

Research Article**Study of Lipid Profile and Glycemic Control in Type 2 Diabetes Mellitus Patients with and without Non Alcoholic Fatty Liver Disease as diagnosed by Ultrasonography****Mohammad Aleem¹, Roshan Alam^{2*}, Saba Khan³, Shah Mohammad Abbas Waseem⁴**¹Associate Professor, Department of Radio-diagnosis, Integral Institute of Medical Sciences, Integral University, Lucknow, U.P – 226026, India.²Associate Professor, Department of Biochemistry, Integral Institute of Medical Sciences, Integral University, Lucknow, U.P – 226026, India³Assistant Professor, Department of Biochemistry, Index Medical College Hospital and Research Centre, Indore, M.P-452016, India⁴Assistant Professor, Department of Physiology, Integral Institute of Medical Sciences, Integral University, Lucknow, U.P – 226026, India***Corresponding author**

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Abstract: Non-alcoholic fatty liver disease (NAFLD) has emerged as the most common cause of chronic liver disease worldwide. NAFLD is strongly associated with T2DM and cardiovascular disease (CVD). It is characterized by insulin resistance and mitochondrial dysfunction. The present study was designed to assess the lipid profile and glycemic control in patients of type 2 diabetes mellitus with and without non-alcoholic fatty liver as diagnosed by Ultrasonography. The present study was conducted on 85 type 2 diabetes mellitus patients with fatty liver (male-50, female -35) with mean age of 53.40 ± 7.8 years and the control group consisted of 65 type 2 diabetes mellitus patients without fatty liver (male-40, female-25) with mean age of 46.50 ± 5.5 years. Analysis of various biochemical parameters was performed by standard kit methods. Fasting and postprandial blood sugar, HbA1c and lipid profile were compared in type 2 diabetics patients with fatty liver and diabetics patient without fatty liver. Statistical analysis was done by unpaired t-test. The fasting and postprandial blood sugar, total cholesterol, triglycerides, LDL, VLDL, HbA1c were significantly increased and HDL was significantly decreased in diabetics with fatty liver compared to diabetic patients without fatty liver (p < 0.001). Early detection of fatty liver in diabetic patients by noninvasive procedure e.g. ultrasonography and control of dyslipidemia and maintaining good glycemic control, are key factors to prevent progression of fatty liver in diabetic patients to reduce cardiovascular morbidity and mortality.**Keywords:** BMI (body mass index), Dyslipidemia, Glycated hemoglobin, Lipid profile, Non-alcoholic fatty liver disease and Non-alcoholic steatohepatitis.

INTRODUCTION

Non-alcoholic fatty liver disease has emerged as the most common cause of chronic liver disease worldwide [1]. Non-alcoholic fatty liver disease (NAFLD) defined as a spectrum which encompasses simple steatosis (simple fatty liver), non-alcoholic steatohepatitis (NASH), cirrhosis and even hepatocellular carcinoma (HCC) [2,3]. NAFLD is strongly associated with T2DM and cardiovascular disease (CVD). It is characterized by insulin resistance and mitochondrial dysfunction [4].

The lipid abnormalities are prevalent in type 2 Diabetes Mellitus because the key enzymes and pathways in lipid metabolism are affected due to insulin resistance or deficiency [5]. Studies on chronic

complications of diabetes established the role of glycated hemoglobin (HbA1c) as a marker of evaluation of long term glycemic control and risk for chronic complications [6]. Diabetes, dyslipidemia, hypertension and CVD coexist more frequently in individuals with NAFLD [7].

The present study was designed to assess the lipid profile and glycemic control in patients of type 2 diabetes mellitus with and without non-alcoholic fatty liver as diagnosed by Ultrasonography.

MATERIALS & METHODS

The criteria used for selection of both diabetes and controls were performed by well-established diagnostic criteria as recommended by WHO, serum

lipid reference as mentioned by National Cholesterol Education Programme (NCEP) Adult Treatment Panel III (ATP III) and Abdominal ultrasonography was done to detect fatty liver disease. Those patients who had increased echogenicity of liver as compared to kidney by USG were considered to have fatty liver [8]. Fatty liver was classified into 4 grades, grade 0, grade I, grade II and grade III. Majority of diabetic patients were having grade I fatty liver.

The present study was conducted on 85 type 2 Diabetes mellitus patients with fatty liver (male- 50, female -35) with mean age of 53.40 ± 7.8 years and the control group consisted of 65 type 2 diabetes mellitus patients without fatty liver (male-40, female-25) with mean age of 46.50 ± 5.5 years. Diabetic subjects were only on oral hypoglycemic drugs. The study groups were non-smokers and non-alcoholics and were not suffering from any other chronic disease. The study was approved by the Institute Ethics Committee, Integral Institute of Medical Sciences and Research, Lucknow, India and informed consent was obtained from all the cases and control subjects. Blood samples were collected in plain vacutainers without any anticoagulant and whole blood collected with EDTA from diabetic patients (with and without fatty liver) for the estimation of various biochemical parameters.

- Fasting and postprandial blood sugar was estimated by method of GOD-POD Trinder P. [9]
- HbA1c by kit method (ERBA diagnostics Mannheim GmbH).
- Total cholesterol by kit method (ERBA diagnostics Mannheim GmbH).
- TG by kit method (ERBA diagnostics Mannheim GmbH).
- HDL by kit method (ERBA diagnostics Mannheim GmbH).

- LDL calculated by Friedwald formula. [10]
- $LDL = Total\ Cholesterol - (HDL + TG/5)$.
- $BMI = Weight\ in\ Kg / Height\ in\ meter^2$.

