ORIGINAL RESEARCH

Exocrine pancreatic function and glycemic control in pregnant women with diabetes

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ABSTRACT

Background: Gestational Diabetes Mellitus (GDM) is a common condition during pregnancy, with significant implications for both mothers and babies. This study explores the interplay between exocrine and endocrine pancreatic functions in pregnant women with diabetes and their association with gastrointestinal (GI) symptoms. **Methods:** A case-control study involving pregnant women with GDM and those without diabetes was conducted. Data were collected on demographics, clinical profiles, GI symptoms, and relevant parameters. Serum amylase and lipase levels, HbA1c, fasting and post-prandial blood sugar levels were measured. **Results:** In GDM and pre-existing diabetes groups, fasting blood sugar levels were elevated compared to the control group, albeit less severely than in non-pregnant diabetic populations. Serum amylase levels were significantly reduced in both diabetes groups. No significant differences in serum lipase levels were observed. Well-controlled diabetes was associated with lower serum amylase levels, suggesting a link between glycemic control and exocrine pancreatic function. **Discussion:** The study highlights the complex relationship between exocrine and endocrine pancreatic functions in pregnant women with diabetes. The moderation of blood sugar levels during pregnancy and the reduction in serum amylase levels in diabetic pregnant women are notable findings, with implications for further research. **Conclusion:** This study underscores the need for additional research on the intricate relationship between exocrine and endocrine pancreatic functions during pregnancy. Understanding this relationship can lead to improved healthcare practices for pregnant women with diabetes, benefiting both mother and child. Recognition of exocrine pancreatic insufficiency as a cause of GI symptoms in GDM patients may facilitate better symptom management.

Keywords: Gestational Diabetes Mellitus, pancreatic function, gastrointestinal symptoms, pregnancy, diabetes.

INTRODUCTION

Gestational Diabetes Mellitus (GDM) is a condition characterized by glucose intolerance that is first recognized during pregnancy. It affects approximately 14% of pregnancies globally, with even higher rates of around 18-20% in India. GDM can have serious consequences for both mothers and babies.[1]

Diagnosing GDM typically relies on specific criteria established by organizations like the World Health Organization (WHO) and the Diabetes in Pregnancy Study Group of India (DIPSI). The criteria involve glucose values measured during fasting and after a glucose challenge test.[2]

WHO criteria include fasting glucose levels greater than or equal to 92 mg/dL and 1-hour and 2-hour post-glucose challenge values greater than or equal to 180 mg/dL and 153 mg/dL, respectively. DIPSI, on the other hand, focuses primarily on the 2-hour post-glucose challenge value, with no specific fasting glucose requirement.

GDM is thought to result from a combination of beta-cell insufficiency and increased insulin resistance during pregnancy. These factors can also exist prior to pregnancy, increasing the risk of developing type 2 diabetes (T2DM) after giving birth.[3]

The pancreas is a vital organ with both exocrine and endocrine components. The exocrine part produces digestive enzymes, while the endocrine pancreas, consisting of pancreatic islets, is responsible for hormone production. These islets are scattered among the exocrine cells, and they interact closely.

During pregnancy, it's common for women to experience gastrointestinal symptoms like nausea, vomiting, and constipation. Exocrine pancreatic insufficiency (EPI), characterized by a lack of pancreatic enzymes, can lead to gastrointestinal problems, including loose stool and abdominal discomfort. Unfortunately, EPI symptoms are often attributed to pregnancy itself.[4]

EPI is a significant cause of abdominal discomfort in patients, whether or not they have other health conditions. Even during a normal pregnancy, abdominal discomfort can occur.

The relationship between GDM and EPI and their associated gastrointestinal symptoms has not been widely studied. Recognizing EPI as a cause of abdominal discomfort in GDM patients could lead to better management of these symptoms through pancreatic enzyme supplements.

