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Impact of Risk Factors for Gestational Diabetes (GDM) on Pregnancy Outcomes in Women with GDM in a Single Center Study in Rural Area

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Abstract

Background: Gestational diabetes mellitus (GDM) is a kind of hyperglycemia that initially appears or is detected during pregnancy, which is one of the most common obstetric complications. Gestational diabetes mellitus (GDM) is a unique metabolic disorder that occurs during pregnancy. Both GDM and advanced age increase the risk of adverse pregnancy outcomes.

Objective: The aim of this study is to evaluate the impact of risk factors for gestational diabetes (gdm) on pregnancy outcomes in women with gdm. **Methods:** The cross-sectional observational study was conducted in Joypara Clinic and Diabetic Center, Dhaka, Bangladesh from June 2017 to May 2023. A total of 183 women with gestational diabetes were enrolled and analyzed in this study. The questionnaire was pretested, corrected and finalized. Data were collected by face-to-face interview and analyzed by appropriate computer based programmed software Statistical Package for the Social Sciences (SPSS), version 24.

Results: In this study, majority 84 (45.9%) of the patients were in 21 – 30 years age group and 63 (34.4%) patients were in >30 years age group, Mean±SD of age was 32.6 ± 5.4 years. Most of the patients 102 (55.7%) were housewife. About 49 (26.8%) patients were completed their higher secondary, 29 (15.8%) were completed graduation and 22 (12.0%) were illiterate and majority of the patients 141 (77.0%) came from rural area. Most of the patients 87 (47.5%) were in ≤ 24.9 kg/m^2, 64 (35.0%) of the patients were in the range of 25 – 29.9 kg/m^2, and 32 (17.5%) of the patients were overweight (≥30). Nullipara was found in 84 (45.9%) patients and multigravida was found in most of the patients 107 (58.5%). Antenatal care was found regular in 92 (50.3%) patients. Preterm pregnancy was found in majority 112 (61.2%) of the patients. Systolic and diastolic blood pressure were found 123.67 ± 12.73 and 85.00 ± 7.31. Cholesterol, LDL, HDL, triglycerides were found 252.0 ± 52.4, 131.6 ± 43.2, 68.8 ± 15.5, 225.6 ± 99.3. HbA1c % was found 5.3 ± 0.4 (34 ± 6). Insulin therapy was needed in 87 (47.5%) and cesarean section was done in 118 (64.5%) patients. Pre-eclampsia, anemia, postpartum hemorrhage, abnormal fetal position and preterm birth were found in 12 (6.6%), 16 (8.7%), 8 (4.4%), 17 (9.3%) and 21 (11.5%) cases. Average birth weight was found in 56 (30.6%) neonates, LBW was found in 82 (44.8%) neonates and very LBW was found in 45 (24.6%) neonates. hypoglycemia and hyperbilirubinemia were found in 18 (9.8%) and 9 (4.9%) neonates, admission to NICU was needed for 34 (18.6%) neonates, respiratory distress syndrome was found in 25 (13.7%) neonates and neonatal death was occured in 3 (1.6%) cases.

Conclusion: In pregnant women with GDM was an independent risk factor for pregnancy outcomes in women. Pregnant women with GDM aged over 40 years was an independent risk factor for SGA. This shows the necessary of paying greater attention to GDM and improving prenatal care to enhance pregnancy outcomes of them.

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Keywords: Gestational diabetes; Fetal outcomes; Maternal outcomes; BMI; Insulin therapy

Introduction

Diabetes detected in the second or third trimester of pregnancy that is not clearly classified as type 1 or type 2 diabetes (T2D) is known as gestational diabetes mellitus (GDM) [1]. Globally, the prevalence of GDM is rising in tandem with the growth in obesity and type 2 diabetes [1-4]. GDM complicates about 7% of pregnancies overall, accounting for about 200,000 cases every year. Depending on the population under study and the diagnostic procedures used, the prevalence could be anywhere from 1 and 14% of all pregnancies [5]. Recent changes to diagnostic criteria have resulted in a lack of agreement over which criteria should be applied [6]. Pre-pregnancy overweight/obesity, advanced mother age, and a family history of type 2 diabetes are well-established risk factors for GDM.

However, depending on race or ethnicity, these risk variables contribute differently. Because it can be changed the most, overweight/obesity is regarded as the most significant risk factor for GDM from the standpoint of public health [7-10]. For GDM, obesity appears to be a significant risk factor across all racial/ethnic groups, but it is particularly high among non-Asians [11]. One of the primary risk factors for having GDM is thought to be ethnicity. Specifically, Indigenous Australians, African Americans, Native Americans, Asians, Pacific Islanders, and Hispanics are among the ethnic groups thought to be at a greater risk of developing GDM [12-14]. Women from South and Southeast Asia are often seen as being at the highest risk [2].

