

## Correlation between liver enzymes and lipid profile in type II diabetes mellitus – A case control study

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### Abstract

**Background:** Liver is the critical site for carbohydrates and lipid metabolism. Any alternation in liver function may lead to altered metabolism of both glucose and lipids. Hence relationship must exist between lipid profile and liver function tests. Many studies showed that metabolically type II diabetes mellitus patients have hyperlipoproteinemia.

**Objectives:** Hence the present study was undertaken to study the comparison and correlation between liver enzymes and lipid profile in type 2 diabetes mellitus patients.

**Material and methods:** The study was conducted at HSK hospital, Bagalkot. Fifty subjects participated in type II diabetes mellitus patients and Controls. Biochemical parameters like fasting blood glucose, urea, creatinine, lipid profile, liver enzymes and HbA1c were estimated.

**Results:** The biochemical parameters FBS, HbA1c, blood urea, serum bilirubin, liver enzymes namely AST, ALT, ALP, GGT and lipid profile were raised significantly in T2DM patients compared to controls. AST showed significant positive correlation with TGL, TC, VLDL-C and LDL-C. There was significant positive correlation between ALT and TGL, TC, VLDL-C, ALP showed significant correlation with TC ( $p=0.027$ ). GGT was significant positively correlated with TGL and VLDL-C. Serum HDL-C was significantly negatively correlated with all enzymes except ALP ( $p=0.852$ ).

**Conclusion:** Routine analysis liver enzymes and lipid profile in type II diabetes mellitus patients, helps in early detection and prevention of liver injury and cardiovascular accidents.

**Key words:** Diabetes mellitus, Lipid profile, Liver enzymes.

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### I. Introduction

The World Health Organization reported the prevalence of type II diabetes mellitus estimated by the year 2025 would be 380 million people worldwide will be diagnosed as diabetes mellitus [1]. Presently India has approximately 50 million diabetes mellitus cases, making India “the diabetes capital of the world” [2,3]. In Indian population prevalence of diabetes mellitus is estimated to be 58% and diabetic population is expected to increase 87 million in 2030 [3].

Many studies have showed liver disease plays a pivotal role in morbidity and mortality of type 2 diabetes patients [4,5]. It is well known fact that liver plays a paramount role in regulation of glucose homeostasis, during fasting and post prandial period [6]. The scope of liver disease in type 2 diabetes includes abnormal liver enzymes and non-alcoholic fatty liver disease (NAFLD), cirrhosis, hepatocellular carcinoma (HCC), acute liver failure [7]. Chronic mild elevation of transaminases is commonly seen in type II diabetes mellitus [8]. Alanine trans aminase (ALT) and aspartate trans aminase (AST) both the enzymes are markers of hepatic injury [6] and serum gamma glutamyl transferase (GGT) is reliable marker of hepatic fat accumulation which can lead to hepatic insulin resistance and long term hepatic insulin resistance may lead to type II diabetes mellitus[9].

Insulin resistance status in type II diabetes mellitus patients is responsible for lipid abnormalities[10]. The diabetic dyslipidemia are initiated by the elevation of triglyceride rich very low density lipoprotein (VLDL) from hepatic over production [11,12]. The risk of cardiovascular disease is high in type II diabetes mellitus because of dyslipidaemia which is characterized by significantly higher serum levels of triglycerides, low

density lipoprotein cholesterol (LDL-C) and total cholesterol (TC) and lower levels of high density lipoprotein (HDL) than normal healthy subjects [13]. Altered lipoprotein metabolism and liver enzymes have been identified as independent risk factors for the development of cardiovascular disease (CVD) [6,14]. Very few studies reported the correlation between liver enzymes and lipid parameters in type II diabetes mellitus, hence the current study was designed to compare and correlate the liver enzymes and lipid profile in type II diabetes patients.

## II. Material and methods

This case control study was done at Hanagal Shri Kumareshwara hospital, Bagalkot from Sept 2016 to Feb 2017. The study was approved by Institutional ethics committee. Informed consent was obtained from all study subjects. Fifty type II diabetes mellitus and 50 apparently healthy controls were selected for the study. The diagnosis of type 2 DM was based on WHO criteria. Chronic alcoholics, smokers, patients with complications of diabetes mellitus, liver disease, other systemic conditions were excluded from the study. Under aseptic precautions 5 ml of venous fasting blood sample was collected, following the biochemical parameters were estimated: fasting blood glucose, blood urea, creatinine and liver enzymes and lipid profile were estimated using Biosystems A 25 fully automated biochemistry analyzer; and HbA1c was estimated by HPLC method.

