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Estimation of Risk Factors and Frequency of Gestational Diabetes Mellitus in Pregnant Women Visiting Sheikh Zayed Medical Complex Lahore, Pakistan

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ABSTRACT

Background: The burden, determinants, and outcomes of gestational diabetes mellitus (GDM) are not completely known. Pregnant women with GDM are at higher risk of adverse pregnancy outcomes which include preterm birth, still birth and low birth weight that are major causes of neonatal morbidity and mortality. Despite the severity of the situation, many countries still lack epidemiological data that may help them respond effectively.

Objective: To evaluate the current frequency and risk factors of GDM in population of Lahore attending Sheikh Zayed Medical complex.

Methods: A cross sectional study was conducted among pregnant women, who were visiting Gynecology OPD in Sheikh Zayed Medical Complex Lahore between April, 2021 and July, 2021. A structured questionnaire was designed to collect demography information which included age, weight, height, body mass index (BMI), total family members, lifestyle, history of smoking, blood pressure, years of marriage and residential area etc. Height and weight were measured using standard protocol.

Results: A total of 314 pregnant women (mean age: 27.63±4.62 years) having 3rd trimester were enrolled for this research who underwent 75g OGTT. Cutoff values were taken according to International Association of Diabetes and Pregnancy Study Group (IADPSG) criteria. 10.2% study participants had GDM while 9.2% were categorized as prediabetic and remaining had normal blood sugar levels.

Conclusion: Advanced gestational age, higher pre-pregnancy BMI, excessive weight gain during current pregnancy and gravida were found more significantly related to GDM. Family history of DM was found to be less significant risk factor for GDM in this study. Higher rates of GDM pose a challenge to healthcare systems, but improved screening provides an opportunity to attempt to reduce the associated morbidity and mortality for mother and child.

Introduction

Diabetes mellitus is a set of metabolic disorders marked by hyperglycemia triggered by defects in insulin production, insulin action, or both. One of the most common endocrine hyperglycemic diseases is diabetes mellitus. [1] Diabetes-related chronic hyperglycemia is linked to chronic damage, dysfunction, and failure of multiple organs, including the eyes, kidneys, blood vessels, heart, and nerves. Diabetes is caused by a number of different pathogenic mechanisms. These can range from autoimmune degeneration of the pancreatic beta -cells, resulting in insulin insufficiency, to anomalies that lead to insulin resistance. [2] Diabetes causes anomalies in glucose, lipid, and protein metabolism due to insulin's ineffective action on target tissues. Inadequate insulin secretion and/or decreased tissue responses to insulin cause insulin deficiency at one or more locations along the complicated hormone action pathways. Insulin secretion and insulin action anomalies frequently coexist in the same patient, making it difficult to determine which aberration, if either, is the major reason of hyperglycemia. [3] Different diagnostic tests like blood sugar fasting (BSF), blood sugar random (BSR), HbA1c and oral glucose tolerance test (OGTT) are performed for assessment of diabetes mellitus. [4]

According to a 2017 study by the International Diabetes Federation, 451 million adults worldwide had diabetes in 2017, with 693 million people anticipated to have diabetes by 2045 (Federation 2017). Figure 1.1 shows etiological classification and abbreviated description of etiology of diabetes mellitus.