The recently suggested International Association of the Diabetes and Pregnancy Study Groups (IADPSG) approach [15] suggests measuring fasting, 1-, and 2-hour glucose levels, administering a 75-g 2-hour OGTT (one-step procedure), and classifying any single aberrant value as a diagnosis of gestational diabetes mellitus. The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study [16], a large-scale, multinational cohort study involving 25,000 pregnant women, which showed correlations between glycemic levels and a higher risk of obstetric and perinatal morbidities, is the sole source of data for the IADPSG criteria.

GDM screening in Italy is done using predetermined risk factors. Specifically, in women with at least one of the following conditions, a 75-g 2-h OGTT (one-step technique) is conducted to assess fasting, 1- and 2-h glucose levels at 16–18 weeks of gestation (and repeated at 24–28 weeks, if negative). Plasma glucose levels between 100 and 125 mg/dl (5.6–6.9 mmol/l) prior to or at the start of pregnancy, GDM in a previous pregnancy, and a pre-pregnancy body mass index (BMI) of > 30 kg/m^2 [17,18]. The test is administered at 24–28 weeks of gestation to women who meet at least one of the following criteria: pregnancy history of T2D (first degree relative with T2D), age ≥ 35 years, pre-gestational body mass index (BMI) ≥ 25 kg/m^2, fetal macrosomia in a prior pregnancy (≥ 4.5 kg), and ethnic groups with high diabetes prevalence (South Asia, the Caribbean,Middle East).

Short-term negative consequences for the mother (hypertension, preeclampsia, cesarean section, and preterm delivery) and her children (shoulder dystocia, birth trauma, neonatal jaundice, respiratory distress, and neonatal hypoglycemia) are linked to gestational diabetes mellitus (GDM) [19]. Long-term consequences for moms with GDM include an elevated risk of GDM recurrence, type 2 diabetes, hypertension, and cardiovascular disease (CVD). Furthermore, diabetes during pregnancy may raise the chance of obesity and type 2 diabetes in the offspring's later years [1].

This retrospective observational study set out to determine how the risk variables taken into account for selective screening affected clinical and biochemical markers as well as the outcomes of both the mother and the fetus in pregnancies complicated by gestational diabetes mellitus.

Methodology

The cross-sectional observational study was conducted at Joypara Clinic and Diabetic Center, Dhaka, Bangladesh from July 2022 to June 2023. A total of 183 women with gestational diabetes were enrolled and analyzed in this study. Patients who matched the inclusion and exclusion criteria were approached for participation in the study. Patients who were not willing to give consent were excluded. Purposive sampling was done according to the availability of the patients who fulfilled the selection criteria. Face to face interview was done to collect data with a semi-structured questionnaire. After collection, the data were checked and cleaned, followed by editing, compiling, coding, and categorizing according to the objectives and variable to detect errors and to maintain consistency, relevancy and quality control. Statistical evaluation of the results used to be obtained via the use of a window-based computer software program devised with Statistical Packages for Social Sciences (SPSS-24).

Result

Table 1 shows that, majority 84 (45.9%) of the patients were in 21 – 30 years age group and 63 (34.4%) patients were in >30 years age group, Mean±SD of age was 32.6 ± 5.4 years.

Table 1: Distribution of the patients according to age (n = 183).

Age group	Frequency	%
≤20	36	19.7
21 - 30	84	45.9
>30	63	34.4
Total	183	100
Mean + SD: 32.6 ± 5.4 Years		

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Table 2 shows that most of the patients 102 (55.7%) were housewife and 81 (44.3%) patients were service holder.

Table 2: Distribution of the patients according to occupation (n = 183).

Occupation	Frequency	%
Housewife	102	55.7
Service	81	44.3
Total	**183**	**100**

Table 3 shows that, 49 (26.8%) patients were completed their Higher Secondary, 29 (15.8%) were completed Graduate and 22 (12.0%) were illiterate.

Table 3: Distribution of the patients according to educational status (n = 183).

Education	Frequency	%
Illiterate	22	12
Primary	46	25.1
Secondary	37	20.2
Higher Secondary	49	26.8
Graduate	29	15.8
Total	**183**	**100**

Table 4 shows that, most of the patients 141 (77.0%) came from rural area and 42 (23.0%) patients came from partly rural area.

