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FREQUENCY OF GESTATIONAL DIABETES MELLITUS IN PATIENTS WITH OBESITY DURING PREGNANCY

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Abstract

Introduction: Gestational Diabetes Mellitus (GDM) refers to any degree of glucose intolerance that is first identified during pregnancy, regardless of whether it persists postpartum. GDM has been associated with a higher risk of maternal and fetal complications, making early detection and management crucial. Obesity is considered a significant risk factor for the development of GDM, as it can lead to insulin resistance and other metabolic disturbances that increase the likelihood of glucose intolerance during pregnancy. The findings of this study aim to raise awareness about the impact of maternal obesity on the prevalence of GDM and emphasize the need for early diagnosis and appropriate management strategies by healthcare professionals.

Objective: The primary objective of this study was to determine the frequency of Gestational Diabetes Mellitus (GDM) in pregnant women with obesity attending antenatal care at the Department of Gynecology and Obstetrics, Nowshera Medical College, Qazi Hussain Ahmad Medical Complex, Nowshera, Pakistan.

Methods: This was a descriptive cross-sectional study conducted at the Gynecology and Obstetrics outpatient department (OPD) of Nowshera Medical College, Qazi Hussain Ahmad Medical Complex. The study enrolled all pregnant women between the ages of 20 and 34 years who attended the antenatal clinic for the first time and met the inclusion criteria. After explaining the purpose and benefits of the study, informed written consent was obtained from each participant or their attendant. A detailed history, physical examination, BMI measurement, abdominal examination, and assessment of gestational age were conducted using either last menstrual period (LMP) or ultrasound examination. Baseline investigations, including Complete Blood Count (CBC), urine routine examination (R/E), Random Blood Sugar (RBS), virology tests, and oral

glucose tolerance test (OGTT), were performed. Obstetrical ultrasound was carried out to assess gestational age, amniotic fluid index (AFI), and fetal growth. A two-step diagnostic procedure, consisting of a 50g glucose challenge test followed by a 100g OGTT, was employed for diagnosing GDM. The OGTT was conducted between 24 to 28 weeks of gestation. A plasma glucose level ≥140mg/dl on the 50g glucose challenge test was considered positive, prompting referral for the 100g OGTT. GDM was diagnosed if more than two plasma glucose values met or exceeded the National Diabetes Data Group (NDDG) cut-off values (105, 190, 165, and 145mg/dl). GDM diagnosis was confirmed based on the OGTT results, and management was conducted by a senior obstetrician, considering gestational age, glucose profile, and other relevant risk factors. Delivery was also managed by a senior obstetrician.

Results: Among the 166 participants enrolled in the study, the mean age of the patients was 29 years (SD ±6.194), with a mean weight of 58.99 kg (SD ±6.068), and a mean BMI of 23.295 kg/m² (SD ±2.68). The mean gestational age was 33.97 weeks (SD ±0.999). Out of the 166 patients, 39 women (23.5%) were diagnosed with GDM and had obesity, while the remaining 127 women (76.5%) did not have GDM.

Conclusion: In conclusion, our study found that the prevalence of GDM in overweight and obese patients was 23.5% among pregnant women presenting at the tertiary care hospital in Nowshera. Overweight and obesity could be prevented through the implementation of healthy lifestyle interventions, including physical activity and nutritional counseling, prior to pregnancy. This study provides valuable evidence of a high prevalence of GDM in women with elevated mid-pregnancy BMI, especially among obese and overweight women. Our findings underline the importance of early diagnosis and management of GDM in high-risk populations and can be used to develop targeted programs aimed at supporting high-risk mothers in antenatal care.

Keywords: Gestational Diabetes Mellitus, Obesity, Pregnant Women, Frequency, Antenatal Care, Pregnancy.

Introduction

Gestational diabetes mellitus (GDM), a condition characterized by glucose intolerance first identified during pregnancy, is a significant health concern globally. In the United States, GDM affects approximately 7% of pregnancies, leading to over 200,000 cases annually (1). The increasing prevalence of obesity has been linked to a rise in GDM cases, as women who are obese face a significantly higher risk of developing GDM compared to those with a normal body mass index (BMI) (2, 3). Recent trends in the U.S. have seen a dramatic increase in obesity rates, which mirrors a concerning, rise in GDM (4).

Obesity is a major risk factor for GDM, which not only increases the likelihood of adverse pregnancy outcomes, such as preeclampsia and large-for-gestational-age infants (5, 6), but also raises the risk of long-term health consequences. Both mothers and their children are at a heightened risk of developing type 2 diabetes later in life (7, 8). Studies have demonstrated that obesity increases the risk of gestational hypertension, with a higher incidence of hypertension in obese women compared to normal-weight women (9). Furthermore, a significant proportion of obese pregnant women, as well as some women with normal weight, require medication to control their blood glucose levels during pregnancy (10).

