Correlation of Liver Enzymes (Gamaglutamyl Transferase, Alkaline Phosphatase) with Glucose and Insulin in the type 2 diabetes mellitus patients

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Abstract:

Background: Type 2 diabetes (T2DM) aetiology has been linked to the liver. It is crucial for maintaining normal glucose levels, and it has been proposed that insulin resistance syndrome causes hepatic dysfunction, which then results in T2DM. Glycosylation of haemoglobin results in the formation of HbAlc, a glycated haemoglobin. This value displays a person's glycaemic state for the last two to three months. In certain groups, markers of hepatic function, notably g-glutamyltransferase (GGT) and alanine aminotransferase (ALT), predict the occurrence of T2DM. The serum aminotransferases, alkaline phosphatase (ALP), total protein (TP), albumin, bilirubin and prothrombin time are the most frequently used parameters. **Objectives:** Aim of the study is to find out the Comparison and Correlation of GGT, ALP with Glucose and Insulin in the patients of T2DM and in non diabetic persons. **Materials and Methods:** FBG, Insulin, GGT, ALP, and HOMA-IR were all examined in 400 patients (200 cases and 200 controls) by Kit method on ELISA reader and Semi autoanalyzer (Erba chem-7). The data was analyzed statistically SPSS version 21 . Result: Out of 400 participants, 200 were normal and 200 were T2DM patients. Biochemical investigations were estimated i.e FBS, Insulin, HbA1c, and hepatic enzyme levels . The control group's average age was 51.40 ± 7.67 (Mean $\pm$ SD) years, whereas the patients average Mean $\pm$ age was 52.41 ± 7.86 years. FBS ,insulin, HOMA-IR, and hepatic enzymes were compared between the cases and control groups is shown in Table 1 and a graph chart. It is observed that FBS was highly significant (174.33 ± 26.39 mg/dl) in T2DM.as compared to (80.99 ± 8.18 mg/dl) Healthy participants, HOMA-IR, GGT was considerably increased (8.94 ± 4.86) , (58.89 ± 20.08 u/l) in T2DM than healthy control (2.07 ± 0.98), (42.25 ± 6.94 u/l), respectively . while ALP observed substantially higher (93.23 ± 31.50 u/l) than control group (82.73 ± 16.58 u/l). A correlation of FBG, HOMA-IR, and insulin with GGT was highly significant (p- value=0.000)..

Conclusion: T2DM showed increased Hepatic enzyme activity than healthy individuals , according to the our findings. It was observed that insulin, GGT associated with T2DM. Type 2 diabetes mellitus, GGT, ALP, insulin level, and HOMA-IR were all found to be related.

Keywords: Type 2 DM, FBG, Liver Marker enzymes

Introduction:

Type 2 diabetes (T2DM) aetiology has been linked to the liver. It is crucial for maintaining normal glucose levels, and it has been proposed that insulin resistance syndrome causes hepatic dysfunction, which then results in T2DM (Ko H.s. et al. 2015). Type 2 diabetes results from decreased insulin sensitivity in the target tissues as well as compromised -cell

function and ability to generate sufficient amounts of insulin (insulin resistance). Extremely prevalent non-communicable illness in the globe, type II diabetes is affecting a significant number of individuals and is rising at an alarming rate. HPV is becoming an increasingly serious issue for global health care and, in low- and middle-income nations in particular, threatens to become endemic by 2030 (Shibabaw T. et al. 2019).

Glycosylation of haemoglobin results in the formation of HbAlc, a glycated haemoglobin. This value displays a person's glycaemic state for the last two to three months. In order to evaluate the glycaemic status over the previous two to three months, it is tested in diabetics as well as in people with impaired glucose tolerance (Nitin S. et al. 2010).

Both postprandially and during fasting, the liver is crucial for preserving normal glucose levels. Recent research suggests that obesity, insulin resistance, and type II diabetes are all linked to aberrant hepatic function. Insulin resistance leads to metabolic syndrome, so, that excess insulin is required for functioning. (Ramya SG. et al. 2017).