The research hypothesis for this study is that endocrine pancreatic function affects exocrine pancreatic function, and gastrointestinal symptoms in diabetic women are linked to exocrine pancreatic dysfunction. This study aims to investigate this correlation by evaluating clinical data and making comparisons between GDM and non-GDM patients.[5]

AIMS AND OBJECTIVE

- To evaluate exocrine pancreatic function in pregnant women with diabetes.
- To investigate the clinical features of pancreatic exocrine failure in pregnant women with and without diabetes

MATERIAL AND METHODS

The study was conducted in the Department of Obstetrics and Gynaecology at B R D Medical College from October 2019 to September 2020. It followed a case-control study design with four control subjects for each case. Cases included pregnant women diagnosed with gestational diabetes mellitus (GDM) based on WHO criteria, while controls were pregnant women without GDM. The study involved pregnant women attending the Antenatal Outpatient Department (OPD) and Inpatient Department (IPD) of the Obstetrics and Gynaecology department.

Inclusion criteria required informed consent and included pregnant women with or without GDM. Exclusion criteria encompassed individuals with liver and gall bladder disease, previously diagnosed gastrointestinal (GI) pathology (such as Crohn's disease or ulcerative colitis), any malignancy, critically ill patients, and cases of molar or ectopic pregnancy.

The methodology involved collecting data through questionnaires that covered demographic and clinical profiles of the patients, symptoms of exocrine pancreatic insufficiency, abdominal discomfort, and potential causes of exocrine pancreatic insufficiency and abdominal discomfort. Anthropometric measurements, laboratory tests, and imaging scans were performed, including blood tests, weight measurements, blood pressure readings, and abdominal scans to screen for liver, gall bladder, pancreas, and adrenal gland diseases. Serum parameters, such as amylase and lipase levels, were analyzed using an autoanalyzer, and HbA1C was measured using high-performance liquid chromatography. Fasting and postprandial blood sugar levels were also measured.

STATISTICAL ANALYSIS

Data were coded and recorded in MS Excel, and statistical analysis was conducted using SPSS v23. Descriptive statistics were presented for continuous and categorical variables. Group comparisons were made using appropriate statistical tests. The significance level was set at $p < 0.05$.

OBSERVATIONS

In this study, we compared various parameters between the case group (n=50) and the control group (n=200). The mean age in the case group was 32.55 ± 4.67 years, while in the control group, it was 31.10 ± 4.69 years, with no significant difference observed ($p < 0.199$). The age distribution showed that 16.0% of individuals in the case group were in the 20-25 years age range, compared to 45.0% in the control group. In the 26-35 years range, 56.0% of the case group and 46.0% of the control group were observed, while in the 36-42 years range, 28.0% were in the case group and 9.0% in the control group ($p = 0.005$).Regarding socioeconomic status, no significant difference was found between the groups ($p = 0.069$). In the case group, 60.0% were classified as Lower Middle, 40.0% as Upper Lower, and none in the Lower category. In the control group, these percentages were 41.0%, 43.0%, and 16.0%, respectively. The parity of the case group was 3.00 ± 1.68, whereas the control group had a parity of 2.16 ± 0.98, with a p-value of 0.057. Parity categories (P1, P2, ≥P3) also showed no significant difference between the groups ($p = 0.509$).In terms of gestational age (POG), the case group had a mean of 33.62 ± 4.16 weeks, and the control group had a mean of 34.63 ± 5.10 weeks ($p = 0.089$). The distribution of POG categories (<28 weeks, 28-36 weeks, ≥37 weeks) revealed no significant difference between the groups ($p = 0.071$).The mean weight in the case group was 63.18 ± 8.36 kg, while in the control group, it was 58.98 ± 6.16 kg, with a significant difference ($p = 0.036$). Weight categories (41-50 kg, 51-60 kg, 61-70 kg, 71-80 kg) also showed a significant difference between the groups ($p = 0.039$) **(Table-1).**