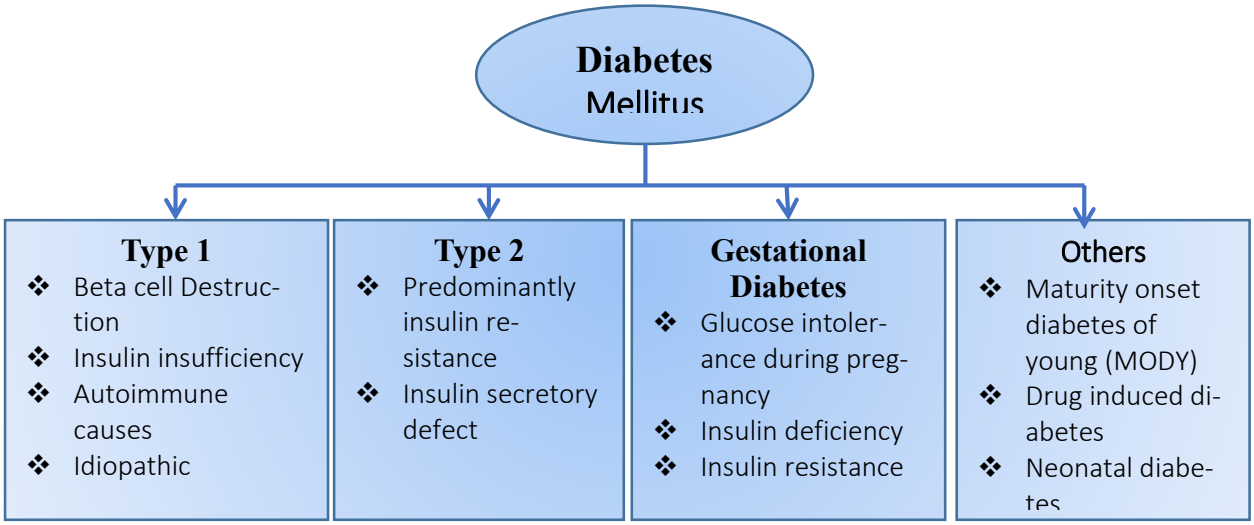

Figure: Etiological Classification of etiology of Diabetes mellitus [5]

Many complication are posed by GDM during pregnancy. [6] It's been defined as glucose intolerance in the second or third trimester of pregnancy in women who haven't had diabetes before pregnancy. It affects 4–12% of all pregnancies, making it one of the most common endocrinopathies. However, depending on diagnostic criteria and the presence of various risk factors such as maternal age and BMI; prevalence of overt diabetes; population ethnicity; and genetic, social, and environmental factors, its prevalence rises. [7] Every year, hundreds of thousands of pregnant women are diagnosed with gestational diabetes mellitus. In general, Gestational diabetes mellitus is considered important for two reasons. First, it is a major risk for both mother and the fetal health as it causes hypertensive disorder of pregnancy in mother and excessive growth and adiposity in fetus. Second, GDM represents the high risk pregnant women and children for hyperglycemia and cardiovascular disease in long term.[8] GDM is thought to affect from around 1% to 36% of pregnancies worldwide, depending on the

population studied and the diagnostic tests used. [9]

The purpose of this study was to evaluate the current frequency and risk factors for population of Lahore who are attending Sheikh Zayed Medical complex related to the GDM with the help of literature review and analysis of collected data results. Also sum up the present data to realize the tendency and collective prevalence and risk factors of GDM, undiagnosed GDM mellitus and pre GDM in a common population of Lahore.

Methods

This was a hospital based cross sectional study conducted among pregnant women who were visiting Gynecology OPD in Sheikh Zayed Medical Complex Lahore between April 2021 and July 2021. Ethical clearance was taken from ethical review committee of Life Sciences Department, UMT Lahore as well as Institutional Review Board (IRB) of Sheikh Zayed Medical Complex Lahore. The study population for this research was pregnant women, who had gestational period between 18-20 weeks, age between 15 and 40 years and no previous history of diabetes mellitus. Females with chronic diseases or other serious illness were excluded.

A total of 314 pregnant women were enrolled for this research who undergo 75g oral glucose test after inclusion and exclusion criteria. Convenient sampling technique was used to approach pregnant women who were visiting Gynecology out patients department (OPD) in Sheikh Zayed Medical Complex Lahore. Participants' files were conveniently approached and thoroughly observed. All pregnant women with gestational period between 18-24 weeks were asked to enroll for OGTT. They were informed about the objectives of the study. Those who were willing to participate in research were asked to come fasting on their next visit when they are having gestational period between 26 and 28 weeks. The women with diabetes type I, type II and previous history of GDM were excluded.

The enrolled participants were briefed about objectives of the study. An informed consent was taken from each participant. Demographic data and medical history were taken from each participant. Demographic data included participant's age, weight, height, body mass index (BMI), total family members, life style, history of smoking, use of smokeless tobacco, systolic and diastolic blood pressure, years of marriage and residential area etc. Moreover, information related to eating behavior, physical activities and other diabetes related risk factors were assessed by filling a standard questionnaire. Blood pressure of participants was checked by using manual mercury sphygmomanometer.

The participants were asked to come to the test fasting. They should not eat or drink anything 8 hours before test. At first, a fasting blood sample was taken for fasting blood sugar level (BSF). Then the participants were given 75grams glucose in 250 ml water solution orally. After one hour, another blood sample (5ml) was drawn in labelled grey top vial. Cutoff values were taken according to IADPSG criteria.

