

# Comparison of Serum Gamma Glutamyl Transferase and Blood Sugar Levels in Type-2 Diabetic Patients with and Without Peripheral Neuropathy

Serum Gamma  
Glutamyl  
Transferase and  
Blood Sugar in  
Diabetic

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## ABSTRACT

**Objective:** To evaluate and compare the levels of serum glutamyl transferase, HbA1C, fasting blood glucose and postprandial blood glucose in diabetics with and without peripheral neuropathy.

**Study Design:** Cross sectional comparative study.

**Place and Duration of Study:** This study was conducted at the Department of Medicine, Niazi Medical & Dental College Sargodha from March 2020 to May 2020.

**Materials and Methods:** This was an exploratory study comprised of 80 type-2 diabetic patients and they were divided into two groups. Group A contained 40 patients with no peripheral neuropathy while Group-B consisted of 40 peripheral neuropathic patients.

**Results:** In Group-A, 35 (87.5%) had serum GGT up to 55 U/L while 5 (12.5%) patients had > 55 U/L and in Group-B, 9 (22.5%) had serum GGT up to 55 U/L while 31 (77.5%) patients had > 55U/L (p=0.001). The mean serum gamma glutamyl transferase of peripheral neuropathy diabetics was 30.97±7.93 U/L and 75.25±12.63 U/L in peripheral neuropathy diabetics (p=0.001).

**Conclusion:** Majority patients with PN had raised serum gamma glutamyl transferase while normal gamma glutamyl transferase levels were observed among most of the patients without peripheral neuropathy.

**Key Words:** Diabetes mellitus, Polyneuropathy, Oxidative stress, Gamma-glutamyl transferase.

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## INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic illness caused by reduced insulin production by the pancreas, or by a failure of the body to use insulin effectively. Hyperglycemia is one of the results of uncontrolled DM and causes significant neurological and blood vessel destruction. Type-2 DM patients comprised 90% of the whole DM patients.<sup>1</sup> The total population of Pakistan is 207 million according to the 2017 Pakistan Census<sup>2</sup> out of which 7.1 million suffer from DM.<sup>3</sup>

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Among those DM patients 0.4 million suffer further complications of DM like foot ulcers secondary to PN.<sup>4</sup> Diabetes mellitus is the leading cause of PN globally and the frequency of PN ranges from 10 to 50 percent in DM patients.<sup>5</sup> Pakistan has 39.6 per cent prevalence of diabetic PN.<sup>6</sup>

Diabetic peripheral neuropathy is usually multifactorial. One of the most important reasons for its cause is oxidative stress. In otherwise healthy people, GGT has been evidenced to be one of the initial indicators of oxidative stress. Current researchers have discovered that high hepatic enzyme levels like alanine aminotransferase and GGT, are related to DM progression.<sup>7,8</sup> Diabetes mellitus induced oxidative stress overloads the metabolic pathways of glucose which in turn lead to excessive free radical generation and promotes the development of Diabetic PN in the peripheral nervous system.<sup>4</sup> A recent study concluded that GGT has been proven as an early marker of oxidative stress in healthy individuals.<sup>9</sup> There is a correlation between Diabetic PN and serum GGT concentration and in Type 2 DM patients.<sup>10</sup> This study was carried out to evaluate and compare the levels of serum GGT, HbA1C, FBG and PPBG in diabetics with and without PN.

## MATERIALS AND METHODS

This cross sectional comparative study was carried out at Department of Medicine, Niazi Medical & Dental College Sargodha from 1<sup>st</sup> March 2020 to 31<sup>st</sup> May 2020 This was an exploratory study comprised of 80 type-2 diabetic patients and they were divided into two groups. Group A contained 40 patients with no peripheral neuropathy while Group-B consisted of 40 peripheral neuropathic patients. All the patients included in this study were above 40 years in age. Patients with history of chronic alcohol consumption and hepatobiliary disorders, patients who had PN other than diabetic PN and patient taking drugs like phenytoin, amiodarone, hydralazine, statin, metronidazole, INH (isoniazid), cancer therapy drugs such as vincristine were excluded from study. Study variables were controlled for confounding factors i.e. age, weight, gender and body mass index (BMI). After written consent demographic data (gender, age, occupation, BMI) was collected. Five ml of venous blood was collected from each of the subject in a disposable syringe under aseptic measures. Serum was separated and preserved at  $-20^{\circ}\text{C}$  for assay of biochemical marker until analyzed. FBG and PPBG levels were estimated by using PAP method.<sup>11</sup> Serum GGT<sup>12</sup> and HbA1C was measured using microlab 300.<sup>13,14</sup>