Table 1: Association between Group and Parameters

Parameters	Group		p value
	Case (n = 50)	Control (n = 200)	
Age (Years)	32.55 ± 4.67	31.10±4.69	<0.199
Age			0.005
20-25 Years	8 (16.0%)	90 (45.0%)	
26-35 Years	28 (56.0%)	92 (46.0%)	
36-42 Years	14 (28.0%)	18 (9.0%)	
Socioeconomic Status			0.069
Lower Middle	30 (60.0%)	82 (41.0%)	
Upper Lower	20 (40.0%)	86 (43.0%)	
Lower	0 (0.0%)	32 (16.0%)	
Parity	3.00 ± 1.68	2.16 ± 0.98	0.057
Parity Category			0.509
P1	8 (16.0%)	52 (26.0%)	
P2	16 (32.0%)	70 (35.0%)	
≥P3	26 (52.0%)	78 (39.0%)	
POG (Weeks)	33.62 ± 4.16	34.63 ± 5.10	0.089
POG			0.071
<28 Weeks	2 (4.0%)	10 (5.0%)	
28-36 Weeks	32 (64.0%)	78 (39.0%)	
≥37 Weeks	16 (32.0%)	112 (56.0%)	
Weight (Kg)	63.18 ± 8.36	58.98 ± 6.16	0.036
Weight			0.039
41-50 Kg	6 (12.0%)	42 (21.0%)	
51-60 Kg	18 (36.0%)	90 (45.0%)	
61-70 Kg	18 (36.0%)	64 (32.0%)	
71-80 Kg	8 (16.0%)	4 (2.0%)	

In the assessment of patients with Gestational Diabetes Mellitus (GDM) and Pre-existing Diabetes (Pre-DM), various parameters were compared between the two groups. Serum lipase levels (S. Lipase) were comparable between GDM (37.32 ± 18.47 IU/L) and Pre-existing Diabetes (36.11 ± 13.79 IU/L), with no significant difference noted (p = 0.802). The majority of individuals in both groups had lipase levels within the normal range (≤60 IU/L), and there was no statistically significant difference between the groups (p = 1.000). Similarly, serum amylase levels (S. Amylase) showed no significant difference between GDM (44.69 ± 16.84 IU/L) and Pre-existing Diabetes (52.66 ± 21.84 IU/L) groups (p = 0.397). All individuals in both groups had amylase levels within the normal range (≤115 IU/L), with no significant difference observed (p = 1.000). Hemoglobin A1c (Hba1c) levels differed significantly between the two groups (p = 0.023), with individuals in the GDM group having a mean Hba1c of 5.69 ± 1.21%, compared to 7.24 ± 1.98% in the Pre-existing Diabetes group. The distribution of Hba1c categories (<6.5% and ≥6.5%) also showed a significant difference (p = 0.015). Fasting blood sugar (FBS) levels were not significantly different between GDM (104.41 ± 21.87 mg/dL) and Pre-existing Diabetes (112.55 ± 26.82 mg/dL) groups (p = 0.505). The distribution of FBS categories (<100 mg/dL and ≥100 mg/dL) did not reveal a statistically significant difference between the groups (p = 1.000). Postprandial blood sugar (PPBS) levels were comparable between GDM (156.67 ± 32.00 mg/dL) and Pre-existing Diabetes (166.63 ± 34.04 mg/dL) groups, with no significant difference observed (p = 0.718). The distribution of PPBS categories (<140 mg/dL and ≥140 mg/dL) also showed no significant difference between the two groups (p = 1.000) **(Table-2).**

Table 2: Association between Diagnosis of DM and Parameters

Parameters	Diagnosis of DM		p value
	GDM (n = 30)	PRE EXISTING DIABETES(n = 12)	
S. Lipase (IU/L)	37.32 ± 18.47	36.11 ± 13.79	0.802
S. Lipase			1.000
≤60 IU/L	28 (93.3%)	12 (100.0%)	
>60 IU/L	2 (6.7%)	0 (0.0%)	
S. Amylase (IU/L)	44.69 ± 16.84	52.66 ± 21.84	0.397
S. Amylase			1.000
≤115 IU/L	30 (100.0%)	12 (100.0%)	

Parameters	Diagnosis of DM		p value
	GDM (n = 30)	PRE EXISTING DIABETES(n = 12)	
>115 IU/L	0 (0.0%)	0 (0.0%)	
Hba1c (%)	5.69 ± 1.21	7.24 ± 1.98	0.023
Hba1c			0.015
<6.5 %	22 (73.3%)	3 (25.0%)	
≥6.5 %	8 (26.7%)	9 (75.0%)	
FBS (mg/dL)	104.41 ± 21.87	112.55 ± 26.82	0.505
FBS			1.000
<100 mg/dL	14 (46.7%)	5 (41.6%)	
≥100 mg/dL	16 (53.3%)	7 (59.9%)	
PPBS (mg/dL)	156.67 ± 32.00	166.63 ± 34.04	0.718
PPBS			1.000
<140 mg/dL	10 (33.3%)	3 (25.0%)	
≥140 mg/dL	20 (66.7%)	9 (75.0%)	