Power of the study was calculated (100%) retrospectively based on the mean ALT values in type II diabetes mellitus and apparently healthy controls (95% CI). SPSS software was used for statistical analysis. Quantitative data was expressed in mean±SD.  $p < 0.05$  was considered as statistically significant. Unpaired ‘t’ test was used for comparison; Pearson’s correlation was used to find the correlation between the liver enzymes and lipid profile.

## III. Results

BMI, waist circumference, systolic blood pressure and diastolic blood pressure were significantly more in type II diabetes mellitus patients compared to apparently healthy controls, but there was no significant difference in age (Table 1).

**Table 1: Demographic features of cases and controls**

Parameters	Cases	Controls	t	p
<b>Age years</b>	<b>51.4±15.7</b>	<b>46.3±10.1</b>	<b>-1.901</b>	<b>.060</b>
BMI kg/m <sup>2</sup>	25.7±3.4	22.2±3.4	-5.013	.000
WC cm	97.2±10.0	84.4±11.7	-5.884	.000
SBP mm Hg	151.0±13.8	115.4±5.9	-16.044	.000
DBP mm Hg	93.3±3.6	76.4±4.4	-20.739	.000

BMI: Body mass index

WC: Waist circumference

SBP: Systolic blood pressure

DBP: Diastolic blood pressure

The biochemical parameters namely fasting blood glucose, HbA1c, serum urea, triglyceride, total cholesterol, VLDL-C, LDL-C, AST, ALT, ALP and GGT were raised significantly in type II diabetes mellitus cases compared to healthy controls, other parameters serum creatinine and ALP were also increased in cases than in controls but it was not statistically significant the p values were 0.528 and 0.263 respectively. HDL-C decreased significantly in type II diabetes mellitus patients as compared to controls ( $p=0.000$ ) (Table 2).

**Table 2: Biochemical parameters in type II diabetes mellitus patients and healthy controls**

PARAMETERS	CASES	CONTROLS	t	p
FBG mg/dl	182.9±68.5	87.0±17.4	-9.139	0.000
HbA1C %	8.5±1.3	5.356±0.6	-14.926	0.000
Urea mg/dl	25.8±9.4	20.0±6.7	-3.449	0.001
<b>Creatinine mg/dl</b>	<b>1.4±2.9</b>	<b>1.1±0.3</b>	<b>.633</b>	<b>0.528</b>
Triglyceride mg/dl	206.7±68.1	113.8±34.6	-8.291	0.000
Total cholesterol mg/dl	207.9±35.3	187.4±33.5	-2.938	0.004
HDL-C mg/dl	35.9±5.6	50.4±4.8	13.581	0.000
VLDL-C mg/dl	41.3±13.6	22.7±6.9	-8.291	0.000
LDL-C mg/dl	130.6±29.7	114.2±28.9	-2.769	0.007
AST (U/L)	44.9±11.9	23.6±8.9	-9.864	0.000
ALT (U/L)	38.8±10.0	20.6±12.8	-7.895	0.000
ALP (U/L)	112.5±65.1	100.0±45.4	1.125	0.263
GGT (U/L)	33.7±12.2	20.6±12.8	-5.217	0.000

FBG: Fasting blood glucose  
 HbA1c: Glycosylated haemoglobin  
 HDL-C: High density lipoprotein cholesterol  
 VLDL-C: Very low density lipoprotein cholesterol  
 LDL-C: Low density lipoprotein cholesterol  
 AST: Aspartate transaminase  
 ALT: Alanine transaminase  
 ALP: Alkaline phosphatase  
 GGT: Gamma glutamyl transferase

The correlation between the lipid parameters and liver enzyme is depicted in table 3. AST showed significant positive correlation with TGL, TC, VLDL-C and LDL-C. There was significant positive correlation between ALT and TGL, TC, VLDL-C, whereas there was no significant correlation between ALT and LDL-C ( $p=0.09$ ). ALP did not showed significant correlation with any of the lipid parameters except for TC ( $p=0.027$ ). GGT was significantly positively correlated with TGL and VLDL-C. Serum HDL-C was significantly negatively correlated with all enzymes except ALP ( $p=0.852$ ).

