**Journal of Research in Medical and Dental Science**
**2022, Volume 10, Issue 6, Page No:106-109**

Available Online at: www.jrmds.in
eISSN No. 2347-2367: pISSN No. 2347-2545

# Assessment of Liver Aminotransferases and their Association in Type 2 Diabetes Mellitus Patients in a Tertiary Care Hospital in Karnataka, India

**Mamatha BV*, Vijay Mahantesh S Samalad, Bhagyajyothi M Bhat, Vivian D'Souza, Shrajanraj Shetty**

*Department of Biochemistry, Kanachur Institute of Medical Sciences, Mangalore, Karnataka, India*

## ABSTRACT

*Introduction: Nonalcoholic fatty liver disease (NAFLD) is the most common liver pathology seen in type 2 Diabetes mellitus (T2DM) patients. This causes abnormality in the pattern of liver enzymes. Elevated levels of transaminases indicate ongoing liver injury.*

*Objectives: To estimate and compare the levels of serum Alanine aminotransferase and Aspartate aminotransferase in T2DM patients and non-diabetics.*

*Methods: The study method chosen was Analytical prospective study. The study participants were 50 T2DM patients and non-diabetic subjects respectively. Study was commenced after obtaining Institutional ethical committee approval. Serum levels of glucose, Aspartate transaminase (AST), Alanine transaminase (ALT), Cholesterol, Triglycerides were estimated in the subjects. Glycated haemoglobin (HbA1c) was also estimated. Data was expressed in Mean ± Standard deviation. Independent student 't' test was applied. For comparison of data, Pearson correlation was used. p value <0.05 was considered statistically significant.*

*Results: Levels of Fasting and postprandial serum glucose, AST, ALT, Cholesterol and Triglycerides were higher in T2DM compared to controls and were statistically significant. Mean AST in cases and controls were 31.76 ± 16.79 and 22.26 ± 9.04 U/L respectively. Mean ALT in cases and controls were 30.71 ± 15.29 20.05 ± 5.98 U/L respectively. Cases showed significant correlation of HbA1c with PPBS and serum cholesterol.*

*Conclusions: NAFLD is prevalent in T2DM as a silent liver pathology. Our study demonstrated the elevation of liver aminotransferases in T2DM patients. Routine checkups should include estimation of liver enzymes in T2DM.*

**Key words:** Aminotransferases, Nonalcoholic fatty liver disease, Insulin resistance, Type 2 diabetes mellitus, Dyslipidemia

**HOW TO CITE THIS ARTICLE**: Mamatha BV, Vijay Mahantesh S Samalad, Bhagyajyothi M Bhat, Vivian D'Souza, Shrajanraj Shetty, Assessment of Liver Aminotransferases and their Association in Type 2 Diabetes Mellitus Patients in a Tertiary Care Hospital in Karnataka, India, J Res Med Dent Sci, 2022, 10 (6):106-109.

**Corresponding author:** Mamatha BV

**e-mail✉:** pandayrenu25@gmail.com

**Received:** 06-June-2022, Manuscript No. JRMDS-22-65967;

Editor assigned: 07-June-2022, **PreQC No.** JRMDS-22-65967 (PQ);

**Reviewed:** 21-June-2022, QC No. JRMDS-22-65967;

**Revised:** 23-June-2022, Manuscript No. JRMDS-22-65967 (R);

**Published:** 30-June-2022

## INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a heterogeneous group of metabolic disorders and is characterized by increased blood glucose levels due to impairment in insulin action or insulin secretion or both. Main hormone which regulates glucose uptake from the blood into most cells, including adipocytes and skeletal muscle cells is insulin. The liver plays an important role in the regulation of carbohydrate metabolism. Liver uses glucose as a fuel, it can store glucose as glycogen which is utilized to maintain blood glucose levels. Liver is also involved in gluconeogenesis. This crucial role makes the liver more susceptible to diseases in persons having a metabolic disorder, especially for Diabetes Mellitus (DM) [1]. As there is the loss of a direct effect of insulin to suppress hepatic glucose production and glycogenolysis, there is an increase in hepatic glucose production in T2DM.