In certain groups, markers of Hepatic function, notably ALT and GGT, prognosticate the occurrence of type II diabetes. Studies verified that hepatic GGT is a better predictor than ALT in T2DM . We recently found that a moderate increase in GGT level within range is a significant risk factor for T2DM without obesity (Bonnet F. et al. 2011).

Hepatic enzymes (AST, ALT and GGT) levels have been shown to self-reliantly forecast type II diabetes, metabolic syndrome, and cardiovascular disease in numerous investigations. These markers have been linked to HOMA-IR and fasting insulin levels, which are two indirect measures of insulin resistance (Kawamoto R. et al. 2012).

The serum aminotransferases, albumin ,ALP, total protein (TP), bilirubin, and prothrombin time are the most frequently used LFT. Accretion of fat in the liver, a feature of nonalcoholic fatty hepatic disease, is the initial explanation that DM can cause abnormalities in liver function (NAFLD). The other conceivable theory is that people with metabolic syndrome, such as those with diabetes mellitus, are more susceptible to liver inflammation, which impairs liver function and results in a shift in liver biomarkers (Teshome G. et al. 2019).

Acute liver failure, fatty liver disease, cirrhosis, hepatocellular carcinoma, and altered LFTs such as aminotransferases (ALT, AST), ALP, and GGT in the serum with type 2 diabetes (Singh A. et.al. 2019). NAFLD may be the hepatic component of T2DM as the metabolic syndrome, according to some investigators. 6,7 NAFLD commonly results in asymptomatic abnormalities of the hepatic markers ALT, ALP and AST. (Mathur S. et al. 2016).

It is well known that elevated IR has a role in development of type II diabetes (DM Type-2).] The beginning of hyperglycemia may occur several years before the vascular consequences of diabetes. It will therefore be extremely beneficial if IR can be identified early so that any potential therapies can be implemented at a young age to stop or delay the emergence of diabetes and its problems (Bhagyanathan M. et al. 2017).

Gamma glutamyl transpeptidase (GGT) and alanine aminotransferase (ALT) either anticipate the development of the metabolic syndrome or correlate with its

elements, or both. Similar observations are attributed to GGT or both, ALT predicts diabetes mellitus and other conditions. Correlations between ALT and GGT, indirect and direct measures of insulin resistance have been found. A sensitive indicator of liver injury is GGT (Al-Sultan, A. I. et al. 2008).

Aims and objectives:

Aim: Comparison and Correlation of gamaglutamyl transferase, alkaline phosphatase with Glucose and Insulin in the patients of Type II Diabetes mellitus and in non diabetic subjects.

Objectives:

• To evaluate the levels of Fasting blood glucose (FBG).

• To evaluate the hepatic enzymes (GGT, ALP)

• A Comparison and Correlation of FBG with Insulin, GGT and ALP.

• Comparison and Correlation of HOMA-IR with Insulin, GGT and ALP.

Material and Methods:

The blood Samples were withdraw from outpatient department (OPD) at Shri Guru Ram Rai Institute of Medical & Health Sciences, Dehradun with collaboration of Glocal Medical College & Research center, Saharanpur, Uttra Pradesh within the period of April 2021 to March 2022. Samples were collected by random sample technique. Both genders were considered together with the person's age between >40 and <65. Exclusion standards Type-I Diabetes sufferers, hepatic disorders (hepatitis B or C, hemochromatosis) Drug-induced disease, Wilson disease. Renal failure and Various illnesses (eg. Viral infections), on drug therapy like steroids and antibiotics, expecting mothers, lactating females malignancies of the

thyroid, pancreas, and other cancers. FBG, Insulin, GGT, ALP, and HOMA-IR were all examined in all 400 patients (200 cases and 200 controls). With the help of an ELISA reader and semi-autoanalyzer (Erba Chem 7) , all the values were calculated.

Statistical Analysis:

The data was analyzed for statistical investigation used SPSS software. The mean SD were calculated for categorical variables and frequency . Using the independent t-test, each continuous variable was examined. Before doing any t-tests, the data were checked for normal distribution. At $p < 0.05$, differences considered as significant.