Data analysis was conducted using Statistical Package for Social Sciences software version 25. A chi-square test was used to assess relation between serum markers FBG, PPBG & HbA1C and GGT levels in PN and non PN patients. Independent sample t-test was used to assess the mean difference of the two groups for serum

levels of FBG, PPBG & HbA1C and GGT. Statistical significance was accepted at  $p < 0.05$ .

## RESULTS

Group-A included 40 patients without PN while group B comprises of 40 patients of PN. In group A 28 (70%) patients were from 41-50 years, 9 (22.5%) from 51-60 years and 3 (7.5%) were above 60 years of age. In group B 20 (50%) patients were from 41-50 years, 17 (42.5%) from 51-60 years and 3 (7.5%) were above 60 years of age. Male to female ratio was 3:1 and 1.5:1 in groups A & B respectively. In group A 11 (27.5%) patients were from BMI range 18.5-24.5, 18 (45%) from 25-29.9 years and 11 (27.5%) were from above 30 kg/m<sup>2</sup> of BMI. In group B, 10 (25%) patients were from BMI range 18.5-24.5, 15 (37.5%) from 25-29.9 years and 15 (37.5%) were from above 30 kg/m<sup>2</sup> of BMI. In group A 17(42.5%) patients were on Government jobs, 0% in private organizations, 1(2.5%) businessmen, 10(25.0%) labourer, 2(5%) retired from job and 10(25%) housewives. In group B 13(32.5%) patients were on Government jobs, 4(10%) in private organizations, 2(5%) businessmen, 4(10.0%) labourer, 2(5%) retired from job and 15(37.5%) housewives. There is significant association of frequency of patients with and without PN who have abnormal levels of GGT (>55/L) in their blood ( $p=0.001$ ). This association is not significant with levels of HbA1C, FBG and PPBG levels (Table1). There are statistically significant differences of HbA1C, FBG, PPBG and GGT levels in type-2 diabetic patients with PN and without PN ( $p=0.001$ ) (Table2).

**Table No.1: Frequency and percentages of DM type-2 patients with and without PN according to different levels of HbA1C, FBG, PPBG and GGT**

Group	HbA1c			FBG (mg/dl)		PPBG (mg/dl)		GGT (U/L)	
	≤5.7%	5.8-6.4%	>6.5%	80-110 mg/dL	>110 mg/dL	120-140 mg/dl	>140 mg/dl	≤55	>55
Patients without PN (n=40)	5 (12.5%)	3 (7.5%)	32 (80%)	2 (5%)	38 (95%)	-	40 (100%)	35 (87.5%)	5 (12.5%)
Patients with PN (n=40)	2 (5%)	-	38 (95%)	-	40 (100%)	-	40 (100%)	9 (22.5%)	31 (77.5%)
P-value	0.532			0.494		1.024		0.001*	

**Table No.2: Comparison of HbA1C, FBG, PPBG and GGT in DM type-2 patients with & without PN**

Variable	Patients without PN	Patients with PN	P-value
HbA1c	7.2±1.34	8.7±1.57	0.001*
FBG	123±5.23	147±7.34	0.001*
PPBG	170±12.17	207±14.19	0.001*
GGT	30.97±2.59	75.24±8.64	0.001*

## DISCUSSION

In the current study 80 patients with DM were recruited according to the criteria of inclusion and exclusion. This study results showed that 75.0 percent of group A subjects and 60.0 percent of group B subjects were male, which reflects male dominance in both groups. In 2010 Cho conducted a study to determine the relationship between serum GGT level and peripheral diabetic PN in patients with type 2 diabetics. Results

revealed that 61.1% of PN patients were male while the 39.9% of non-PN patients were female.<sup>10,15,16</sup>

