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Original Research Article

ASSOCIATION OF ASPARTATE AMINOTRANSFERASE AND ALANINE AMINOTRANSFERASE WITH DIABETIC PROFILE IN THE PATIENT OF TYPE 2 DIABETES MELLITUS

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Abstract

Background: Diabetes mellitus (DM) is a metabolic illness triggered by an imbalance in insulin secretion, insulin act, or both. This leads to persistent hyperglycaemia, which is thought to be the primary factor in diabetes consequences, including long-term organ system failure and damage. It is general non-communicable diseases, diabetes mellitus is becoming more common everywhere. 90% of cases of diabetes are of type 2, making it the most prevalent type. Numerous liver diseases, including, acute liver failure, cirrhosis, carcinoma of liver, and fatty hepatic disease is all linked to type 2 diabetes. The liver is where the metabolic processes and insulin clearance happen. Aim of the study was to find out the correlation of Fasting blood glucose with hepatic marker enzymes (AST and ALT) and Insulin. **Materials and Methods:** 200 patients and 200 controls who visited the OPD of the SGRRIMHS, Dehradun, served as the subjects of the current study. Many Biochemical studies (FBG, Insulin, AST and ALT) of these patients were analysed by ELISA and Semi automated Clinical Chemistry analyzer method using accepted protocol. SPSS programme used to statistically analyse the data. **Result:** 400 participants, both cases and controls, participated in the study. 200 participants were selected from 400 about Type 2 Diabetes Mellitus patients (Type2DM) and 200 participants were normal. The fasting blood glucose (FBS), HbA1c, Insulin & Liver enzymes of these cases and controls were analysed. The age range of the cases is 52.41 ± 7.86 (Mean ± SD) years and range of control peer group is 51.40 ± 7.67 (Mean ± SD) years. Glucose mean value (174.33 ± 26.39 mg/dl), HbA1c mean value (8.01 ± 1.83 %), Insulin mean value (19.94 ± 8.62 µIu/ml), SGOT/AST mean value (51.00 ± 14.50 u/l) and SGPT/ALT mean value (45.17 ± 11.13 u/l) is appreciably higher in case than representative sample. FBG has positive relationship with HbA1c (Cr value = 0.711, P- value = 0.19) is a non-significant statistic. FBG and Insulin have a positive correlation that is statistically significant (Cr value= 0.625, P- value = 0.002). FBG and SGOT have a positive correlation that is statistically insignificant (Cr = 0.343, P- = 0.188). FBG and SGPT have a positive correlation that is statistically significant (Cr value = 0.239, P- value = 0.000). **Conclusion:** This study shows that, T2DM cases had higher hepatic enzyme activity than non-T2DM patients. Additionally, in our study sample we found that liver enzymes of type2 diabetic patients work considerably higher than non-diabetics therefore there is a positive correlation between insulin & liver parameters and diabetes mellitus. An association was found between type 2 diabetes mellitus, liver marker enzymes and insulin level. In some cases, a thorough examination may aid in prompt diagnosis and therapy. Therefore, through this study there is probability to reduce liver-related morbidity and mortality in T2DM patients. This could be done by routine assessment and early detection of aberent liver enzymes.

