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A comparative study of Serum ALT levels in metabolic syndrome patients with and without NAFLD

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Abstract

Background: This study was undertaken to evaluate the Serum ALT levels in Metabolic Syndrome (MetS) patients with and without NAFLD. The objective was to compare the change in serum ALT levels in those patients.

Methods: The study was conducted in the Department of Biochemistry in association with Department of Medicine, National Institute of Medical Sciences and Hospital, Jaipur. At the same time adult diagnosed 150 MetS patients (75 without NAFLD & 75 with NAFLD) were taken. Anthropometric measurements were taken. ALT was measured in serum in both groups. The data obtained was statistically analyzed.

Results: Serum ALT was 67.89 ± 36.26 U/l in MetS with NAFLD while it was 46.03 ± 8.99U/l in without NAFLD.

Conclusions: increased ALT level is highly significant (p value < 0.001) in MetS with NAFLD as compare to without NAFLD. So increase in ALT in blood is associated with NAFLD in MetS patients.

Keywords: Metabolic Syndrome; NAFLD; SGPT; ALT

1. Introduction

The metabolic syndrome is a cluster of various metabolic risk factors that directly promote the causes and progression of atherosclerotic cardiovascular disease (ASCVD). Metabolic syndrome individuals also are at high risk for development of type 2 diabetes mellitus and the underlying risk factors contribute to the metabolic risk factors. Atherogenic dyslipidemia, increased blood pressure and increased plasma glucose are generally acknowledged with risk factors for metabolic syndrome. Subjects with metabolic risk factors mainly show pro-inflammatory and prothrombotic condition [(1)].

According to International Diabetes Federation (IDF) metabolic syndrome (MetS) is a group of clinical abnormalities which includes increased waist circumference and at least 2 of the following: elevated fasting serum glucose or high triglyceride levels or low high-density lipoprotein cholesterol (HDL-C) or high blood pressure[(2)].

Non-alcoholic fatty liver disease (NAFLD) is most common cause of chronic liver disease & regarded as the hepatic component of metabolic syndrome (MetS). Non-alcoholic fatty liver disease is defined as the fat accumulation in hepatic cells in the absence of existing intake of a significant amount of alcohol [(3)].

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NAFLD encloses a range of hepatic disease from steatosis to nonalcoholic steatohepatitis (NASH) and finally cirrhosis [4]. According to the American Association for the Study of Liver Diseases, NAFLD is defined as accumulation of fat in the hepatocytes immense 5% to 10% by weight, which is arbitrated from fat-laden percentage in hepatocytes by light microscopy. Steatosis attributable to NAFLD is typically macro-vesicular alternately micro-vesicular [5].

NAFLD is the hepatic phenomenon of the metabolic (insulin resistance) syndrome. Underlying risk factors for primary NAFLD involve abdominal obesity, type 2 Diabetes Mellitus, dyslipidaemia, elevated serum triglyceride, history of cyclic weight gain & loss, and hypertension[6]. All these situations also bear a risk factor for Cardiovascular Disease. So treatment of patients who have NAFLD should aim to identify and treat associated metabolic factors such as obesity, glucose intolerance, dyslipidaemia and hypertension. Despite the fact, NAFLD association with the metabolic syndrome is well-documented, so currently metabolic syndrome is acknowledged as a strong predictor of the presence of NAFLD [7].

Metabolic syndrome and Non-alcoholic fatty liver disease appear to have a common pathophysiology arising mainly from insulin resistance. Rapid urbanization along with change in diet and physical activity has led to an increase in obesity and metabolic abnormalities in Indian population leading to an increase in the prevalence of both NAFLD and **MetS**. Nearly 90.0% of the NAFLD patients have at least one feature of metabolic syndrome and 33.0% of them usually have all features of the **MetS** according to previous reports, with the presence of MetS in an individual the risk of developing NAFLD increases to almost 4–11 times [8].