Increased insulin concentration in blood in combination with a high free fatty acid (FFA) flux and hyperglycemia are known to up-regulate lipogenic transcription factors in T2DM. Also the pathways which decrease the hepatic FFA pool, i.e., both FFA oxidation and efflux of lipids from the liver are impaired. This increased availability of glucose, FFA and insulin contribute to increase in

malonyl-CoA by stimulating acetyl CoA carboxylase which converts acetyl-CoA to malonyl-CoA [2]. The FFAs overload the hepatic mitochondrial oxidation system, leading to accumulation of fatty acids in the liver. These mechanisms finally cause non-alcoholic fatty liver disease (NAFLD) in T2DM patients. In addition, several studies have also shown an association between NAFLD and features of the metabolic syndrome, dyslipidemia and DM, stressing the association with insulin resistance as an important feature of NAFLD. NAFLD causes asymptomatic abnormality of liver enzyme levels including alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP). Among these liver enzymes, ALT is most closely related to liver fat accumulation and hence used as a marker of NAFLD. Serum aminotransferase such as ALT and AST indicate the concentration of hepatic intracellular enzymes which have leaked into the circulation during hepatocellular injury and are used as primary markers [3–6]. Recent reports show a significant association of increased ALT and AST with insulin resistance, T2DM, and metabolic syndrome [7,8].

Therefore, we aimed to assess liver enzyme levels, such as ALT, AST and their association with T2DM as compared with non-diabetes control groups.

## OBJECTIVES

To estimate the levels of serum Alanine aminotransferase and Aspartate aminotransferase in type 2 diabetes mellitus patients and non-diabetics.

To compare the levels of serum Alanine aminotransferase and Aspartate aminotransferase in type 2 diabetes mellitus patients and non-diabetics.

## MATERIALS AND METHODS

An analytical prospective study was conducted on randomly selected 50 type 2 diabetes mellitus patients attending as out-patients in the Department of Medicine at Kanachur Institute of Medical Sciences, Mangalore, Karnataka, India. Age and sex matched 50 non diabetics were chosen as controls. The study was conducted from January 2022 to March 2022. The sample size was calculated by the formula:

$$n=2[Z1-\alpha/2 +Z1-\beta]2\ \sigma2/\ d2$$

And the sampling procedure was done by simple random sampling. Ethical clearance was obtained from the Institutional Ethical Committee.

### Inclusion criteria

Cases: 50 Diagnosed cases of T2DM patients without complications, diagnosed by American Diabetes Association, aged between 30 years to 70 years, who are on oral hypoglycemic, not on insulin and willing to participate in the study were included in the study.

Controls: 50 age and sex matched euglycemic subjects.

### Exclusion criteria

- ✓ Patients of diabetes having nephropathy, neuropathy, retinopathy and other microvascular complications.
- ✓ Individuals with severe infections, hepatic or renal diseases and persons on drugs that would affect blood glucose levels.
- ✓ Chronic alcoholics, Overt thyroid dysfunction, use of hepatotoxic drugs, clinical evidence for acute hepatitis, hepatitis B and C virus infection.
- ✓ Pregnant and lactating women .
- ✓ Persons not willing to participate in the study.

## METHODOLOGY

Detailed history was taken and a systematic general, systemic examination was done. Written informed consent was taken from the study participants after explaining the procedure. Basic investigations using standard protocol was done to rule out diabetes among controls and complications of diabetes among cases. Investigations like fasting and post prandial blood sugar estimation, serum alanine aminotransferase, aspartate aminotransferase, HbA1c, serum triglyceride, serum cholesterol levels were done.

### Collection of blood sample

5ml of venous blood sample was collected, after overnight fasting, from antecubital vein under all aseptic precautions. It was allowed to clot and then centrifuged for serum separation. Serum was used for the analysis of all the pre mentioned investigations. The tests were done on the same day after serum separation. EDTA blood was collected for HbA1c estimation in cases. All the investigations except HbA1c were carried out in auto analyzer Vitros 5600 using standard kits. HbA1c was estimated in the instrument Finecare.

- ✓ Blood glucose was estimated by glucose oxidase-peroxidase method [9].
- ✓ AST, ALT were estimated by IFCC kinetic method [10].
- ✓ Serum cholesterol was estimated by cholesterol oxidase phenol 4-aminoantipyrine peroxidase (CHOD-PAP) method [11].
- ✓ Serum triglyceride was estimated by glycerol phosphate oxidase method [12].
- ✓ HbA1c was estimated by fluorescence immunoassay method [13].