In cases, there was no significant difference in serum amylase levels between those with and without GI symptoms. In contrast, among the control group, those with GI symptoms had significantly higher serum amylase levels compared to those without GI symptoms **(Table-3).**

Table 3: Comparison of the 2 Subgroups of the Variable GI Symptoms in Terms of S. Amylase (IU/L) in (Group: Case) (n = 25) and control (n=100)

S. Amylase (IU/L) Cases	GI Symptoms		Wilcoxon-Mann-Whitney U Test	
	Present	Absent	W	p value
Mean (SD)	51.07 (17.69)	44.99 (21.61)	79.000	0.340
Median (IQR)	49.9 (36.2-63.35)	36.5 (35.7-40.3)		
Range	24.6 - 79.8	22.2 - 86.4		
S. Amylase (IU/L) Control	**GI Symptoms**		**Wilcoxon-Mann-Whitney U Test**	
	Present	**Absent**	**W**	**p value**
Mean (SD)	125.06 (46.50)	58.64 (22.48)	1591.400	<0.001
Median (IQR)	99.85 (93.98-154.82)	53.2 (42.38-70.45)		
Range	86.9 – 270	21.2 - 122.5		

DISCUSSION

This study presents a groundbreaking exploration of the intricate relationship between exocrine and endocrine pancreatic functions in pregnant women with diabetes. Although extensive research has delved into diabetes and its impact on pancreatic function, limited attention has been given to the specific context of pregnancy. This study aimed to address this gap by investigating serum amylase and lipase activities in two distinct groups: pregnant women with gestational diabetes (GDM) and pregnant women with pre-existing diabetes, comparing their results to those of a healthy control group.

The study's findings revealed several noteworthy observations. Firstly, it was evident that fasting blood sugar (FBS) levels in both the GDM and pre-existing diabetes groups were elevated compared to the control group. However, it's worth noting that these elevations were less severe than those observed in previous non-pregnant diabetic populations. This suggests that the unique physiological conditions of pregnancy might have a moderating effect on blood sugar levels, as suggested by the study by E. Bertelli et al.[6]

One of the pivotal findings of the study was the significant reduction in serum amylase levels in both the GDM and pre-existing diabetes groups when compared to the control group. This observation aligned with M. R. Hayden et al.,[7,8] which focused on non-pregnant individuals with diabetes. The exact mechanisms underlying this reduction in serum amylase levels remain an open question, and further research is needed to elucidate this phenomenon. Furthermore, the study noted that serum lipase levels were also lower in both GDM and pre-existing diabetes groups, although this difference did not reach statistical significance in the case of GDM. This suggests that pregnant women with diabetes may exhibit reduced serum lipase activity, with the extent of reduction potentially varying based on diabetes type and duration.

Additionally, the study explored the correlations between serum amylase and lipase levels and HbA1c values in pregnant women with diabetes. These correlations provided intriguing insights into the potential connections between glycemic control and exocrine pancreatic function. Notably, the study revealed that well-controlled diabetes cases were associated with lower serum amylase levels than poorly controlled cases, implying a link between glycemic control and exocrine pancreatic function. These observations raise essential questions about the factors influencing pancreatic function in pregnant

women with diabetes, warranting further investigation, as found by Kloppel G et al.[9]

Comparing the findings of this study with Lankisch PG et al.,[10] both similarities and differences were observed. While certain trends persisted across studies, variations in results emphasized the need for more extensive research on this subject. The unique characteristics of pregnant women, including the physiological changes accompanying pregnancy, necessitate dedicated investigations into the specific interplay between exocrine and endocrine pancreatic function in this population.[11-14]

CONCLUSION

In conclusion, this pioneering study casts a spotlight on the intricate interplay between exocrine and endocrine pancreatic functions in pregnant women with diabetes. It underscores the importance of conducting further research in the context of diabetes during pregnancy. Such research will be crucial for developing a more comprehensive understanding of the complex relationship between exocrine and endocrine pancreatic function and its relevance to the management of diabetes in pregnant women. These insights have the potential to enhance healthcare practices for this unique and vulnerable population, ultimately improving the well-being of both mother and child during pregnancy and beyond.

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