INTRODUCTION

Diabetes mellitus (DM) is a catabolic and anabolic (metabolic) illness caused by abnormalities in insulin secretion, insulin performance, insulin action or all. This leads to chronic hyperglycaemia, which is thought to be the primary factor in diabetes sequelae, including long-term failure and damage to a number of organ systems.[1] Among the most common non-communicable diseases, diabetes mellitus is becoming more common everywhere. 90 % of cases of diabetes are of type 2, making it the most prevalent type. It was expected that prevalence of diabetes would rise from 2.8% in 2000 to 4.4% in 2030. By 2030, there will be 366 million cases of diabetes worldwide, up from 171 million in 2000, predicts. Men are more likely than women to have diabetes.[2]
Hyperglycaemia, insulin resistance & relative insulin insufficiency are defining hallmarks of Type 2 Diabetes Mellitus (T2DM) triggered by the interplay of genetic, environmental, and behavioural risk factors.[3]
Blood glycated haemoglobin investigation discloses information about last two to three months representative blood glucose level of the patient or person. Half-life of red blood cells(RBCs) matched with that. When the physiological conditions are favourable, proteins are frequently glycated during a variety of enzymatic processes. Hemoglobin, on the next hand, experiences glycation by a nonenzymatic reaction involving glucose and N-terminal end of chain, which results in creation of a Schiff base. The Schiff base is converted into Amadori products during readjustment, with HbA1c being the most well-known.[4]
Numerous liver conditions, like carcinoma of liver, cirrhosis, fatty hepatic disease and acute hepatic failure, are linked to type 2 diabetes.[5] In the aetiology of this condition, the liver is crucial.[6] (Prabhudeva N et al. ,2014). However, T2DM affects every organ in the body, and the liver is not spared from the effects of this fatal condition. According to evidence, T2DM may be detected in up to 70% of people with cirrhosis, which may lead to the development of chronic liver disease.[7] The precise aetiology of DM that results in alterations in liver biomarkers is still unknown. The liver is crucial in the control of carbohydrate homeostasis. In people with poorly controlled diabetes, hepatocellular glycogen buildup causes hepatomegaly and abnormalities in liver enzymes. Increased glycogen synthesis in hyperglycemic situations results in intracellular glycogen buildup in the hepatocytes, which is characterised biochemically in the form of modest to moderately elevated aminotransferases, normal hepatic synthesis, with or without slight elevations of ALP.[8] There is proof connecting obesity with insulin resistance and hepatic steatosis, both of which lead to liver damage, from a variety of liver illnesses. Numerous investigations in nonalcoholic fatty liver disease have consistently found.[9]
Transaminases, also known as aminotransferases, are sensitive markers of damage to liver cells. They consist of the enzymes alanine aminotransferase (ALT) and aspartate aminotransferase (AST). In decreasing direction of concentration, AST is present in the Hepatocytes, pancreas, heart muscle, renals, brain, lungs, skeletal muscle, leukocytes, and RBC. Since ALT is mostly present in liver, it is a more accurate sign of liver damage. Low quantities of aminotransferases are typically found in serum. When the liver cell membrane is injured and becomes more permeable, more of these enzymes are unrestricted into the blood. Although the normal range for aminotransferases varies significantly between laboratories, it typically falls between 10 - 40 U/L.[10]
The most prevalent liver abnormality in NAFLD and NASH is high blood alanine aminotransferase (ALT), whereas less often elevated levels of alkaline phosphatase (Alk-P) and glutamyl transferase.[11]
One of the main characteristics of metabolic syndrome is insulin resistance. It means that more insulin is needed to produce a regular physiologic response at the cellular or systemic level.[12] Insulin resistance is linked to increased activity of these markers.[13] The most common marker of liver illness, elevated blood activity of the two aminotransferases aspartate aminotransferase (AST) and alanine aminotransferase (ALT), occurs more commonly in diabetics than in the general population.[14]
Insulin resistance is the inability to respond to the metabolic effects of insulin, such as its suppression of endogenous glucose production, stimulation of peripheral (particularly skeletal muscle) glucose uptake, stimulation of glycogen synthesis, and inhibition of adipose tissue.[15]
One way to describe IR is as a state in which either usual insulin concentrations or higher than standard insulin concentrations are essential to achieve usual metabolic responses.[16] Patients with type 2 diabetes have been documented to exhibit both hypoinsulinaemia and hyperinsulinaemia and more significantly, several of the chronic consequences of diabetes mellitus are connected to the current plasma insulin levels.[17] Diabetes mellitus with insulin resistance is virtually always present, but neurological, cardiac, and renal problems are typically not present.[18]
Others, however, assert that the development of hepatic fat deposition and hepatic insulin resistance is not necessary for peripheral insulin resistance to manifest. Models where hepatic fat addition occurs without peripheral fat addition are necessary to determine the steps between hepatic fat addition and hepatic insulin resistance. The progression of hepatic and peripheral insulin resistance was studied.[19]
A reliable method for the alternate valuation of IR is Homeostasis Model Assessment of IR (HOMA-IR). However, there abundance variation in the HOMA-IR threshold levels used to identify IR.[20] For the measurement of insulin resistance in research,

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Matthews et al. created homeostasis model assessment-estimated insulin resistance (HOMA-IR).[21]

Insulin resistance (IR), which is well-defined as the inability of a known amount of insulin to increase glucose acceptance and consumption, is a common pathophysiological condition. Utilizing the fasting plasma glucose and the insulin concentrations, homeostasis model judgment-estimated IR (HOMA-IR) was utilised to calculate insulin sensitivity.[22]

Aim: Correlation of Fasting blood glucose (FBG) and Insulin with Liver marker enzymes in the patients of Type 2 Diabetes mellitus.

Objectives:

- To estimate Fasting blood glucose (FBG).
- To estimate Liver marker enzymes (AST, ALT).
- Comparison and Correlation of Fasting blood glucose and Insulin with Liver marker enzymes.

