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Lipid Profile Variations and Liver Function in Alcoholic Fatty Liver Disease vs. Non-Alcoholic Fatty Liver Disease: A Comparative Study

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ABSTRACT
Individuals with both NAFLD and AFLD exhibit abnormalities in lipid parameters and liver enzymes. This study was conducted with the aim of conducting a comparative analysis of the lipid profile and liver function tests in persons diagnosed with Alcoholic Fatty Liver Disease (AFLD) and Non-Alcoholic Fatty Liver Disease (NAFLD). This cross-sectional study was conducted on 50 AFLD and 50 NAFLD patients. The lipid parameters and liver function tests were analyzed using established methodologies on a Biosystem BA-400 chemistry analyzer. The statistical analysis was conducted with IBM SPSS Statistics 20. Patients with AFLD displayed markedly elevated levels of total cholesterol (TC), triglycerides (TG), low-density lipoprotein (LDL), and very low-density lipoprotein (VLDL) in contrast to NAFLD patients. Conversely, AFLD patients exhibited a significant reduction in high-density lipoprotein (HDL) levels when compared to those with NAFLD. Patients with AFLD demonstrated higher serum levels of aspartate aminotransferase (AST), total bilirubin, and the AST/ALT ratio when compared to individuals with NAFLD. To sum up, individuals diagnosed with alcoholic fatty liver disease as well as those with non-alcoholic fatty liver disease displayed dyslipidemic lipid marker patterns and abnormal liver function test results.

INTRODUCTION

Roughly 20% of the global population is affected by fatty liver disease[1]. The prevalence of fatty liver is increasing in Western societies, ranging from 16-45%, and in Eastern civilizations, ranging from 9-29%. Among individuals who are obese, the prevalence of fatty liver is as high as 76%, while in heavy drinkers, it ranges from 46-80%[2-4]. Alcoholic fatty liver disease (AFLD) and non-alcoholic fatty liver disease (NAFLD) are two distinct types of fatty liver disease. Both of these conditions' present substantial health risks to individuals globally[5,6]. Nonalcoholic fatty liver disease is characterized by a notable buildup (ranging from 5-10%) of lipids in the liver tissue, without the presence of significant chronic alcohol consumption[7]. The most prevalent conditions linked to hepatic steatosis, characterized by the accumulation of fat in the liver, are AFLD, resulting from excessive alcohol consumption and NAFLD, triggered by obesity and insulin resistance[8]. AFLD and NAFLD exhibit comparable pathological progressions, spanning from simple hepatic steatosis to steatohepatitis, liver cirrhosis and hepatocellular carcinoma. Both AFLD and NAFLD often coincide with extrahepatic complications, such as cardiovascular disease and cancer. The prognosis and survival rates of individuals affected by AFLD and NAFLD are influenced by various disease-related factors[5].

Several research studies have demonstrated that individuals with NAFLD exhibit abnormalities in lipid parameters and liver enzymes[9-12]. In contrast, there has been a limited amount of research conducted to explore the involvement of lipid profiles and liver enzymes in AFLD[13,14]. There exists a dearth of studies comparing lipid markers and liver enzymes in patients diagnosed with alcoholic fatty liver disease (AFLD) with non-alcoholic fatty liver disease (NAFLD). Consequently, this study has been initiated to conduct a comparative analysis of the lipid profile and liver function tests in persons diagnosed with alcoholic fatty liver disease (AFLD) and non-alcoholic fatty liver disease (NAFLD).

MATERIALS AND METHODS

This cross-sectional study was conducted at the Medicine Department of SCB Medical College, Cuttack, India from December 2022 through June 2023. The research protocol was approved from the Institutional Ethical Committee. A total of 100 participants were chosen for the current study, consisting of 50 individuals with non-alcoholic fatty liver disease (NAFLD) of both genders and 50 male patients diagnosed with alcoholic fatty liver disease (AFLD) based on ultrasonography (USG). Patients diagnosed with alcoholic and non-alcoholic fatty liver disease were selected from the outpatient department of the Medicine Ward at SCB Medical College, Cuttack, India. The age range of these patients was between 18 and 60 years. After providing a detailed explanation of the study to each participant, written informed consent was obtained from them. To ensure the confidentiality of participant information, coding and computer recording methods were employed.

Height and weight measurements were taken using standard equipment, with participants wearing minimal clothing and being barefoot. Electronic weighing scales, calibrated for accuracy, were used to measure weight, while height was measured to the nearest centimeter using a portable stadiometer. Body mass index (BMI) was calculated by dividing weight in kilograms by the square of height in meters. All anthropometric measurements were conducted by the same trained individual. After a period of 10 min of rest, systolic and diastolic blood pressures were evaluated using a mercury sphygmomanometer in accordance with standard medical protocols.