Results:

Out of 400 members, 200 were normal and 200 were Type 2 Diabetes Mellitus patients. These patients and the controls fasting blood glucose, HbA1c, insulin, and liver enzyme levels were examined. The control group's average Mean ± SD of age 51.40 ± 7.67 years, while in case 52.41 ± 7.86. Out of 200 case individuals, there were 109 male cases (54.5%), 91 female cases (45.5%), and 104 male controls (52%) and 96 female controls (48%) out of 200 normal people. Comparing several parameter levels between T2DM and healthy persons is shown in Table 1.

Investigations	T2DM =200	Healthy partcipants =200)	T-test	P-value
	MEAN ± SD	MEAN ± SD		
FBS (mg/dl)	174.33 ± 26.39	80.99 ± 8.18	2.508	0.013
Insulin (µIu/ml)	19.94 ± 8.62	11.17 ± 5.94	2.608	0.010
HOMA-IR	8.94 ±4.86	2.07 ±0.98	2.919	.004
GGT (u/l)	58.89 ±20.08	42.25 ±6.94	2.932	.003
ALP (u/l)	93.23 ±31.50	82.73 ±16.58	2.422	.016

Table: 1- Demographic Biochemical investigations In T 2 DM and healthy participants .
(P<0.00 very highly significant , P< 0.01 highly significant, P< 0.05 significant)