MATERIALS AND METHODS

The samples were reserved from the patients who appeared OPD at SGRRIMHS, Dehradun and GMC & RC, Saharanpur, UP, India for a period of one year from April 2021 to March 2022. A straightforward random sampling procedure that satisfied the sampling selection criteria was used to nominate subjects. Person's age from >40 years and <65 years were occupied and both genders were comprised. Exclusion criteria Type-I Diabetic patients. Liver disease extra than nonalcoholic steatosis (hepatitis B or hepatitis C, autoimmune hepatitis, hemochromatosis) Wilson disease, drug-induced disease and renal disease. Other diseases (eg. HIV, Zika virus infection, corona virus). Patients on steroids and antibiotics during that period. Pregnant women. Lactating women. Thyroid cancer, pancreatic cancer and other cancers. All the 400 subjects (200 cases and 200 controls) were analyzed for FBG, HbA1c, Insulin, AST and ALT. All the parameters were estimated by Erba chem-7 semi-automated clinical chemistry analyzer, HPLC and ELISA reader with standard protocols.

Statistical Analysis

The statistical analysis was conducted using SPSS, a mathematic software for social sciences. Numerous statistical techniques were used, which was crucial. Mean SD was intended for quantitative data and frequency for specific variables. The independent t-test was performed on each enduring variable. The data were verified for normal distribution before any t-test. Differences were considered significant at $p < 0.05$.

RESULTS

The existing study was conducted on 400 subjects, comprising cases and controls. From 400 subjects, 200 subjects about Type 2 Diabetes Mellitus patients and 200 subjects were normal. The fasting blood glucose, HbA1c, Insulin and Liver enzymes of these patients and controls were analysed. The usual age of the patients is 52.41 ± 7.86 (Mean ± SD) years and average age of control group is 51.40 ± 7.67 (Mean ± SD) years. No. of female is 91 (45.5%) and male case is 109 (54.5 %) out of 200 case subjects and no. of female control is 96 (48%) and male control is 104 (52%) out of 200 normal persons. Table 1 displays comparison of various biochemical parameter level between Type 2 DM patients and control subjects.

[Table 1 and Figure] display the comparison of Fasting blood glucose, HbA1c, Insulin and liver enzymes between case and control group. Glucose mean value significantly higher (174.33 ± 26.39 mg/dl) in case than control group (80.99 ± 8.18 mg/dl), HbA1c mean value is highly significant higher (8.01 ± 1.83 %) in case than control group (5.18 ± 0.73 %), Insulin mean value significantly higher (19.94 ± 8.62 µIu/ml) in case than control group (11.17 ± 5.94 µIu/ml), SGOT/AST mean value significantly higher (51.00 ± 14.50 u/l) in case than control group (33.63 ± 7.34 u/l) and SGPT/ALT mean value is highly significant higher (45.17 ± 11.13 u/l) in case than control group (29.61 ± 6.33 u/l).