### Statistical analysis

Data was analysed using statistical software SPSS version 21. Values were expressed as mean ± SD (standard deviation). Comparison of values between cases and controls was done by using Student's t test. For comparison of data, Pearson correlation was used. p value of less than 0.05 was considered as statistically significant.

**Table 1: Comparison of Fasting blood sugar (FBS), postprandial blood sugar (PPBS), serum aspartate amino transferase (AST), alanine amino transferase (ALT), triglycerides and cholesterol in cases and controls.**

| Parameter | Cases | Controls | 95% Confidence interval | | p value |
|---|---|---|---|---|---|
| | | | Upper limit | Lower limit | |
| FBS (mg/dl) | 171.89 ± 47.52 | 85.68 ± 13.29 | 102.16 | 70.26 | 0.000** |
| PPBS (mg/dl) | 228.84 ± 85.36 | 115.71 ± 8.58 | 140.86 | 85.39 | 0.000** |
| SGOT [AST] (U/L) | 31.76 ± 16.79 | 22.26 ± 9.04 | 15.66 | 3.33 | 0.003* |
| SGPT [ALT] U/L] | 30.71 ± 15.29 | 20.05 ± 5.98 | 15.96 | 5.34 | 0.000** |
| Triglycerides (mg/dl) | 182.92 ± 87.52 | 116.11 ± 25.48 | 96.28 | 37.35 | 0.000** |
| Cholesterol (mg/dl) | 188.37 ± 39.25 | 171.63 ± 29.62 | 32.63 | 0.84 | 0.039* |
| **Statistically highly significant at p<0.05 | | | | | |
| *Statistically significant at p<0.05 | | | | | |

**Table 2: Pearson correlation of HbA1c with Fasting blood sugar (FBS), postprandial blood sugar (PPBS), serum aspartate amino transferase (AST), alanine amino transferase (ALT), triglycerides and cholesterol in cases.**

| Parameter | FBS (mg/dl) | PPBS (mg/dl) | ALT (U/L) | AST (U/L) | Triglycerides (mg/dl) | Cholesterol (mg/dl) |
|---|---|---|---|---|---|---|
| HbA1c (%) | 0.318 | 0.232** | 0.034 | 0.171 | 0.062 | 0.326* |
| ** Correlation is significant at the 0.01 level | | | | | | |
| *Correlation is significant at the 0.05 level | | | | | | |

## RESULTS

Mean age of cases in this study was 53.61 ± 6.37 years, whereas in controls it was 47.21 ± 9.38 years and it showed statistical significance (p value 0.005) (Table 1). Table 2 shows comparison of FBS, PPBS, ALT, AST, Serum triglycerides and Serum cholesterol in both cases and controls. FBS, PPBS, ALT and Serum triglycerides are showing statistical significance.

## DISCUSSION

DM is a syndrome of disordered glucose metabolism characterized by hyperglycaemia. Many studies have shown that patients of DM have increased incidence of abnormal liver function tests compared to normal people. Transaminases are the sensitive indicators of liver cell pathology and ALT is more specific to liver [3].

The findings from this study show that levels of ALT and AST are elevated in T2DM compared to controls and were statistically highly significant. Our results are in accordance with other studies [3,4,7,8,14]. Our study also showed statistically significant increased levels of serum triglycerides and cholesterol in cases.

Increased levels of ALT in DM are mainly due to fat accumulation in liver. Elevation of ALT without any obvious liver disease in diabetics is a main feature of NAFLD [4]. Insulin resistance which is a main cause behind development of T2DM, activates lipolysis, and enhances deposition of triglycerides in liver, which causes mitochondrial dysfunction, cell damage which leads to elevation of ALT [5,8] . Our study shows statistically significant elevated levels of serum cholesterol and triglycerides supports this hypothesis.

Increased ALT can be explained by another mechanism which links this enzyme to gluconeogenesis. In T2DM, gluconeogenesis is increased which uses alanine as substrate. Conversion of alanine to glucose requires ALT. So this enzyme is Upregulated. Increased ALT may leak out from hepatocytes due to fat deposition [15].

There was elevation of AST in T2DM compared to controls in our study. AST is also a marker of liver function. It is located in cytosol and also mitochondria of liver cells. Elevated levels of AST is also observed in other studies [3,14].