Table 4: Distribution of the patients according to residence (n = 183).

Residence	Frequency	%
Partly rural	42	23
Rural	141	77
Total	**183**	**100**

Table 5 shows that, most of the patients 87 (47.5%) were in ≤ 24.9 kg/m^2, 64 (35.0%) of the patients were in the range of 25 – 29.9 kg/m^2, and 32 (17.5%) of the patients were overweight (≥30).

Table 5: Distribution of the patients according to Body Mass Index (n = 183).

Body Mass Index (kg/m^2)	Frequency	%
≤ 24.9	87	47.5
25 – 29.9	64	35
≥ 30	32	17.5
Total	**183**	**100**

Table 6 shows that, Nullipara was found in 84 (45.9%) patients and multigravida was found in most of the patients 107 (58.5%). Antenatal care was found regular in 92 (50.3%) patients. Preterm pregnancy was found in majority 112 (61.2%) of the patients.

Table 6: Distribution of the patients according to obstetric parameters (n = 183).

Obstetric Parameters		Frequency	Percent
Parity	Nullipara	84	45.9
	Primipara	37	20.2
	Multipara	62	33.9
Gravidity	Primigravida	76	41.5
	Multigravida	107	58.5
Antenatal care	Regular	92	50.3
	Irregular	58	31.7
	Not done	33	18
Gestational age	Preterm (<37 weeks)	112	61.2
	Term (≥37 weeks)	71	38.8

Table 7 shows that, Systolic and diastolic blood pressure were found 123.67 ± 12.73 and 85.00 ± 7.31. Cholesterol, LDL, HDL, triglycerides were found 252.0 ± 52.4, 131.6 ± 43.2, 68.8 ± 15.5, 225.6 ± 99.3. HbA1c % was found 5.3 ± 0.4 (34 ± 6).

Table 7: Distribution of the patients according to clinical parameter and Laboratory Parameters (n = 183).

Clinical Parameter		
Blood pressure	Systolic BP (mmHg)	123.67 ± 12.73
	Diastolic BP (mmHg)	85.00 ± 7.31
Laboratory Parameters		
	Total cholesterol (mg/dl)	252.0 ± 52.4
	LDL cholesterol (mg/dl)	131.6 ± 43.2
	HDL cholesterol (mg/dl)	68.8 ± 15.5
	Triglycerides (mg/dl)	225.6 ± 99.3
	HbA1c % (mmol/mol)	5.3 ± 0.4 (34 ± 6)
	OGTT—Glycemia T 0′ (mg/dl)	88.7 ± 11.8
	OGTT—Glycemia T 60′ (mg/dl)	175.9 ± 28.8
	OGTT—Glycemia T 120′ (mg/dL)	148.0 ± 30.4

Table 8 shows that, Insulin therapy was needed in 87 (47.5%) and cesarean section was done in 118 (64.5%) patients. Pre-eclampsia, anemia, postpartum hemorrhage, abnormal fetal position and preterm birth were found in 12 (6.6%), 16 (8.7%), 8 (4.4%), 17 (9.3%) and 21 (11.5%) cases.

Table 8: Distribution of the patients according to maternal outcome (n = 183).

Maternal outcome	Frequency	%
Insulin therapy	87	47.5
Cesarean section	118	64.5
Pre-eclampsia	12	6.6
Anemia	16	8.7
Postpartum hemorrhage	8	4.4
Abnormal fetal position	17	9.3
Preterm birth	21	11.5

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Table 9 shows that, Average birth weight was found in 56 (30.6%) neonates, LBW was found in 82 (44.8%) neonates and very LBW was found in 45 (24.6%) neonates.

Table 9: Distribution of the patients according to birth weight (n = 183).

Birth weight	Frequency	%
Average birth weight	56	30.6
LBW	82	44.8
Very LBW	45	24.6
Total	**183**	**100**

Table 10 shows that, hypoglycemia and hyperbilirubinemia were found in 18 (9.8%) and 9 (4.9%) neonates, admission to NICU was needed for 34 (18.6%) neonates, respiratory distress syndrome was found in 25 (13.7%) neonates and neonatal death was occured in 3 (1.6%) cases.

Table 10: Distribution of the patients according to fetal outcome (n = 183).