Comparing FBS, insulin, HOMA-IR, and Hepatic enzymes between T2DM and healthy groups is shown in Table 1 and a graph chart. The mean value of Insulin was substantially higher (19.94± 8.62 µIu/ml) in case than in control group (11.17 ± 5.94 µIu/ml), while FBS shows significantly higher(174.33 ± 26.39 mg/dl) in T2DM 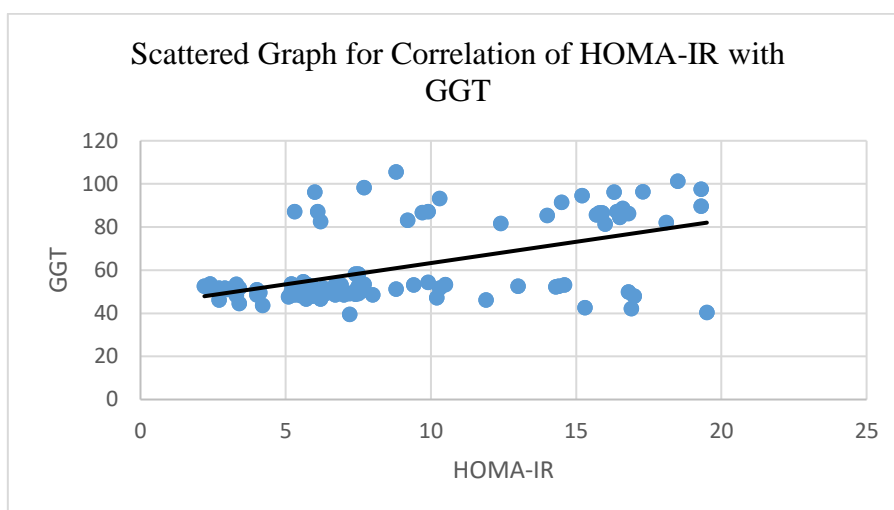than healthy group (80.99 ± 8.18 mg/dl),HOMA-IR mean value was considerably higher (8.94 ± 4.86) T2DM than (2.07 ± 0.98),while GGT statically increased (58.89 ± 20.08 u/l) T2DM as compared to other group (42.25 ± 6.94 u/l),ALP was substantially higher (93.23 ± 31.50 u/l) T2DM than (82.73 ± 16.58 u/l) in healthy group.
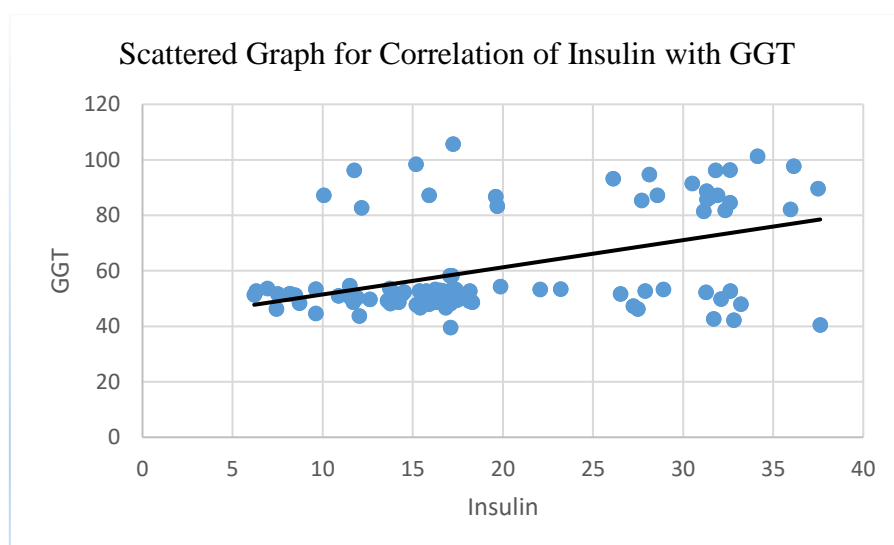
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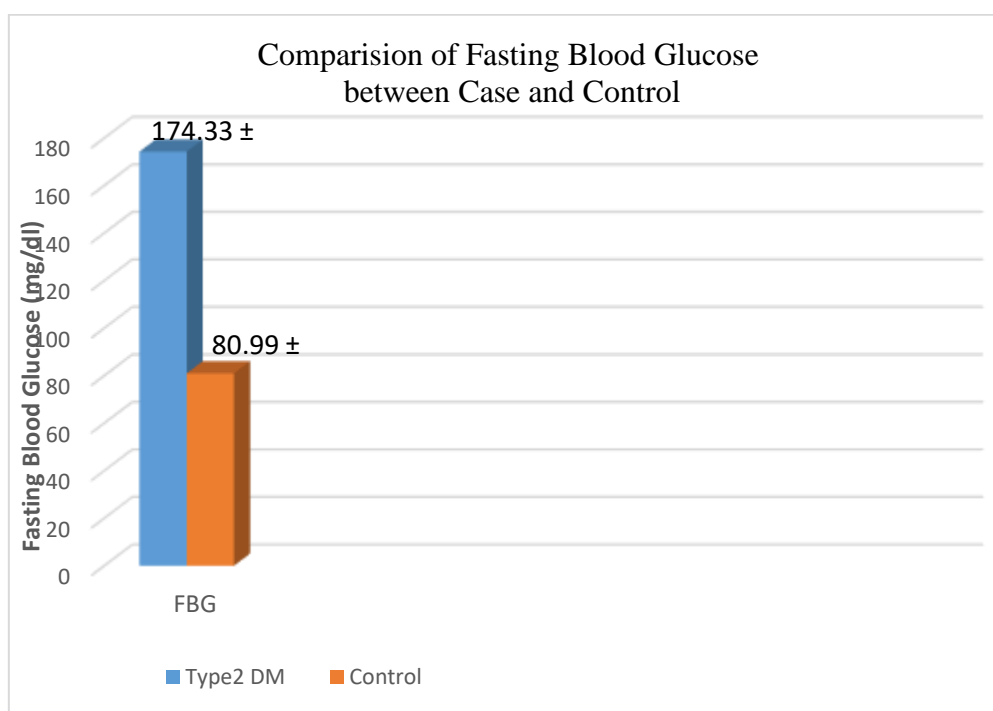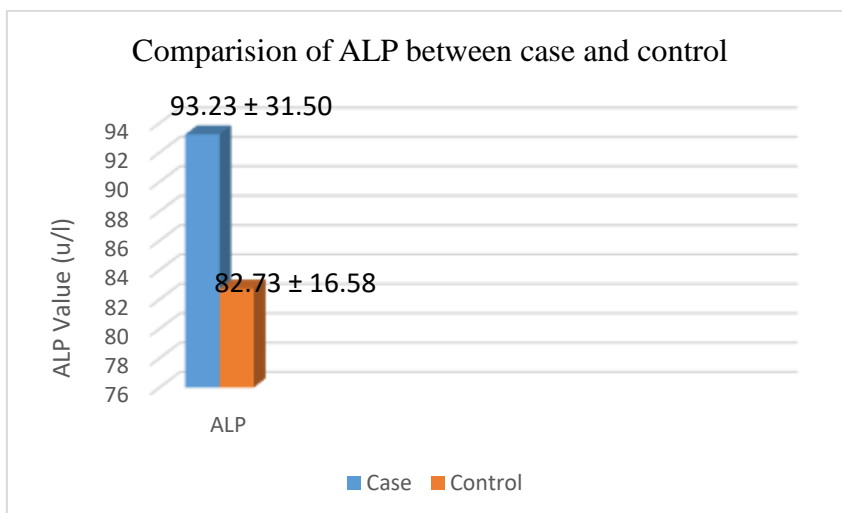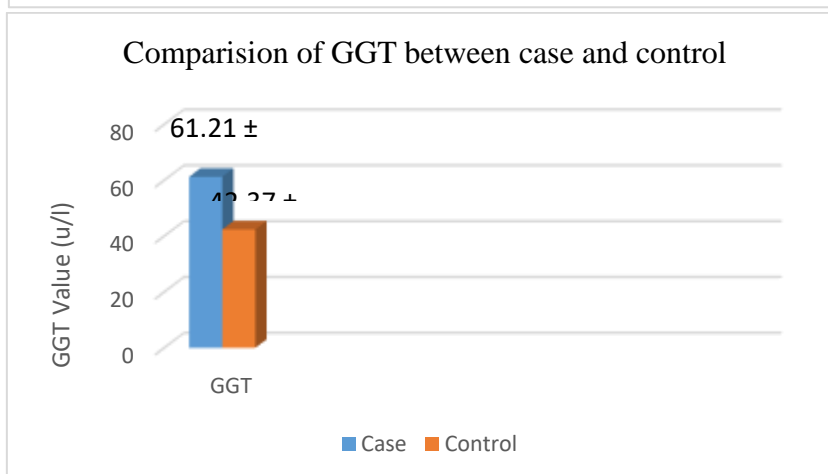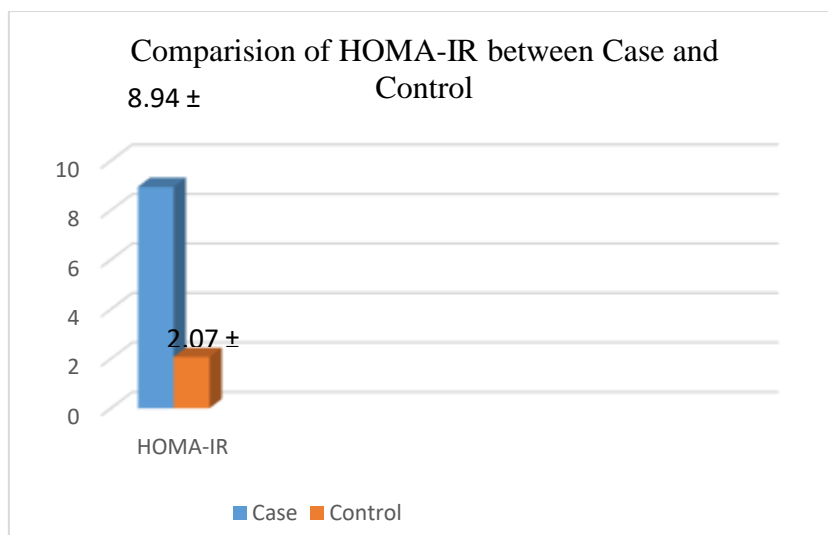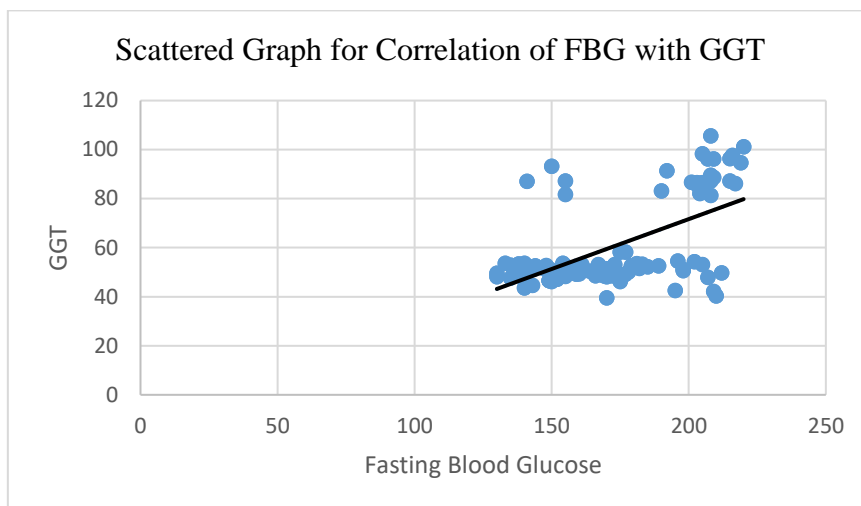
Scattered Graph-1 : FBG has positive correlation with GGT

