19] Duman[20] in a large prospective study in Pakistan also demonstrated age, BMI, family history of diabetes and GDM in previous pregnancy as statistically significant risk factors for GDM. Studies by Turgut et al[21] & Dunhbai et al[22] supported the role of advanced age, a history of DM in the first-degree relatives and a history of GDM in previous pregnancy in the development of GDM. Several other studies pointed out advanced age and BMI as risk factors for GDM.[23,24] The findings of the present study are in agreement with these reports.

Gestational diabetes mellitus is a common health problem and its incidence is increasing globally. The incidence may vary based on geographical location.[23] High incidence rates have been reported in studies from Australia (Indian-born 15%, Chinese 13.9%) and the United States (Zuni Indians 14.3%).[25] These differences may reflect the effects of dynamic interactions among genetic, demographic, sociocultural and economic factors. Statistical variations are partly due to differences in the screening methods and diagnostic criteria used.[23,25]

As GDM may increase the risk of a number of pregnancy-related complications, its screening is important both for the maternal and fetal health. Some experts hold the view that routine GDM screening may actually not be necessary due to the absence of solid data that show a high complication rate among women with GDM.[26-28]

However, opinions as to the timing of GDM screening differ. According to WHO all pregnant women should be screened for GDM between 24th and 28th weeks of pregnancy.[27] On the contrary, ACOG (2001) & American Diabetes Association (ADA, 2004) recommend that high-risk pregnant women (age ≥ 25 years, obese,

previous history of GDM, presence of a large fetus for gestational age, glucosuria and polycystic ovary) be screened in the first trimester, while screening between the 24th and 28th weeks of pregnancy may be appropriate for the remaining pregnant women.[26,28] If there are no obvious risk factors, ACOG (2001) also recommends the "no-screen" option.[28]

CONCLUSION:

From the findings of the study it appears that advanced maternal age overweight and obesity, history of Type-II diabetes in the first-degree relatives of GDM women, hypertensive disorders in the current pregnancy and past history of preterm birth are the significant risk factors for GDM. The past history of spontaneous abortion may also influence the development of GDM in current pregnancy. The findings of study suggest universal screening for GDM in context of our country. Multi-center, prospective population-based studies with large sample size are needed to determine the independent risk factors for GDM.

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