Pearson correlation of HbA1c with other parameters was done in cases to see the effect of glycaemic control on other parameters. Our study showed statistically significant correlation between HbA1c and PPBS, serum cholesterol. Positive correlation was observed between HbA1c and all the other parameters. Study by Jha et al. [16] also demonstrated similar findings.

## CONCLUSIONS

Our study demonstrated high levels of transaminases in T2DM. NAFLD has increased incidence in DM. Liver abnormality can be associated with uncontrolled hyperglycaemia in T2DM.

## IMPLICATIONS

Non-alcoholic fatty liver disease is highly prevalent in patients with T2DM. It may be possible to identify the ongoing liver damage in DM patients by measuring aminotransferases. A timely diagnosis and management of the abnormal liver parameters may help to minimize liver-related morbidity and mortality in the diabetic population.

## FUNDING SOURCE

This study was funded by Rajiv Gandhi University of Health Sciences, Bangalore, Karnataka, India, under short term student research project.

## CONFLICT OF INTEREST

None.

**ACKNOWLEDGEMENT**

We are grateful to our Institution, Management, Statistician Mrs. Preeval Shreya Crasta, Biochemistry department staff, Central laboratory staff , study participants and to all the people who helped us in completing the study successfully.

**REFERENCES**

1. Mahran HN, Saber LM, Alghaithy AA, et al. The role of elevated alanine aminotransferase (ALT), FasL and atherogenic dyslipidemia in type II diabetes mellitus. J Taibah Univ Med Sci 2016; 12:8–13.
2. Diraison F, Moulin P, Beylot M. Contribution of hepatic de novo lipogenesis and reesterification of plasma non esterified fatty acids to plasma triglyceride synthesis during non-alcoholic fatty liver disease. Diabetes Metab 2003; 29:478-485.
3. Mathur S, Mehta DK, Kapoor S, et al. Liver function in type-2 diabetes mellitus patients. Int J Sci 2016; 3:43–47.
4. Alzahrani SH, Baig M, Bashawri JI, et al. Prevalence and association of elevated liver transaminases in type 2 diabetes mellitus patients in Jeddah, Saudi Arabia. Cureus 2019; 11.
5. Mandal A, Bhattarai B, Kafle P, et al. Elevated liver enzymes in patients with type 2 diabetes mellitus and non-alcoholic fatty liver disease. Cureus 2018; 10:e3626.
6. Harris EH. Elevated liver function tests in type 2 diabetes. Clin Diabetes 2005; 23:115–119.
7. Shibabaw T, Dessie G, Molla MD, et al. Assessment of liver marker enzymes and its association with type 2 diabetes mellitus in Northwest Ethiopia. BMC Res Notes 2019; 12:707.
8. Judi L, Toukan A, Khader Y, et al. Prevalence of elevated hepatic transaminases among Jordanian patients with type 2 diabetes mellitus. Ann Saudi Med 2010; 30:25–32.
9. Trinder P. Determination of glucose in blood using glucose oxidase with an alternative oxygen acceptor. Ann Clin Biochem 1969; 6:24–27.
10. https://www.monlab.com/document/Bioquimica/Bioquimica%20rutina/Enzimas/IFU%20GOT-AST%20monlabtest%20EN.pdf
11. Allain CC, Poon LS, Chan CS, et al. Enzymatic determination of total serum cholesterol. Clin Chem 1974; 20:470–475.
12. Spayd RW, Bruschi B, Burdick BA, et al. Multilayer film elements for clinical analysis: applications to representative chemical determinations. Clin Chem 1978; 24:1343-1350.
13. Pohanka M. Glycated hemoglobin and methods for its point of care testing. Biosensors 2021; 11:70.
14. Islam S, Rahman S, Haque T, et al. Prevalence of elevated liver enzymes and its association with type 2 diabetes: A cross-sectional study in Bangladeshi adults. Endocrinol Diabetes Metab 2020; 3:e00116.
15. Schindhelm RK, Diamant M, Dekker JM, et al. Alanine aminotransferase as a marker of non-alcoholic fatty liver disease in relation to type 2 diabetes mellitus and cardiovascular disease. Diabetes Metab Res Rev 2006; 22:437–443.
16. Jha SK, Yadav NK, Rizal S. Prevalence of elevated liver enzymes and its association with type 2 diabetes: A descriptive cross-sectional study among Nepalese adults from Biratnagar, Nepal. Asian J Med Sci 2021; 12:50-55.