Under sterile conditions, approximately 5 mL of fasting venous blood was drawn from each patient and dispensed into plain tubes to analyze liver function tests and lipid parameters. The plain vials containing the blood samples were centrifuged at 3000 rpm for 10-15 min to separate the serum. Analysis of lipid parameters and liver function tests was conducted using standard methods on a Johnson and Beckman Coulter Machine. Low-density lipoprotein and very low-density lipoprotein cholesterol levels were calculated using Friedewald's equation[15].

The statistical analysis was performed using IBM SPSS Statistics 20 (Armonk, NY, USA). The results were presented as mean values with corresponding standard deviations (SD). To evaluate the statistical differences in the studied parameters between NAFLD and AFLD, the student independent sample t-test was utilized. A $p>0.05$ was considered significant.

RESULTS

The first table (Table No. 1) presents a comparison of baseline characteristics between patients with non-alcoholic fatty liver disease (NAFLD) and alcoholic fatty liver disease (AFLD). The average age of NAFLD patients was 44.50 years, while AFLD patients had an average age of 43.05 years. However, this age difference was not statistically significant. The mean body mass index (BMI) of NAFLD patients was 27.12 Kg m^{-2}, whereas AFLD patients had a mean BMI of 25.43 Kgm^{-2}. The BMI was significantly higher in NAFLD compared to AFLD. The average systolic blood pressure for NAFLD patients was 130.05 mm Hg and the diastolic blood pressure was 84.10 mm Hg. Similarly, for AFLD patients, the average systolic and diastolic blood pressures were 127.76 mm Hg and 83.01 mm Hg, respectively. However, after conducting statistical analysis, the differences in blood pressure between the two groups were not found to be

Table No. 1: Comparison of baseline characteristics between NAFLD and AFLD

	NAFLD		AFLD		
	Mean	SD	Mean	SD	*p*-value
Age (years)	44.50	6.21	43.05	7.50	0.2949^{NS}
BMI (Kg m^{-}2)	27.12	3.55	25.43	3.07	0.0124*
SBP (mm Hg)	130.05	15.05	127.76	20.45	0.5251^{NS}
DBP (mm Hg)	84.10	8.54	83.01	8.05	0.5129^{NS}
FBS (mg dL^{-1})	110.00	37.73	124.02	42.10	0.0826^{NS}

^{NS}Not significant; *Significant

Table No. 2: Comparison of lipid profile between NAFLD and AFLD

	NAFLD		AFLD		
Lipid profile (mg dL^{-1})	SD	Mean	SD	Mean	*p*-value
TC	206.46	49.88	229.80	51.78	0.024*
TG	197.85	89.14	245.97	88.12	0.008*
HDL	43.17	7.25	37.87	7.16	0.001*
LDL	124.57	47.63	144.06	47.63	0.043*
VLDL	38.67	17.63	47.02	16.43	0.016*

*Significant

Table No. 3: Comparison of liver function tests between NAFLD and AFLD

Liver function tests	NAFLD		AFLD		
	Mean	SD	Mean	SD	*p*-value
AST (U L^{-1})	36.24	9.17	50.62	12.40	<0.0001*
ALT (U L^{-1})	42.66	12.13	39.22	12.62	0.1678^{NS}
Total Bilirubin (mg dL^{-1})	1.07	0.33	1.22	0.28	0.0174*
Total Protein (g dL^{-1})	6.35	1.25	6.42	1.06	0.7633^{NS}
AST/ALT	0.87	0.16	1.26	0.29	<0.0001*

^{NS}Not significant; *Significant

significant. The mean fasting blood sugar level for NAFLD patients was 110 mg dL^{-1}, while for AFLD patients, it was 124.02 mg dL^{-1}. Statistical analysis indicated that this difference in fasting blood sugar was not significant. Table No. 2 displays a comparison of the lipid profile between patients with non-alcoholic fatty liver disease (NAFLD) and alcoholic fatty liver disease (AFLD). AFLD patients exhibited significantly higher levels of totalcholesterol(TC), triglycerides (TG), low-density lipoprotein (LDL) and very low-density lipoprotein (VLDL) compared to NAFLD patients. On the other hand, AFLD patients showed a significant decrease in high-density lipoprotein (HDL) levels compared to NAFLD patients. Table No. 3 presents a comparison of liver function tests between patients with non-alcoholic fatty liver disease (NAFLD) and alcoholic fatty liver disease (AFLD). AFLD patients exhibited elevated serum levels of aspartate aminotransferase (AST), total bilirubin and the AST/ALT ratio compared to NAFLD patients. However, there was no significant difference in serum levels of alanine aminotransferase (ALT) and total proteins between NAFLD and AFLD patients.

DISCUSSIONS

The present investigation was conducted as an observational cross-sectional study inside a hospital environment, encompassing individuals diagnosed with non-alcoholic fatty liver disease (NAFLD) and alcoholic fatty liver disease (AFLD). The present study aimed to elucidate the aberrations in lipid levels and liver function tests observed in individuals diagnosed with non-alcoholic fatty liver disease (NAFLD) and alcoholic fatty liver disease (AFLD).