Two whole blood samples 5 ml each, first in the fasting state and second after one hour of drinking oral sugar were collected in labelled grey top tubes as per standard protocol. Samples were stored at +2°C to +8°C. Blood samples were used to measure BSF and 1-hour OGTT. The whole blood taken from participants was first centrifuged; plasma/serum was separated from cellular portion of blood. Blood sugar level was determined by using spectrophotometer. Glucose in the sample is oxidized by glucose oxidase (GOD) into Gluconic acid and hydrogen peroxide (H_2O_2). H_2O_2 in conjunction with peroxidase (POD) reacts with chloro-4-phenol and 4-amino-antipyrine (PAP) to form a red quinoneimine. The absorbance of colored complex proportional to concentration of glucose in plasma is measured at 500nm. [10]

All of the data gathered from the participants was entered into an excel spreadsheet. SPSS version 20 was used to clean and decode the data. The frequencies and percentages were calculated using descriptive statistics, whereas

the relationship of various risk factors with GDM was determined using inferential statistics.

Results

A total of 314 pregnant women were enrolled for the study who fulfilled the inclusion criteria. The mean age was 27.63±4.62 years. Among them only 9 (2.8%) females were illiterate, 19 (6.1%) had elementary class degree, 51 (16.2%) had secondary school certificate, 90 (30.9%) females went to the intermediate level of education, and remaining 145 (46.2%) had either graduation or post-graduation degree. Among all, most of the participants 239 (76.4%) were housewives, 35 (11.2%) were private jobs holder, 21 (6.7%) were government employees, 7 (2.2%) were students, 2 (0.6%) were teachers while others have their private business (**Figure 2)**.

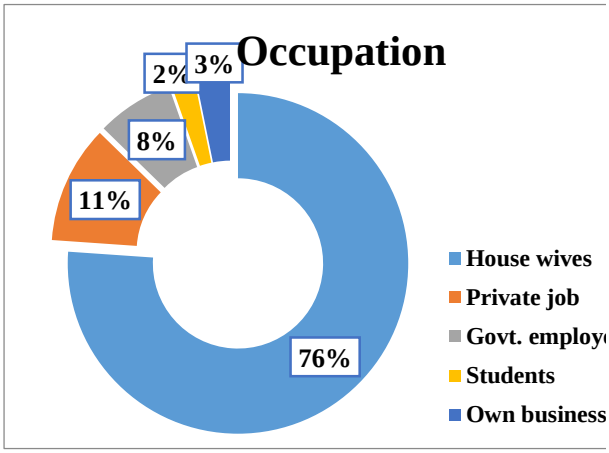

Figure 2: Graphical representation of occupation of the study participants

A total of 44.3% study participants had normal pre-gestational body mass index (BMI 18.5-24.9) while 34.4% and 21.3% were overweight (BMI 25.0-29.9) and obese (BMI >30.0) respectively.

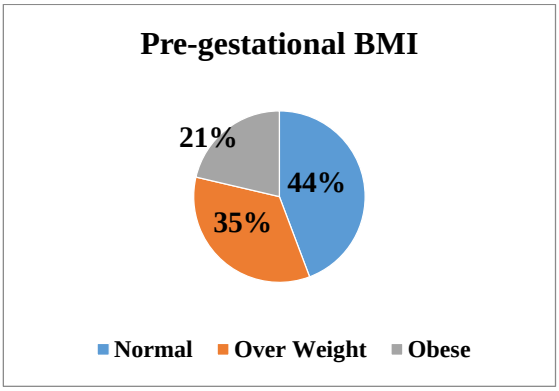

Figure 3: Percentage of pre-gestational BMI of study participants.

The majority of the participants 188 (59.9%) belong to middle class socioeconomic background, 75 (23.9%) belong to poor class and remaining 51 (16.2%) were high class socioeconomic status. Among all only 1.9% females were smokers and 98.1% were nonsmokers. Most of the females 194 (61.8%) do exercise at least 10 minutes on daily basis while 120 (38.2%) did not workout. A total of 119 (37.8%) participants had their primigravida, and highest number of participants 155 (49.4%) had either 2nd or 3rd pregnancy while remaining 40 (12.7%) had >3 gravida.Out of 314, 70 (22.3%) participants said that they gained excessive weight during current pregnancy and 244 (77.7%) gained weight normally. 290 (92.4%) had normal blood pressure at the time of enrollment while 24 (7.6%) had raised blood pressure as shown in table 1.