Analysis of data obtained during the study indicated that 42.5 percent of patients were on government/private jobs while the remaining patients in both classes were traders, labourer and housewives.<sup>15</sup> Body mass index is an important indicator of physical health not only in healthy people but in diabetic patients as well. The BMI of both groups was measured and findings stated that the average BMI of PN patients was  $28.70 \pm 4.88 \text{ kg/m}^2$  and was  $27.51 \pm 3.52 \text{ kg/m}^2$  without PN, i.e. both groups were overweight. The Mørkrid study stated that mean BMI in patients with PN was  $24.7 \pm 3.6$  and  $24.5 \pm 3.3 \text{ kg/m}^2$  without PN showed that both groups had normal weight according to their measured BMI.<sup>17</sup>

Results of this research showed a considerable difference between the two groups' means of GGT levels. The mean serum GGT levels in PN patients were  $75.24 \pm 8.64 \text{ U/L}$  while in patients without PN GGT levels were  $30.97 \pm 2.59 \text{ U/L}$ . These results are close to the findings reported in 2012 by Jyothirmayi and colleagues<sup>18</sup> who found out that PN and non-PN diabetic patients have substantial differences between their mean GGT serum levels. In their research patients with PN had a mean value of  $57.4 \pm 42.4 \text{ U/L}$  while the mean value was  $20.60 \pm 5.87 \text{ U/L}$  for patients without PN.<sup>17</sup>

Results of this study revealed that all patients in both groups had PPBG greater than 140 mg/dL. However, a significant difference was noted between the means of PPBG levels of the two groups. The mean levels PPBG were  $207 \pm 14.19$  and  $170 \pm 12.17 \text{ mg/dl}$  of patient with and without PN respectively. The results are similar with the conclusions of the study conducted by Jyothirmayi et al<sup>18</sup> in 2012 disclosed that patients had mean PPBG  $295.95 \pm 83.01 \text{ mg/dl}$  and  $215.80 \pm 75.19 \text{ mg/dl}$  in patient of PN and without PN respectively.<sup>18</sup> HbA1c levels are used to track patients' regulation of blood sugar, with various studies indicated that the majority of patients in both groups have increased values. In the current analysis, mean HbA1c was  $8.7 \pm 1.57 \%$  in patients with PN while mean was  $7.2 \pm 1.34 \%$  in patients with no PN. A previous study by Janghorbani and colleagues<sup>16</sup> in 2006 showing that mean HbA1c levels were  $11.2 \pm 2.5 \%$  and  $10.5 \pm 2.2 \%$  in patients with and without PN respectively.<sup>18</sup>

Our study analysis indicated a significant association between serum GGT levels and HbA1c in Type-II diabetic patient's frequency in DM patients with and without PN (p-value=0.001). Thirty-one out of 40 PN patients had increased serum GGT levels above 55 U/L, whereas 35 out of 40 patients without PN had normal levels of serum GGT. Study also presented significant association between serum GGT levels in both DM patients' groups with and without PN (p-value=0.001). Current results indicated that majority of PN patients

had elevated serum GGT whereas patients without PN had serum GGT levels within normal range. Study showed that most patients with PN had elevated PPBG and GGT serum while most patients without PN had elevated PPBG but normal GGT levels. This demonstrates the importance of uncontrolled blood sugar levels in PN, and future use of serum GGT as a predictive biomarker for diagnosis of PN.

## CONCLUSION

Current study showed that most PN patients had elevated serum GGT while normal GGT levels were observed in most patients with no PN. Study showed important association between PPBG and GGT and highlighted the significance of serum GGT levels for PN early detection.

### Author's Contribution:

Concept & Design of Study:	Muhammad Faisal Javaid
Drafting:	Maria Gill, Muhammad Imran Khan
Data Analysis:	Saima Rasheed
Revisiting Critically:	Muhammad Faisal Javaid, Maria Gill
Final Approval of version:	Muhammad Faisal Javaid

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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