The prevalence of hepatic steatosis, also known as fatty liver disease, is extensive on a global scale. The prevalence of this condition in the general population of Western countries has been documented to vary between 20-30%[16]. In the past, there was a prevailing notion that this disorder posed no significant harm. However, contemporary understanding has increasingly acknowledged its substantial association with adverse health outcomes and death, particularly in relation to liver-related complications. The evidence suggests that non-alcoholic fatty liver disease (NAFLD) is a significant contributor to the incidence of liver-related morbidity and mortality, mostly due to its propensity to advance to cirrhosis and liver failure. The rationale behind this is attributed to the possibly catastrophic ramifications associated with the disorder. Individuals diagnosed with non-alcoholic fatty liver disease exhibit comparable pathological characteristics to those suffering from alcohol-induced liver disease, despite the absence of alcohol misuse. The progression of disease stages might encompass a continuum starting from mild steatosis and advancing to steatohepatitis, severe fibrosis, and ultimately culminating in cirrhosis. There is a consensus among scholars that nonalcoholic steatohepatitis (NASH) serves as an intermediary stage in the advancement of nonalcoholic fatty liver disease (NAFLD). The disease is characterized by liver steatosis, liver cell death, hepatic inflammation, fibrosis and necrosis[17].

An important comorbidity that is frequently seen in patients who have NAFLD is dyslipidemia. This

condition is characterised by hypertriglyceridemia, reductions in high-density lipoprotein cholesterol (HDL-c) and increases in very low-density lipoprotein (VLDL) and low-density lipoprotein cholesterol (LDL-c) [18,19]. Recent research indicates that specific lipid profile characteristics may be associated with the severity of nonalcoholic fatty liver disease (NAFLD), as well as the progression of nonalcoholic steatohepatitis (NASH) and liver fibrosis[20-23].

When we compare the lipid parameters between AFLD and NAFLD, we found significant increased levels of TG, TC, LDL, VLDL and significant decreased levels of HDL in AFLD compared to NAFLD, indicating that AFLD patients exhibits severe dyslipidemic pattern. In accordance with our research results, Shahi *et al*.[14] discovered that individuals with alcoholic fatty liver disease exhibited a lipid abnormality spectrum characterized by elevated levels of total cholesterol (TC), low density lipoprotein (LDL), triglycerides (TG), and very low-density lipoprotein (VLDL) in comparison to individuals with nonalcoholic fatty liver disease. Similarly, Israelsen *et al*.[24] observed decreased HDL in NAFLD patients compared to alcoholic liver disease. However, in a study done by Ahn *et al*.[25] the values of mean total cholesterol in AFLD and NAFLD were 183.1±36.9 and 186.3±33.2, respectively.

In the present study, AFLD patients had increased serum levels AST, total bilirubin and AST/ALT ratio (De ritis ratio) compared to NAFLD patients. However, there was no significant difference in serum levels of ALT and total proteins between NAFLD and AFLD. In a study conducted by Ramesh *et al*.[13], mean De ritis ratio was found to be 0.867 in NAFLD and 1.22 in AFLD patients. The term “De ritis Ratio” refers to the proportion of aspartate amino transferase (AST) to alanine amino transferase (ALT) in the body. In 1957, Fernado De Ritis was the first person to define the ratio of AST activity to ALT activity in serum. Ever since that time the ratio has been commonly referred to as the “De Ritis ratio”[26]. A positive test for De Ritis can help diagnose hepatitis. This ratio's original function was to discern between increases in aminotransferase levels that were of the inflammatory type (when the De Ritis ratio was less than 0.7) and those that were of the necrotic type (De Ritis ratio greater than 0.7)[27]. According to the findings of a number of separate research[27-29], this ratio is useful for both the differential diagnosis and the classification of hepatic disorders.

However, our research is limited by the following factors. First, due to the setting of our study being limited to a hospital environment, there exists an inherent bias in the patient selection process. Second, the investigation was conducted over a fairly short period of time. Third, this study is also deficient in control patients, which limits the examination of the potential occurrence of NAFLD. Fourth, ultrasonography was employed for the detection of NAFLD. The liver biopsy is widely regarded as the definitive method for diagnosing fatty liver disease. Nevertheless, its invasiveness, potential for complications and substantial expense render it unsuitable for routine use among the general population. Finally, the generalizability of the study's findings is limited due to the small sample size and the restriction of the research to a single hospital center.

CONCLUSION

In conclusion, both patients with alcoholic fatty liver disease and non-alcoholic fatty liver disease exhibited dyslipidemic patterns of lipid markers and abnormal liver function test results. Significant atherogenic dyslipidemia and increased AST and AST/ALT ratio (De ritis ratio) were seen in AFLD when compared to NAFLD patients. Deritis ratio is increased in AFLD, hence can be used as a marker to differentiate between NAFLD from AFLD.

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