SGPT (Serum glutamyl pyruvate transferase) is a glucogenic enzyme so increased SGPT level is also an indicator of insulin abnormalities [9]. NAFLD patients have higher SGPT concentrations in comparison with normal individuals. It is mainly synthesized by liver so SGPT is more specific for hepatic disease [10,11]. An increased SGPT level in asymptomatic patient is considered as a valuable screening test for NAFLD patients, because of SGPT levels are correlated with abdominal fat and higher SGPT concentrations are associated with the progression of steatosis ([12-14]. Mildly to moderately elevated serum levels of aspartate aminotransferase **(AST),** alanine aminotransferase, or both are the most common and often the only laboratory abnormality found in patients with NAFLD [15].ALT is closely associated with hepatic fat accumulation[16]. SGPT is commonly used as representative marker of NAFLD in some epidemiological studies. Increased levels of SGPT are frequently associated with obesity and the metabolic syndrome [17-19]. The purpose of this study was to estimate and compare the level of ALT liver enzyme in Metabolic Syndrome patients with and without NAFLD.

2. Methods

This study was approved by the ethical committee of the institution.

2.1. Study design

Comparative Cross-sectional study

2.2. Study Population

The study population comprised of multiethnic groups of patients from Jaipur district. The sample consisted of 150 MetS patients (75 without NAFLD & 75 with NAFLD), age group of 20 to 60 years of both sexes. The patients were taken from the outdoor patient department of medicine, NIMS Medical College and Hospital, Nims University, Jaipur, Rajasthan.

2.3. Clinical Assessment

Metabolic syndrome patients were selected according to IDF 2005 criteria [2] between the age group of 20 years to 60 years and diagnosed cases of NAFLD were taken. Ultrasound abdomen was conducted for all patients and based on the report presence of NAFLD was ascertained. Each patient of metabolic syndrome was asked about present & past history of chronic significant alcohol intake. Subjects with significant alcohol intake, known chronic liver disease, previous history of hepatitis or drug induced hepatic injury were excluded. Clinical examinations including anthropometric measurements were investigated. Body mass index (BMI) was calculated using the Quetelet's index formula using weight in Kilogram and height in centimeters with light clothes and standing bare feet. WC was measured in centimeters. After an overnight fasting, blood samples were collected for Lipid profile, FBS and ALT tests. The level of ALT in serum was compared in MetS patients with and without NAFLD. Serum ALT was measured by using ready to use LDH-NADH reagent kit (Kinetic method) [20].

2.4. Statistical analysis

The unpaired Student's t test was used to compare serum ALT level and **P<0.001** was considered **highly** significant. All standardized analysis will be performed in SPSS software & Microsoft Excel.

3. Results

Table 1 Comparing anthropometric parameters between Met **with and without** NAFLD

Variables	Met with NAFLD	Met without NAFLD	t - test	P - value	Significance
Age (yrs)	44.35 ± 10.5	42.33 ± 12.13	1.086	0.27921	Not significant
BMI (Kg/m2)	27.23 ± 2.98	24.11 ± 2.62	6.8	0.000001	Significant
Waist circumference (WC)(cm)	93.84 ± 6.28	90.72 ± 5.64	3.202	0.00168	
Systolic BP(mm Hg)	135.84 ± 17.4	134.89 ± 10.93	0.398	0.69106	Not significant
Diastolic BP(mm Hg)	84.4 ± 8.97	84.21 ± 8.65	0.13	0.89693	

In table no 1, Mean ± SD of age in MetS with NAFLD patients was 44.35 ± 10.5 yrs and in MetS without NAFLD patients it was 42.33 ± 12.13 yrs. Mean ± SD of BMI was 27.23 ± 2.98 kg/m2, waist circumference was 93.84 ± 6.28 cm, Systolic BP was 135.84 ± 17.4 (mm Hg) and Diastolic BP was 84.4 ± 8.97 (mm Hg) in MetS with NAFLD patients. Mean ± SD of BMI was 24.11 ± 2.62 kg/m2, waist circumference was 90.72 ± 5.64 cm, Systolic BP was 134.89 ± 10.93 (mm Hg) and Diastolic BP was 84.21 ± 8.65(mm Hg)in MetS without NAFLD patients.

By comparing both groups age, systolic BP and Diastolic BP were not significant and BMI & WC were highly significant (P<.001) as BMI & WC were high in MetS with NAFLD patients compare to MetS without NAFLD patients.