Fetal outcome	Frequency	%
Hypoglycemia	18	9.8
Hypocalcemia	0	0
Hyperbilirubinemia	9	4.9
Respiratory distress syndrome	25	13.7
Need admission to NICU	34	18.6
Neonatal death	3	1.6

Discussion

GDM is a risk factor for adverse maternal and perinatal outcomes [4]. These adverse pregnancy outcomes include pre-eclampsia, preterm birth, caesarean section, stillbirth, macrosomia, large for gestational age (LGA), respiratory distress syndrome, fetal malformations, neonatal hypoglycemia, and neonatal intensive care unit (NICU) admission. Even from that, women with a history of GDM have an even greater risk to get type 2 diabetes mellitus, metabolic syndrome and cardiovascular diseases. And their offspring are more likely to have metabolic illness. Advanced maternal age (AMA) is currently identified as a key risk factor for GDM and adverse pregnancy outcomes. GDM is more common in women during pregnancy with AMA and AMA is related to the prevalence of stillbirth, preterm birth, small for gestational age (SGA), macrosomia.

The cross-sectional observational study was conducted in Joypara Clinic and Diabetic Center, Dhaka, Bangladesh, from July 2022 to June 2023. A total of 183 women with gestational diabetes were enrolled and analyzed in this study.

In this study, majority 84 (45.9%) of the patients were in 21 – 30 years age group and 63 (34.4%) patients were in >30 years age group, Mean±SD of age was 32.6 ± 5.4 years. Most of the patients 102 (55.7%) were housewife and 81 (44.3%) patients were service holder. About 49 (26.8%) patients were completed their graduation, 29 (15.8%) were completed higher secondary and 22 (12.0%) were illiterate and mejority of the patients 141 (77.0%) came from rural area. Most of the patients 87 (47.5%) were in ≤ 24.9 kg/m^2, 64 (35.0%) of the patients were in the range of 25 – 29.9 kg/m^2, and 32 (17.5%) of the patients were overweight (≥30). A logistic regression analysis was performed to evaluate the effect of age, ethnicity, pre-pregnancy BMI, and fasting plasma glucose at OGTT on the requirement of insulin therapy. The factors identified as independent predictors of insulin therapy were Asian ethnicity, age ≥ 35 years, and pre-pregnancy BMI ≥ 25 kg/m^2. Nullipara was found in 84 (45.9%) patients and multigravida was found in most of the patients 107 (58.5%). Antenatal care was found regular in 92 (50.3%) patients. Preterm pregnancy was found in majority 112 (61.2%) of the patients. Systolic and diastolic blood pressure were found 123.67 ± 12.73 and 85.00 ± 7.31. Cholesterol, LDL, HDL, triglycerides were found 252.0 ± 52.4, 131.6 ± 43.2, 68.8 ± 15.5, 225.6 ± 99.3. HbA1c % was found 5.3 ± 0.4 (34 ± 6). Insulin therapy was needed in 87 (47.5%) and cesarean section was done in 118 (64.5%) patients. Pre-eclampsia, anemia, postpartum hemorrhage, abnormal fetal position and preterm birth were found in 12 (6.6%), 16 (8.7%), 8 (4.4%), 17 (9.3%) and 21 (11.5%) cases. In another study, prevalence of insulin therapy was significantly higher in Asians than in Caucasians (63.6 vs 40.7%, p value = 0.006), despite a significantly lower pre-pregnancy BMI in Asians vs Caucasians (28.2 ± 6.9 vs 23.8 ± 4.6 kg/m^2, p = 0.000). An increased requirement for insulin therapy was observed in patients with pre-pregnancy BMI ≥ 25 kg/m^2 vs patients with pre-pregnancy BMI < 25 kg/m^2 (61.3 vs 41.3%, p = 0.04). Patients requiring insulin therapy had higher fasting plasma glucose at OGTT than patients in medical nutrition therapy (93.1 ± 11.3 vs 97.1 ± 11.9 mg/dl, p = 0.003). Frequency of cesarean section was higher in women with age ≥ 35 years than in women with age < 35 years (86.6 vs 57.1%, p = 0.02) and a significant negative correlation between duration of pregnancy and maternal age was found (r − 0.3 p = 0.013). Gestational week of delivery was lower in patients with age ≥ 35 years in comparison with patients with age < 35 years (37.7 ± 1.5 vs 38.8 ± 1.6 weeks, p = 0.013). Prevalence of pre-term delivery (< 37 weeks) was 8.1%. Basal plasma glucose at OGTT was significantly higher in patients with pre-pregnancy BMI ≥ 25 kg/m^2 than in normal weight patients (93.7 ± 9.9 vs 87.5 ± 12.8 mg/dl, p = 0.016). Whereas 1-h plasma glucose at OGTT was significantly lower in obese patients compared with normal weight (147.7 ± 31.6 vs 178 ± 27.8 mg/dl, p = 0.03) and overweight patients (147.7 ± 31.6 vs 188.0 ± 27.4 mg/dl, p = 0.03).