Findings suggest shows that advanced gestational age (≥35 years) is significantly more related to GDM. In this study 30 (9.6%) participants were ≥35 years old with 13.3% prevalence of GDM while other 284 (90.4%) participants were <35 years old with 9.9% prevalence of GDM (CI=95% , *P* value=0.003). In the same way BMI (*P* value <0.0001), gravida (*P* value 0.001) and excessive weight gain during current pregnancy (*P* value 0.04) are significantly more related to the GDM. Obese participants had significantly very high prevalence of GDM (29.9%) as compared to 2.2% among participants with normal BMI. Those women who were having ≥3rd pregnancy had more prevalence (20%) while 1st and 2nd pregnancy carrier females had prevalence 8.4% and 9.0% respectively. Smoking, family history of DM, excessive weight gain during current pregnancy and status of exercise (*P* values >0.04) were found to be less significant risk factors for GDM.

Table 1: Demographic characteristics of study participants

Demographic characteristics		N	%
Age	<35 years	284	90.4
	>35 years	30	9.6
Education	Illiterate	9	2.9
	Elementary (1-8)	19	6.1
	Secondary School	51	16.2
	College (11-12)	90	30.9
	University	145	46.2
Socio-economic Status	Poor	75	23.9
	Middle	188	59.9
	Rich	51	16.2
Gravida	Primigravida	119	37.8
	2-3	155	49.4
	>3	40	12.7
Smoking not a demo feature	Yes	6	1.9
	No	308	98.1
Do You exercise? not a demo feature	Yes	194	61.8
	No	120	38.2
Current blood pressure	Normal	290	92.4
	High	24	7.6
Excessive weight gain during current pregnancy not a demo feature	Yes	70	22.3
	No	244	77.7

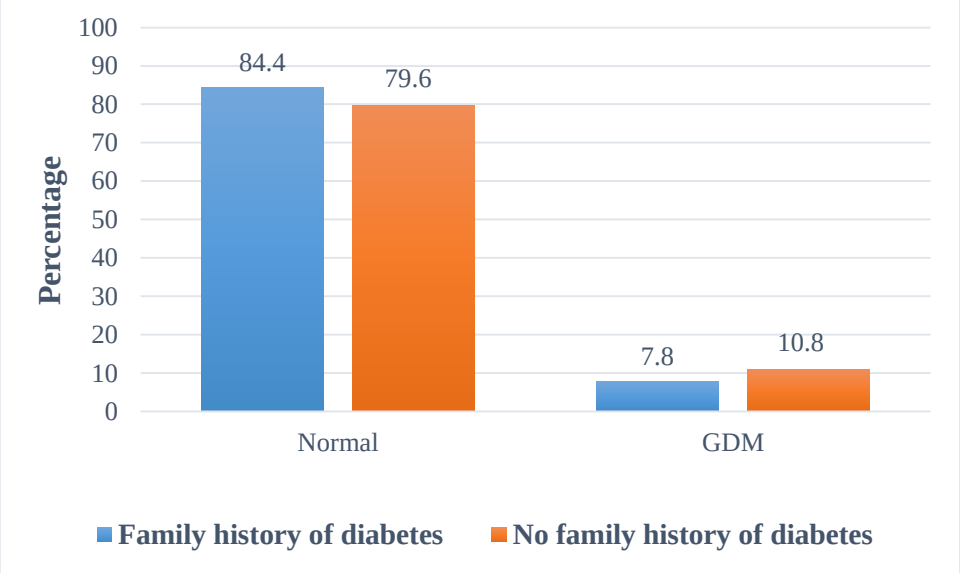

Figure 4: Association of family history of Diabetes with GDM during current pregnancy

Figure 4 presents the family history of diabetes in study participants.

There were 64 (20.4%) participants who had a family history of diabetes out of which only 5 (7.8%) females had GDM while 250 women did not have the family history of diabetes out of which 27 (10.8%) had GDM. This data shows that the participants without family history of diabetes had significantly higher