Scattered Graph- 2: HOMA-IR has positive correlation with GGT

Scattered Graph-3 : Insulin has positive correlation with GGT

Scattered graph 1-3 reveals that the individual correlation of FBG with GGT, HOMA-IR with GGT and Insulin with GGT. A correlation between FBG with GGT (Cr value =0.586, p-value=0.000) significantly high . Like HOMA-IR with GGT (Cr value=0.524, p- value= 0.000) and Insulin with GGT (Cr value= 0.460, p- value= 0.000).

Discussion:

In this learning we have experiential higher levels of Glucose, Insulin, HOMA-IR, GGT and ALP. FBS , Insulin and HOMA-IR 74.33 ± 26.39 mg/dl, 19.94 ± 8.62 µIu/ml and 8.94 ± 4.86 elevated in patients than healthy persons. The mean ± SD of GGT and ALP was 58.89 ± 20.08 u/l 93.23 ± 31.50 u/l elevated in T2DM.

Ko S.H. et al. reported that serum ALT and GGT levels were positively associated with the prevalence of T2DM. He stated that higher GGT levels (42.5 Iu/l men and 26.6 Iu/l women) in diabetic population (Ko S. H. et al. 2015).

Teshome G. et al. stated that average values of ALP were higher significantly in T2DM than the control group (Teshome G. et al. 2019).

A study done by Adiga U. et al that insulin (20.51 ± 3.37 µu/l), ALP (94.54 ± 2.96 Iu/l), GGT (68.09 ± 13.44 u/l) and HOMA-IR (8.17 ± 1.25) higher in T2DM patients .

Reported by Jha S.K. et al. significant correlation of FBS ,ALP and GGT. The higher value of ALP (194.18 ± 58.98 u/l) and GGT (88.34 ± 59.79 Iu/l) in diabetic population .

It was observed that there was higher value of ALP (93 ± 34 Iu/l) in diabetic patients than control group (Ghimire S. et al. 2018).

Conclusion:

The increased heaptic enzyme levels observed in T2DM than non-T2DM patients, according to the study's findings. A positive association with insulin, GGT, and T2DM was also seen in our study population. Type 2 diabetes mellitus, GGT, ALP, insulin level, and HOMA-IR were all found to be related. Regular evaluation of the GGT in those populations may stop future issues related to the liver brought on by insulin resistance. We are therefore sure that our study's findings will serve to motivate medical personnel to keep an eye on this previously unrecognised diabetic liver outcome in T2DM patients.

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