**Table 3: Correlation between lipid parameters and liver enzymes in type II diabetes mellitus patients.**

		AST	ALT	ALP	GGT
Triglyceride	r	0.496	0.418	-0.152	0.319
	p	0.000	0.000	0.134	0.001
Total cholesterol	r	0.318	0.191	-0.222	0.078
	p	0.001	0.050	0.027	0.443
HDL-C	r	-0.515	-0.488	0.019	-0.327
	p	0.000	0.000	0.852	0.001
VLDL-C	r	0.496	0.418	-0.152	0.319
	p	0.000	0.000	0.134	0.001
LDL-C	r	0.292	0.171	-0.196	0.037
	p	0.003	0.090	0.051	0.716

HDL-C: High density lipoprotein cholesterol  
 VLDL-C: Very low density lipoprotein cholesterol  
 LDL-C: Low density lipoprotein cholesterol  
 AST: Aspartate transaminase  
 ALT: Alanine transaminase  
 ALP: Alkaline phosphatase  
 GGT: Gamma glutamy transferase

#### IV. Discussion

In the present study there was significant rise in all lipid parameters and liver enzymes except ALP, which also increased but it was not statistically significant ( $p=0.236$ ). Philip R et al [15] in their study showed significant increase in AST, ALT and GGT ( $p<0.01$ ) as compared to healthy controls, findings of present study are similar. Agarawal J [16] in North India, reported serum levels of AST, ALT, ALP and GGT all were significantly elevated in type II diabetes mellitus patients as compared to controls ( $p<0.05$ ). Deepika G et al [17], in their comparative study on normal healthy subjects, diabetics with good glycemic control and without glycemic control, found significant elevation in serum ALP level in type II diabetes mellitus patients as compared to healthy normal subjects. In the current study we did not get significant rise in ALP in type II diabetes mellitus patients as compared to healthy control group.

Belay Z et al [18], an Ethiopian study showed significant rise in triglyceride, total cholesterol, VLDL-C and LDL-C in type II diabetes mellitus patients as compared to control group. Statistically significant lower levels of HDL-C in diabetics than healthy controls similar finding were reported by Al-Jameil N et al [6] and Jain HR et al [19]. The current study is also in accordance with previous studies. Our previous study on “correlation between GGT and lipid profile in type II diabetes mellitus”, we did not got significant increase in LDL-C levels in cases as compared to controls. Nigerian study by Ugwu CE et al [20] found contrary results mean TC, TG, and LDL-C levels were lower in the diabetics than in the control subjects though these were not significant ( $P > 0.05$ ).

Rajeshwari S et al [13] found significant correlation AST with TGL( $r=0.487$ ) negative correlation with LDL-C ( $r= - 0.237$ ) and HDL-C ( $r= -0.254$ ). But in the present study AST showed significant positive

correlation with TGL, TC, VLDL-C and LDL-C negative correlation with HDL-C only. Balaji A S et al [21] showed ALT was positively correlated with TGL( $r=0.431$ ) and LDL-C ( $r=0.555$ ) and significant negative correlation with HDL-C( $r= - 0.072$ ). Al-Jamel et al their study showed ALT have significant positive correlation with TGL, TC and LDL-C and negative correlation with HDL-C, in current also reported similar findings. Saligram et al [22] reported the association of increased ALT levels with elevated triglycerides and low HDL-C [D]. Rajeshwari S et al [13] ALT showed negative correlation with LDL-C ( $r= - 0.237$ ), HDL-C ( $r= -0.254$ ). ALP showed positive correlation with TGL ( $r= 0.393$ ), VLDL-C ( $r= 0.192$ ), negative correlation with HDL-C ( $r= - 0.379$ ). Atiba AS et al [23] in their Nigerian study reported significant positive correlation ALP with TC, LDL-C. Statistically significant negative correlation with HDL-C. They did not found correlation between other liver enzymes and lipid profile parameters. In this study ALP did not revealed and significant correlation with any lipid parameter except TC, and it was negative correlation ( $r = - 0.222$ ,  $p = 0.027$ ).

Rajarajeshwari D et al [24] showed GGT was positively correlated with TGL ( $r=0.112$ ), TC ( $r= 0.027$ ), LDL-C ( $r= 0.05$ ), and negatively correlated with HDL-C( $r= -0.298$ ).

Ortega E et al [25] their study on insulin resistance in Pima Indian children showed GGT was positively correlated with TGL and negatively correlated with HDL-C. Al-Jamel et al their study showed GGT have significant positive correlation with TGL, TC and LDL-C and negative correlation with HDL-C. Rajeshwari S et al [13] GGT had positive correlation with TC ( $r= 0.209$ ) and VLDL-C ( $r= 0.327$ ), in the present study also GGT similar results.

Limitation of the present study was small sample size. Further large sample size studies are required with radiological correlation with liver enzymes and lipid profile.

In conclusion AST, ALT and GGT were increased in type II diabetes mellitus and correlated with lipid parameters. Routine analysis of liver enzymes and lipid profile can help in early detection of liver injury and cardiovascular accident in type II diabetes mellitus patients.

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