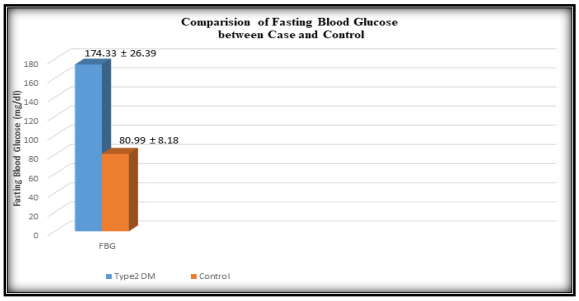

Figure 1: Comparision of Fasting Blood Glucose between Case and Control

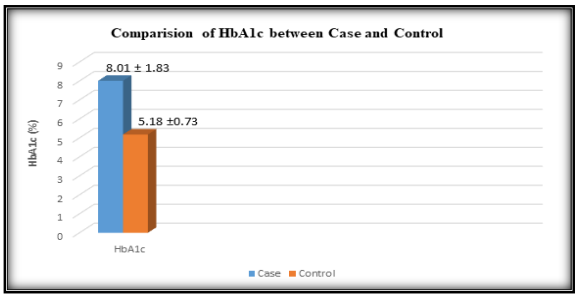

Figure 2: Comparision of HbA1c between Case and Control

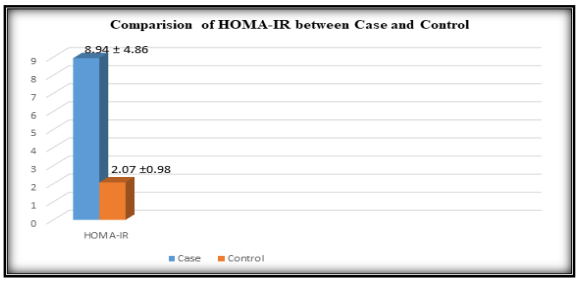

Figure 3: Comparision of HOMA-IR between Case and Control

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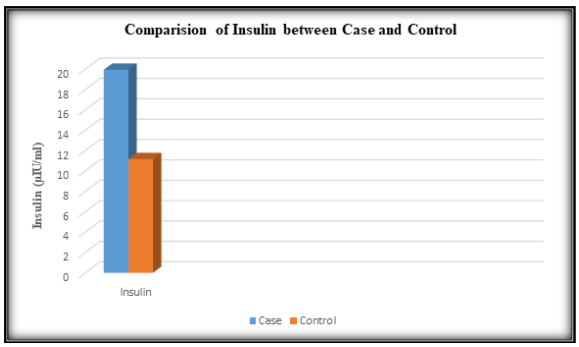

Figure 4: Comparision of Insulin between Case and Control

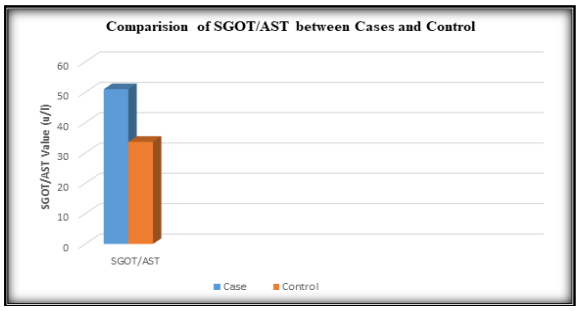

Figure 5: Comparision of SGOT/AST between Cases and Control

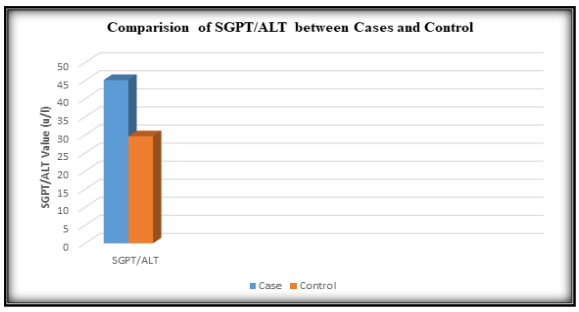

Figure 6: Comparision of SGPT/ALT between Cases and Control

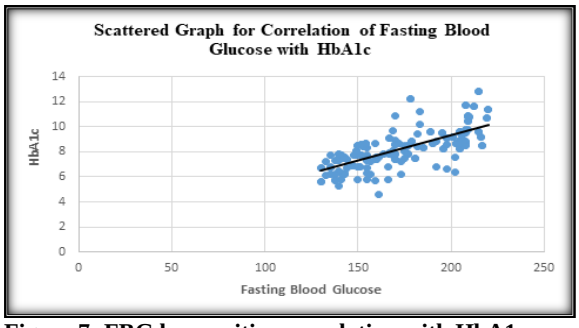

Figure 7: FBG has positive correlation with HbA1c.

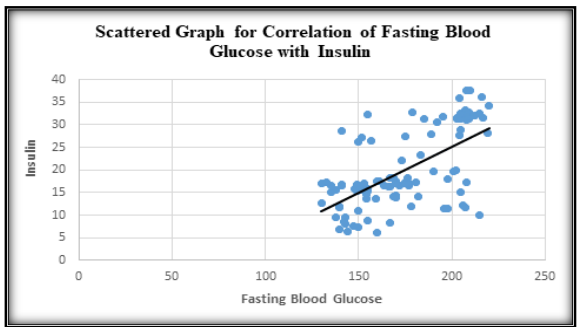

Figure 8: FBG has positive correlation with Insulin.

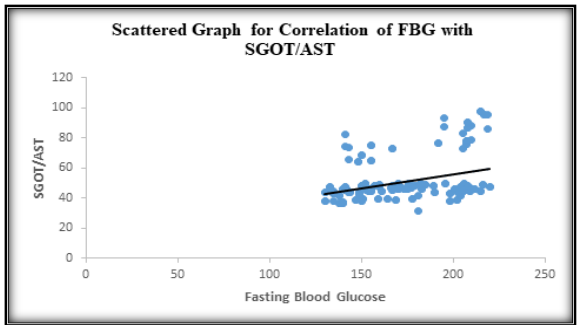

Figure 9: FBG has positive correlation with SGOT/AST.