Table 2: Gestational Diabetes and associated Risk Factors

Risk Factors		Total	GDM						p-Value
			Normal		Pre-diabetes		Diabetes		
		n	n	%	n	%	n	%	
Age	<35	284	234	82.4	22	7.7	28	9.9	0.003*
	>=35	30	19	63.3	7	23.3	4	13.3	
Education	Illiterate	9	7	77.8	1	11.1	1	11.1	0.934
	Literate	305	246	80.7	28	9.2	31	10.2	
Socioeconomic status	Rich	51	42	82.4	4	7.8	5	9.8	0.977
	Middle Income	188	150	79.8	19	10.1	19	10.1	
	Poor	75	61	81.4	6	8.0	8	10.6	
BMI	Normal	139	131	94.2	5	3.6	3	2.2	<0.0001*
	Over Weight	108	90	83.3	9	8.3	9	8.3	
	Obese	67	32	47.8	15	22.4	20	29.9	
Gravida	Primi gravida	119	99	83.2	10	8.4	10	8.4	0.001*
	2-3	155	126	81.3	15	9.7	14	9.0	
	>3	40	28	70	4	10	8	20	
Smoking	Yes	6	3	50	2	33.3	1	16.7	0.187
	No	308	250	81.2	27	8.8	31	10.1	
Excessive weight gain	Yes	70	49	70	10	14.3	11	15.7	0.040*
	No	244	204	83.6	19	7.8	21	8.6	
Family history diabetes?	Yes	64	54	84.4	5	7.8	5	7.8	0.682
	No	250	199	79.6	24	9.6	27	10.8	
Current blood pressure	Normal	290	236	81.4	26	9.0	28	9.7	0.472
	High	24	17	70.8	3	12.5	4	16.7	
Exercise	Yes	194	159	82.0	18	9.3	17	8.8	0.566
	No	120	94	78.3	11	9.2	15	12.5	

Discussion

This study shows that 9.2% out of 314 females were categories as prediabetic, 10.2% fall under GDM and all others had normal blood sugar levels. Advanced gestational age, higher BMI and gravida were found to be very significantly related to GDM.

Both the pregnant woman and her fetus can be affected by gestational diabetes, but with careful management, consequences can be avoided. GDM is becoming more common in both developed and developing nations[11] and it is expected to continue in the coming years as the population's average age rises, urban unhealthy lifestyles become more common, and the prevalence of overweight women rises.[12] A reliable understanding about disease frequency and underlying factors is necessary for effective planning. Several studies suggest obesity as a substantial risk factor for GDM, stating that

being overweight or obese at the start of pregnancy predisposes to GDM. Obesity was identified as a risk factor for the development of GDM in studies conducted in Karachi, Peshawar, and Bahawalpur, suggesting that obese and overweight women are more likely to experience GDM. [13] A significant number of individuals with GDM were obese in the Bahawalpur study. .Family history of DM was found to be less significant risk factor for GDM in this study while much other study showed that family history of type 2 DM as a significant risk factor of GDM. According to a study conducted at Baqai Medical University, more than 50% of the participants had a family history of diabetes. [14] This was may be due to less knowledge of the study participants about their family history of DM or some other factors.

In this study we found the prevalence of GDM almost similar to the prevalence of GDM across Asia. A review study was done in different countries and major cities of Asia according to which GDM was found to be 11.5% in Asia [15]. This statistic can thought to be more indicative of the GDM burden in Asian populations. The prevalence of GDM in Asia is higher than in Europe (5.4%) but lower than in Africa (14.0%) [16]. We don't know why there's such a disparity, but it could be attributable to maternal age and BMI variations, as well as ethnic origin [17]. South Asians, for example, had a higher risk of acquiring GDM at the same age as White Europeans and Black Africans. Similarly, among GDM patients, South Asian women were older and fatter. As a result, the high prevalence of GDM in Asia is linked to growing age, increasing BMI, and racial group. It could possibly be attributable to Asians' genetic susceptibility to develop insulin resistance at a higher rate than Caucasians [18]. When compared to previous available data of GDM in Pakistan, this study has comparable results. According to a study conducted in 2019 [19] the prevalence of GDM was 11.5% while this study resulted 10.2% but AKUH survey results showed 19% prevalence of GDM in 2019.

One of the study's limitations is that we did not follow up with these women to assess obstetric problems such as premature births, macrosomia, and caesarean section. We didn't do the OGTT again after the baby is delivered. The rising trend of GDM in pregnant women can be controlled by raising community awareness about the use of nutritious foods and physical activity to maintain a healthy weight. In addition, for the prevention of different maternal and newborn problems, screening and early identification of GDM by OGTT in all pregnant women, as well as frequent monitoring, is recommended. In order to get a clear sense of the occurrence of GDM in Pakistan, more large-scale investigations are required.

Conclusion

To conclude, this study showed the prevalence of GDM was 10.2% and there was an association of GDM with pre-gestational BMI, excessive weight gain during current pregnancy, advanced maternal age and gravida while no association was found with education level, socioeconomic status, family history of DM, smoking and current blood pressure.

To avoid complications of GDM during pregnancy and the risk of acquiring Type 2 DM later, pregnant women should be educated about the repercussions of GDM and the importance of maintaining strict blood sugar level before, during, and after pregnancy.

Conflict of Interest: The authors have no competing interests.

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