Table 2 Comparison of ALT between metabolic syndrome **with and without** NAFLD (Values are mean ± SD)

Met with NAFLD	Met without NAFLD	t - test	P - value
67.89 ± 36.26 U/l	46.03 ± 8.99 U/l	5.07	0.000001

** Highly Significant (P < 0.001)

In table no 2, Mean ± SD of serum ALT in MetS with NAFLD patients was 67.89 ± 36.26 U/l and in MetS without NAFLD patients it was 46.03 ± 8.99 U/l. By comparing both groups serum ALT level was highly significant (P<.001) as it was lower in MetS without NAFLD patients compare to MetS with NAFLD patients. Hence, serum ALT level may be a biomarker for progression of NAFLD

Table 3 Descriptive statistics of ALT in metabolic syndrome patients with and without NAFLD

Groups	Minimum	Maximum	Median	IQR
Met with NAFLD	31	192	56	(45 , 73.5)
Met without NAFLD	30	64	45	(39 , 53.5)

In table 3 and figure 1 were shown descriptive statistics of ALT levels in MetS with and without NAFLD patients. The ALT range 31 U/l - 192 U/l, median value 56 U/l & Interquartal range 45 U/l, 73.5 U/l was found in MetS with NAFLD patients. The AST range 30 U/l – 64 U/l, median value 45 U/l & Interquartal range 39 U/l, 53.5 U/l was found in MetS without NAFLD patients.

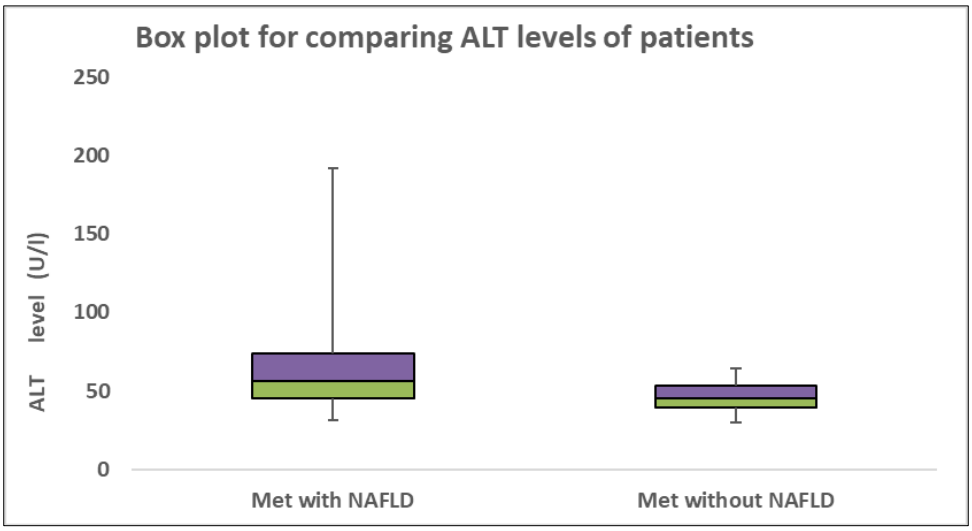

Figure 1 Descriptive statistics of ALT in metabolic syndrome patients with and without NAFLD

Table 4 Frequency distribution of ALT levels of metabolic syndrome patients with and without NAFLD

ALT Interval	Met with NAFLD	Met without NAFLD
≤ 30	0	2
30 - 40	10	26
40 - 50	17	22
50 - 60	19	23
60 - 70	8	2
70 - 80	6	0
80 - 90	2	0
> 90	13	0

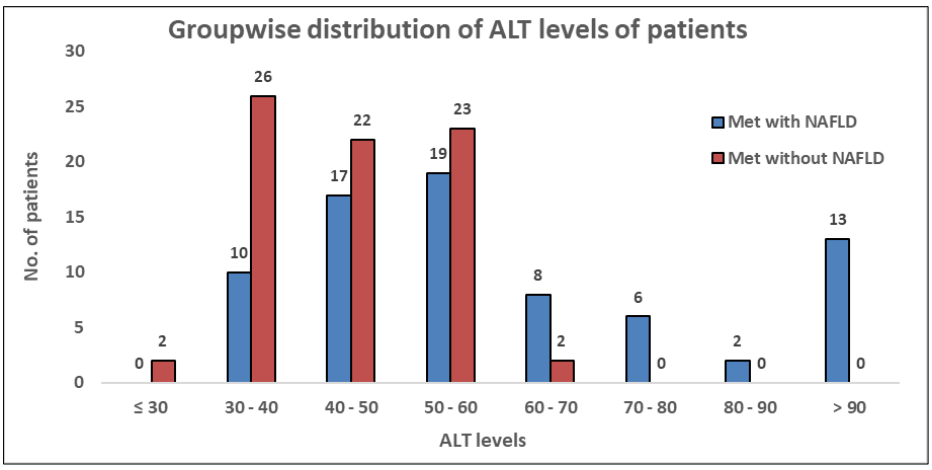

Figure 2 Frequency distribution of ALT levels of metabolic syndrome patients with and without NAFLD