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Average birth weight was found in 56 (30.6%) neonates, LBW was found in 82 (44.8%) neonates and very LBW was found in 45 (24.6%) neonates. hypoglycemia and hyperbilirubinemia were found in 18 (9.8%) and 9 (4.9%) neonates, admission to NICU was needed for 34 (18.6%) neonates, respiratory distress syndrome was found in 25 (13.7%) neonates and neonatal death was occured in 3 (1.6%) cases. Asian ethnicity, while having a much lower prepregnancy BMI, was independently linked to the need for insulin treatment. Numerous investigations have discovered certain biochemical or clinical characteristics at diagnosis that are connected to the need for insulin therapy [20]. Pregnancy BMI ≥ 30 kg/m^2 and non-European ethnicity were associated with the majority of them [21]. This study also found that pre-pregnancy overweight patients required more insulin therapy, most likely as a result of insulin resistance. It has been discovered that poor glycemic control in pregnant women with GDM is significantly predicted by increasing peripheral insulin resistance, which is already physiologically exacerbated during pregnancy [22].

It is commonly known that obesity is a major risk factor for the development of GDM and the need for insulin therapy; however, the relative importance of this risk factor may vary depending on a person's race or ethnicity. However, there is continuous discussion regarding what constitutes obesity and overweight in Asian people. Lower body mass index (BMI) cut-off values (< 23 kg/m^2 for normal weight) have been recommended by the WHO and the ADA for Asians because they better detect health concerns for cardiovascular disease and type 2 diabetes [23, 24].

A genetic propensity toward enhanced insulin resistance in the muscle or larger levels of visceral fat may be the cause of Asians' higher risk of GDM and insulin therapy at a lower BMI [11]. According to this theory, the influence of ethnicity in this study sample may "masked" the benefit of higher BMI values in predicting the need for insulin treatment. Patients who were 35 years of age or older had a higher frequency of cesarean sections. This outcome was seen in additional research [25-28], and it may represent the situation in the broader community, regardless of the existence of GDM.

In fact, compared to women under 35, women with a single pregnancy who are over 35 years old had a 1.39–2.76 times higher relative risk of a cesarean section in developed nations [25]. It is commonly known that women with complicated GDM pregnancies had a higher cesarean section rate than women with normal pregnancies. This is primarily because unmanaged GDM is associated with a high prevalence of macrosomia. Nonetheless, regardless of fetal weight, Gorgal et al. [29] found a greater prevalence of cesarean sections in GDM patients.

Therefore, this data might be explained by the fact that women over 35 had a greater prevalence of GDM and cesarean sections [29]. Furthermore, the increased frequency of cesarean sections among older GDM patients may also be a reflection of gynecologists' willingness to reduce the likelihood of potentially challenging deliveries. While there was no correlation between mother age and preterm delivery, there was a substantial negative correlation between mother age and the length of gestation. Although most studies in the literature have found no link between older mothers and preterm deliveries, there are still contradictory findings on this topic [30]. Therefore, more research is required to assess this factor, particularly in cases of difficult GDM pregnancy. Insulin therapy in GDM was reported to be predictive of elevated fasting blood glucose levels at diagnosis. This study found a correlation between the need for insulin and fasting plasma glucose at OGTT. It was not, however, an independent predictor of insulin therapy in multivariate analysis. In previous investigations, the insulin-treated group's 1-and/or 2-hour plasma glucose levels at OGTT were considerably greater than those of the diet group. In this cohort, obese patients' 1-hour plasma glucose at OGTT was considerably lower than that of normal weight and overweight patients', which may indicate that the obese group had a higher level of insulin resistance. Additionally, the history of GDM is a known risk factor. Recurrence of GDM has been shown to be highly correlated with pre-pregnancy BMI ≥ 30 kg/m^2. Pre-pregnancy BMI was also discovered to be one of the primary predictors for GDM recurrence in a recent meta-analysis. According to these results, 17% of the study group had a history of GDM, and every patient who had recurrent GDM had been overweight prior to becoming pregnant.

Conclusion

In conclusion, it was found that age, BMI had the biggest effects on the success of pregnancies in GDM patients. According to this perspective, it is important to identify these risk factors at the time of diagnosis, or even earlier, in order to better tailor the treatment of the illness and avoid negative consequences.

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