All data were expressed as mean \pm SD. Unpaired student's t-test was used for between group comparisons. Differences were considered of statistical significance when the p-value was $p < 0.05$.

RESULT AND DISCUSSION

The study was conducted on 85 type 2 Diabetes mellitus patients with fatty liver (male- 50, female -35) with mean age of 53.40 ± 7.8 years and the control group consisted of 65 type 2 diabetes mellitus without fatty liver (male- 40, female-25) with mean age of 46.50 ± 5.5 years. The demographic and biochemical parameters in type 2 diabetes mellitus patients and control subjects are depicted in Table 1. Blood sugars FBS mg/dl (155.90 ± 18.51), PPBS mg/dl (195.70 ± 20.50) was significantly higher in type 2 diabetes mellitus patients with fatty liver as compared to diabetic patients without fatty liver FBS mg/dl (135.89 ± 13.21) PPBS mg/dl (165.50 ± 15.47) $p < 0.001$. HbA1c% (8.93 ± 1.50) was significantly higher in diabetic patients with fatty liver as compared to patient without fatty liver (7.865 ± 1.10) $p < 0.001$. All the lipid parameters (mg/dl) TC (225.59 ± 14.33 $p < 0.001$), TG (196.50 ± 19.50 ; $p < 0.001$), VLDL (45.18 ± 3.9 ; $p < 0.001$), LDL (142.67 ± 12.50 ; $p < 0.001$),) was significantly higher in diabetic patients with fatty liver as compared to diabetic patients without fatty liver TC (186.52 ± 17.65), TG (175.45 ± 15.30), VLDL (35.09 ± 3.10), LDL (109.86 ± 11.05). While HDL (mg/dl) 37.16 ± 4.10 was significantly lower in diabetic patients with fatty liver as compared to diabetic patients without fatty liver 41.78 ± 3.5 ; $p < 0.001$.

Table-1: Demographic and Biochemical parameters in type 2 diabetes mellitus patients with and without fatty liver.

Parameters	Diabetic Patients (With fatty liver)	Diabetic Patients (Without fatty liver)	P-value
	N=85	N= 65	
Age (years)	53.40 ± 7.8	46.50 ± 5.5	—
Sex (M/F)	50/35	40/25	—
BMI (kg/m ²)	30.21 ± 3.84	26.14 ± 3.12	< 0.001
Hemoglobin (gm/dl)	14.50 ± 2.50	15.38 ± 2.81	< 0.045
FBS (mg/dl)	155.90 ± 18.51	135.89 ± 13.21	< 0.001
PPBS (mg/dl)	195.70 ± 20.50	165.50 ± 15.47	< 0.001
HbA1c (%)	8.93 ± 1.50	7.86 ± 1.10	< 0.001
T C (mg/dl)	225.59 ± 20.50	186.45 ± 17.65	< 0.001
HDL (mg/dl)	37.16 ± 4.10	41.50 ± 3.5	< 0.001
TG (mg/dl)	196.50 ± 19.50	175.45 ± 15.30	< 0.001
VLDL (mg/dl)	45.18 ± 3.9	35.09 ± 3.10	< 0.001
LDL (mg/dl)	142.67 ± 12.50	109.86 ± 11.05	< 0.001

Values are expressed as mean \pm S.D N= number of subjects; 'P' < 0.05 was considered significant. NS= not significant

The term 'NASH' (nonalcoholic steatohepatitis) was first introduced by Ludwig *et al.* in 1980 to describe histological changes indistinguishable from alcoholic hepatitis in patients with no or insignificant (less than 20 g/day) alcohol intake [11].

Several studies showed higher prevalence of NAFLD in type 2 diabetics than in general population, independent of glycemic control [12]. Type 2 diabetics have approximately 80% more fatty liver compared with nondiabetics matched for age and sex [13]. Framingham Heart Study showed fatty liver remained associated with diabetes, impaired fasting glucose, hypertension, metabolic syndrome, HDL cholesterol, triglycerides, and adiponectin levels (all $P < 0.001$), whereas associations with systolic (SBP) and diastolic (DBP) blood pressure were attenuated ($P > 0.05$) [14]. It has been shown that increased liver enzymes predict T2DM independent of obesity [15]. Poorly controlled diabetes, hepatic steatosis and metabolic syndrome associated with higher cardiovascular morbidity and mortality.

In the present study the BMI, FBS, PPBS, HbA1c, TC, TG, VLDL, LDL was significantly higher in type 2 diabetes mellitus patients with fatty liver as compared to diabetic patients without fatty liver except HDL which was found significantly lower in the diabetic patients with fatty liver. These findings were in agreement with the previous studies of Shivananda Pai *et al.* [16]. Glycemic control and lipid profile results are in accordance with study of Williamson RM *et al.* [17]

Major limitation of our study, we used noninvasive procedure e.g. ultrasonography which having lower specificity and sensitivity as compared to gold standard procedure which include liver biopsy and histological examination.

CONCLUSION

Dyslipidemia, poor glycemic control and elevated liver enzymes are more common in diabetic patients with fatty liver as compared to diabetic patients without fatty liver disease.

Early detection of fatty liver in diabetic patients by noninvasive procedure and control of dyslipidemia and maintaining good glycemic control, are key factors to prevent progression of fatty liver in diabetic patients to reduce cardiovascular morbidity and mortality. Weight loss, diet and exercise provide significant clinical benefits for treating nonalcoholic fatty liver disease.

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