In **table 4** and figure 2 Frequency distribution of ALT levels in MetS with and without patients were shown in which ≤ 30U/l SGPT level was not found in any subject, 30 – 40 U/l found in 10 subjects, 40 – 50 U/l found in 17 subjects 50 – 60 U/l found in 19 subjects, 60 – 70 U/l found in 8 subjects, 70 – 80 U/l found in 6 subjects, 80 – 90 U/l found in 2 subjects and > 90U/l found in 13 subjects.

≤ 30U/l ALT level was found in 2 MetS without NAFLD patients, 30 – 40 U/l found in 26 subjects, 40 – 50 U/l found in 22, 50 – 60 U/l found in 23 subjects, 60 – 70 U/l found in 2 subjects. 70 – 80 U/l, 80 – 90 U/l and > 90U/l ALT level was not found any MetS without NAFLD subject.

Frequency distribution of ALT levels analysis showed a significant highly level of ALT in MetS with NAFLD patient compare to MetS without NAFLD.

4. Discussion

The change in serum ALT in Metabolic syndrome and NAFLD is well documented but whether changes occur in metabolic syndrome with & Without NAFLD is not known. This study was conducted to reveal changes in serum ALT in both groups.

We found significant association between BMI and NAFLD in our study. Mean ± SD of BMI was 27.23 ± 2.98 kg/m2 in MetS with NAFLD patients & it was 24.11 ± 2.62 kg/m2, in MetS without NAFLD patients. The difference in these two groups was statistically significant ($p<0.001$), Similar results were found by Manu Yadav (2022)[21] & Nigam *et al*. (2013)[22].

The mean ALT (mean± SD) of MetS patients with NAFLD was 67.89 ± 36.26 U/l and it was 46.03 ± 8.99 U/l in MetS without NAFLD patients. The difference in these two groups was statistically significant ($p<0.001$). Mofrad P *et al*. Reported that the entire histologic spectrum of NAFLD can be seen in individuals with normal ALT values [23]. Similar results significant association between SGPT with NAFLD were also shown by Abangah G, *et al* [24] and Ekstedt, M[25].

The ALT range 31 U/l - 192 U/l, median value 56 U/l & Interquartal range 45 U/l, 73.5 U/l was found in MetS with NAFLD patients. The ALT range 30 U/l – 64 U/l, median value 45 U/l & Interquartal range 39 U/l, 53.5 U/l was found in MetS without NAFLD patients. Chang et al. [26] reported that an association between SGPT and the incidence of NAFLD as determined by USG. Therefore, elevated SGPT may be an independent indicator of NAFLD.

Our results show that serum ALT was significant high in metabolic syndrome patient with NAFLD compare to without NAFLD with highly significant P value ($P<0.001$) which showed significant difference in both groups. So we can use serum ALT as a diagnostic tool as it is high in NAFLD.

An increased ALT activity caused by liver damage, is probably specific of hepatic diseases, Thus there may be less ALT available to leak into serum in patients with non alcoholic liver disease.. The study showed that ALT concentration is proportional to the degree of nonalcoholic fatty live, it may be assumed in ALT is correlated with nonalcoholic fatty liver. NAFLD is denoted by a higher release of the ALT enzyme in response to hepatocyte derangement and the clearance of this enzyme is mainly associated with the liver cells[27]. Increase in ALT level in metabolic syndrome with NAFLD is a result of increase in blood glucose due to mobilisation of **Free Fatty Acids** from stored lipids. Increase in ALT can also be due to autoimmunity, metabolic response to hormone or hereditary etiological factors[28]. Associated with abnormal hepatic processes are an imbalance in adipocytes secretion and a chronic pro-inflammatory status which causes progression of the hepatic dysfunction[29]. In our study, ALT was associated with increased incidence of non alcoholic fatty liver, thereby implying its role as a screening test in detection of NAFLD. Routine monitoring of Liver Function Test, especially transaminases, should be done in patients with NAFLD and in patients if symptoms of hepatic impairment develop to prevent further progression of NAFLD to cirrhosis.

5. Conclusions

Patients with NAFLD had increased ALT concentration which may be an indication for NAFLD development.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declared no conflicts of interest relevant to the article.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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