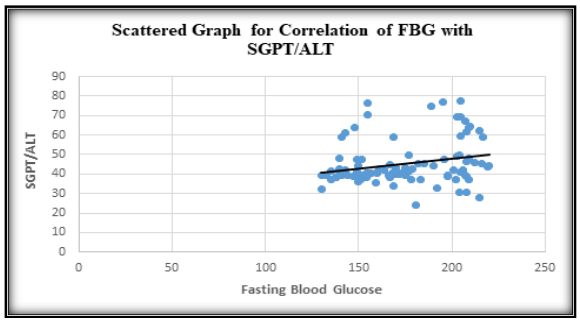

Figure 10: FBG has positive correlation with SGPT/ALT.

Scattered [Figure 7-10] shows the individual correlation between the Fasting blood glucose (FBG) with HbA1c, Insulin, SGOT, SGPT. FBG has positive correlation with HbA1c (Cr value= 0.711, P-value= 0.169), which is statistically not significant. FBG has positive correlation with Insulin (Cr value= 0.625, P- value= 0.002), which is statistically significant. FBG has positive correlation with SGOT (Cr value= 0.343, P- value= 0.188), which is statistically not significant. FBG has positive correlation with SGPT (Cr value= 0.239, P- value= 0.000), which is statistically significant.

Table 1: the comparison of various biochemical parameter level between Type 2 DM Case and control group. (<0.01 highly significant, <0.05 significant)

Parameter	Case (200)	Control Group (200)	T-test	P-value
	MEAN ± SD	MEAN ± SD		
Glucose (mg/dl)	174.33 ± 26.39	80.99 ± 8.18	2.508	.013
HbA1c (%)	8.01 ± 1.83	5.18 ± 0.73	3.461	.0006
Insulin (µlu/ml)	19.94 ± 8.62	11.17 ± 5.94	2.608	.010
SGOT/AST (u/l)	51.00 ± 14.50	33.63 ± 7.34	3.131	.002
SGPT/ALT (u/l)	45..17 ± 11.13	29.61 ± 6.33	3.459	.0006

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DISCUSSION

In this study we witnessed higher levels of Glucose, HbA1c, Insulin SGOT/AST and SGPT/ALT. In our study, the glucose mean value (174.33 ± 26.39 mg/dl) was higher, HbA1c mean value (8.01 ± 1.83 %) was higher, and Insulin mean value (19.94 ± 8.62 µIu/ml) was also higher in the study group than normal subjects. SGOT/AST mean value (51.00 ± 14.50 u/l) was higher in study and SGPT/ALT mean value (45.17 ± 11.13 u/l) was also elevated in the study group than normal subjects.

Adiga U. et al stated that there is higher value of insulin (20.51 ± 3.37 µu/l), AST (52.28 ± 5.75 u/l), ALT (40.17± 3.74 u/l) in diabetic patients (Adiga U. et al. 2019). Ghimire S. et al. described that HbA1c was positively correlated at significant level with transaminases (ALT and AST) in diabetic population. He also reported higher value of AST (51 ± 34 u/l) and ALT (58 ± 40 u/l) in diabetic subjects.[23]

Jha S.K. et al. reported positive correlation of HbA1c with AST and ALT. He stated that positive correlation of FBS with AST and ALT. He also narrate that higher value of AST (72.53 ± 40.41 u/l) and ALT (76.90 ± 42.41 u/l) in diabetic population.[24] Marushchak.M. et al. described that higher value of insulin (19.27 µIu/ml) in diabetic subjects.[25]

Al. H. K. M. A. et al. reported that higher value of insulin (18.97 ± 11.38 µIu/ml) in diabetic patients.[26]

Alam S. et al. reported that higher value of HbA1c (8.1 ± 0.33 %), AST 31.99 ± 16.00 U/l) and ALT (38.7 ± 12.80 u/l) in diabetic subjects.[27]

Elmahi H.M et al. narrate the higher value of ALT and AST in diabetic population.[28] Shibabaw T. et. al. state that there is higher value of AST (42.94 ± 19..08 Iu/l) and ALT (46.06 ± 22.38 Iu/l) in diabetic patients.

CONCLUSION

According to the results of this study, T2DM patients had higher liver enzyme activity than non-T2DM patients. Additionally, in our study sample we found that liver enzymes of type2 diabetic patients work considerably higher than non diabetics therefore there is a positive correlation between insulin and liver parameters and diabetes mellitus. An association was found between type 2 diabetes mellitus, liver marker enzymes and insulin level. In some cases, a thorough examination may aid in prompt diagnosis and therapy. Therefore, through this study there is probability to reduce liver-related morbidity and mortality in T2DM patients. This could be done by Routine assessment and early detection of aberent liver enzymes.

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