Despite the well-established association between obesity and GDM, the magnitude of this association remains uncertain, partly due to variations in the reported prevalence of GDM across different populations. Additionally, discrepancies in diagnostic methods and definitions of GDM contribute to inconsistencies in research findings (11). For instance, differences in the criteria used for diagnosing GDM, such as the timing of glucose testing and the cut-off values for plasma glucose levels, have led to variability in the prevalence rates reported in different studies (12). The diverse approaches to GDM diagnosis and the lack of uniformity in study designs hinder a clear understanding of the relationship between obesity and GDM in various settings.

Several studies from different parts of the world, including the U.S., Europe, and Asia, have documented a clear link between maternal obesity and the increased risk of developing GDM (13, 14). However, the exact risk factors, such as the degree of obesity or the impact of lifestyle factors like diet and physical activity, remain subjects of ongoing research (15). A meta-analysis of studies examining the association between obesity and GDM found a consistent association between increasing BMI and the risk of GDM, but the magnitude of this relationship varied by region and study design (16).

The implications of maternal obesity and GDM extend beyond pregnancy, as women who experience GDM are at an elevated risk of developing type 2 diabetes postpartum, a risk that is compounded in obese women (17). Similarly, children born to mothers with GDM are more likely to develop obesity and diabetes later in life, emphasizing the importance of early intervention and prevention (18). Therefore, addressing maternal obesity and GDM is crucial for reducing both immediate and long-term health risks for mothers and children alike.

This study aims to determine the frequency of Gestational Diabetes Mellitus (GDM) in pregnant women with obesity attending the Department of Gynecology & Obstetrics at Nowshera Medical College, Qazi Hussain Ahmad Medical Complex, Nowshera, Pakistan. Given that no such study has been conducted in this region, this research will provide valuable insights into the prevalence and impact of GDM among local pregnant women. Understanding the magnitude of GDM in our population is essential for developing targeted healthcare strategies and improving maternal and fetal outcomes. By assessing the link between obesity and GDM in our community, we aim to contribute to the broader understanding of this critical health issue and to highlight the importance of early diagnosis and management of GDM in high-risk populations.

Methods

Study Setting: Department of Gynecology & Obstetrics, Nowshera Medical College, Qazi Hussain Ahmad Medical Complex, Nowshera, Pakistan.

Study design: Descriptive cross-sectional.

Duration of study: This study was conducted for about 06 months from 15/01/2022 till 15/07/2022.

Sample size: Total sample was 166 keeping proportion of 19.2% cases of obese women need medication for control diabetes (11) keeping confidence interval at 95% and margin of error 6% using WHO sample size calculator.

Sampling technique: Non-probability consecutive sampling.

Sample selection: Women between the age of 20-34 years attending antenatal clinics for the first time with no chronic medical illness, no history of GDM and pre-eclampsia, no family history of diabetes mellitus, and no history of fetal macrosomia (birth weight ≥4,000g) were included in the study whereas those with unknown bodyweight prior to pregnancy and had metabolic syndrome were excluded.

Data Collection Procedure: In this study, all patients fulfilling the inclusion criteria were enrolled in the study through OPD and Department of Gynecology & Obstetrics. Presenting purpose and benefits of study were explained and informed written consent was obtained from the patient or attendant of patient. A two-step diagnostic procedure using a 50-g glucose challenge test and a 100-g oral glucose tolerance test (OGTT) will be used to diagnose GDM. 50-g glucose challenge test will be performed at 24-28 weeks gestation. Plasma glucose ≥ 140 mg/dl will be considered a positive result and will be referred for a diagnostic 100-g oral glucose tolerance test (OGTT). GDM will be defined as having > 2 plasma glucose values equal to or above the NDDG cut-off values (105, 190, 165, 145 mg/dL).

Data Analysis Procedure: Data were analyzed using by SPSS version 22. Mean and standard deviation were computed for continuous variables like age, duration of disease. Frequency and percentages were computed for categorical variables like gender, maternal age, parity, gestational age and GDM. GDM was stratified with age, maternal age, parity, gestational age, duration of disease, to see the effect modifiers. Post stratification chi square test was applied in which P

value≤0.05 was considered as significant.

Results

In this study, age of patients ranged from 20 to 40 years. Mean age was 29.14±6.194 years, mean weight was 58.99±6.068 kg, mean BMI was 23.295±2.6808 kg/㎡ and mean gestational age was 33.97±0.999 weeks. Among 166 patients, 99 (59.6%) of patients were in a range 20-30 years, 67 (40.5%) patients were in age range 31-40 years. Mean age was 29±6.194 years. Among 166, gestational age was analyzed in which 93 (56%) patients were between 28-32 weeks and 73 (40%) were between 33-36 weeks. Among 166 patients, 103 (62%) were of low parity (1-2) and 63 (38%) were of 3-4 parity. Among 166 patients, GDM was diagnosed in 39 (23.5%) patients, in which Class-I obesity was seen in 25 (24.3%) patients and Class-II obesity was seen in 14 patients (22.2%).

Table-1: Stratification of Gestational Diabetes Respect to Duration of Complaints (N=166)

Duration of Complaints*Gestational Diabetes					
		Gestational Diabetes		**Total**	
		Yes	**No**		
Duration of Complaints (weeks)	**10 or below**	17 (21.5%)	62 (78.5%)	79 (100%)	p-value=0.923
	More than 10	22 (25.3%)	65 (74.7%)	87 (100%)	
Total		39 (23.5%)	127 (76.5%)	166 (100%)	

Table-2: Stratification of Gestational Diabetes with Respect to Parity (N=166)

Parity*Gestational Diabetes					
		Gestational Diabetes		Total	
		Yes	**No**		
Parity	**1-2**	25 (24.3%)	78 (75.7%)	103 (100%)	p-value=0.707
	3-4	14 (22.2%)	59 (77.8%)	63 (100%)	
Total		39 (23.5%)	127 (76.5%)	166 (100%)	

Discussion

To the best of our knowledge, this was the first study to evaluate maternal obesity and gestational diabetes mellitus (GDM) in our population. Approximately 23.5% of pregnant women were diagnosed with GDM among obese mothers. The prevalence of GDM globally varies by study setting and diagnostic criteria, with factors such as age, obesity, and health service utilization influencing the rates. For instance, using International Classification of Diseases (ICD) diagnostic codes (ICD-9 and ICD-10), GDM prevalence was reported as 6% in the USA (19), and 10% in Korea (20). A meta-analysis of 22 studies from sub-Saharan Africa, with a range of diagnostic criteria and study settings, reported a GDM prevalence of 2-6% (21). A study in China using a 75-g 2-h Oral Glucose Tolerance Test (OGTT) reported a GDM prevalence of 8% (22). Our study found a significant association between GDM and mid-pregnancy obesity (BMI >25). Maternal age of 30 years or older and a family history of diabetes were also significantly associated with GDM. These results are generally in agreement with previous studies that have identified similar associations with GDM risk factors. For example, Kumari et al. found a GDM prevalence of 24.5% in obese women compared to 2.2% in non-obese women ($p<0.0001$) (23). In a retrospective cohort study of 613 obese (BMI >35; class II and III) and 11,313 non-obese women, there was a threefold increase in the likelihood of developing GDM among obese patients compared to non-obese women (OR:

3.2, 95% CI: 2.5-4.2) (24). In a recent meta-analysis, Chu et al. reported Odds Ratios (OR) of 2.14 (95% CI: 1.82-2.53), 3.56 (95% CI: 3.05-4.21), and 8.56 (95% CI: 5.07-16.04) for overweight, obese, and severely obese women, respectively, compared with normal-weight pregnant women (25). According to Kim et al., in a study of pregnant women from Florida, USA, the likelihood of GDM increased with BMI across all racial/ethnic groups, with 41.1% of GDM cases attributed to overweight and obesity (26). The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) Study Cooperative Research Group demonstrated that higher maternal BMI is associated with increased pregnancy complications, including fetal growth abnormalities, adiposity, and pre-eclampsia (27).

There is growing epidemiological evidence that depression may be a risk factor for GDM (28,29). Our study shows a significant association between depression and GDM, which aligns with some prior studies (29), but not all (30). A longitudinal study by Hinkle et al. in the USA found that persistently high depression scores during the 1st and 2nd trimesters were associated with a three-fold increased risk of GDM (highest vs. lowest quartile in both trimesters: RR: 3.21, 95% CI: 1.00-10.28) (28). In a cross-sectional study, women with GDM were more than three times more likely to have a history of depression compared to non-depressed women (OR: 3.79, 95% CI: 1.07-13.45) (29). However, using data from prenatal care clinics at a University of Washington Medical Center, Katon et al. found no evidence of association between GDM and antepartum depression (OR = 0.95; 95% CI: 0.68-1.33) (30). Furthermore, a 2016 meta-analysis concluded that the association between depression and diabetes during pregnancy is still not fully understood, and further studies are needed [29]. While the exact cause of these differences remains unclear, we speculate that variations in nutrition, physical activity, and other lifestyle factors may have contributed to these results. Pregnancy is a major life event that increases vulnerability to depression, and co-morbid depression and GDM have serious implications for both maternal and infant health outcomes.

This study had several strengths, including the use of trained interviewers and standard laboratory procedures for measuring plasma glucose. Our relatively large sample size and the high prevalence of GDM provided statistical power to study the associations of interest. However, some limitations must be considered when interpreting the results. First, a family history of diabetes was assessed based on self-report, and recall bias cannot be ruled out. Additionally, while previous studies have demonstrated associations between GDM and adverse pregnancy outcomes, data on pregnancy outcomes were not collected in our study cohort. Lastly, participants were pregnant women from Lima, and our results may not be generalizable to the broader Peruvian population. Future studies that collect more objective measures potentially associated with GDM and obesity may help overcome some of these concerns.

Conclusion

In conclusion, our study found that the prevalence of GDM in overweight and obese patients was 23.5% among pregnant women presenting at the tertiary care hospital in Nowshera. Overweight and obesity could be prevented through the implementation of healthy lifestyle interventions, including physical activity and nutritional counseling, prior to pregnancy. This study provides valuable evidence of a high prevalence of GDM in women with elevated mid-pregnancy BMI, especially among obese and overweight women. Our findings underline the importance of early diagnosis and management of GDM in high-risk populations and can be used to develop targeted programs aimed at supporting high-risk mothers in antenatal care.

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