Section: Medicine

Original Article

ISSN (0): 2347-3398; ISSN (P): 2277-7253

# Association of Fatty Liver Severity and Endothelial Function in Non-Alcoholic Fatty Liver Disease (NAFLD) Patients

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## Abstract

**Background:** Non alcoholic fatty liver disease is fast attaining the status of being the most common disease throughout the world. The present study was conducted to evaluate the association of fatty liver severity and endothelial function in Non-Alcoholic Fatty Liver Disease (NAFLD) patients. **Subjects and Methods:** The study was conducted on 50 non-alcoholic fatty liver disease subjects (cases) and 50 healthy volunteers (controls). Biochemical tests such as serum bilirubin, total serum protein, serum albumin, serum globulin, aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) and prothrombin index (PTI) were performed. Brachial artery diameter and its changes, post cuff-deflation were determined. Blood Flow mediated vasodilatation (FMD), was determined ultrasonographicaly. **Results:** The mean baseline brachial artery diameter in cases was 3.88 mm and in control was 3.77 mm. The difference found to be non- significant ($p > 0.05$). The mean post cuff deflation brachial artery diameter in cases was 4.03 mm and in control was 4.17 mm. The difference found to be significant ($p < 0.05$). The mean flow mediated vasodilatation in cases was 0.15 and in control was 0.40. The difference found to be highly significant ($p < 0.05$). **Conclusion:** Authors found that the mean FMD in brachial artery in patients with non-alcoholic fatty liver disease is below normal range. Reduced percent FMV was associated with NAFLD.

**Keywords:** BAL- Bronchoalveolar lavage, CBNAAT- Cartridge based nucleic acid amplification test, PTB- Pulmonary tuberculosis, ZN- Ziehl-neelsen.

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**Received:** April 2020
**Accepted:** April 2020

## Introduction

Non alcoholic fatty liver disease (NAFLD) is fast attaining the status of being the most common disease throughout the world. The prevalence is as high as 20-30% of general population in western countries while in India the prevalence in various studies varies from 9-32% in different studies.[1] Non-alcoholic fatty liver disease is the most common cause of chronic liver disease in the general population and presents when fatty infiltration affects >5% of hepatocytes, in the presence of <20 g (2.5 U) of alcohol consumption per day, without evidence of other causes of liver disease. NAFLD is regarded by many to be the hepatic manifestation of metabolic syndrome and therefore it is linked to cardiovascular disease. NAFLD disease is a fast emerging global epidemic which is recognized as a common metabolic disorder that is closely associated with obesity and insulin resistance.[2]

Overnutrition and sedentary lifestyle often result in obesity and hepatic steatosis; however, these factors might not necessarily result in hepatocyte necrosis, inflammation, and fibrosis. Furthermore, a subset of individuals with obesity (about 25–30%) might have metabolically healthy obesity.[3] Although association between NAFLD and endothelial dysfunction as observed by flow mediated dilatation has been studied in various studies and some of these studies showed that irrespective of presence of components of metabolic syndrome (diabetes, obesity, dyslipidemia, hypertension), NAFLD itself was a strong predictor of endothelial dysfunction, thus opening a new dimension for exploration.[4] The present study was conducted to evaluate the association of fatty liver severity and endothelial function in Non-Alcoholic Fatty Liver Disease (NAFLD) patients.

## Subjects and Methods

The study was conducted on 50 non-alcoholic fatty liver disease subjects (cases) and 50 matched healthy volunteers (controls) without any fatty liver disease, attending outdoor and indoor patient department of Guru Nanak Dev Hospital, attached to Government Medical College Amritsar. The study was conducted after approval from institutional ethical committee, Government medical college, Amritsar. Patients were informed about the study procedure and written informed consent was taken according to the proforma attached.

Physical examination including general physical examination, per abdominal examination, cardiovascular

examination, respiratory examination and central nervous system examination was done. Biochemical tests such as serum bilirubin, total serum protein, serum albumin, serum globulin, aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) and prothrombin index (PTI) were performed. Complete Haemogram of patients was also performed. A longitudinal section of the brachial artery was analyzed; (Medial epicondyle was used as anatomical landmark for brachial artery). Brachial artery diameter and its changes were determined by using a high resolution B mode ultrasonography system ENVISOR (Phillips) version B.O.-I having an electrical linear transducer mid-frequency of 7.5 m Hz. Blood Flow mediated vasodilatation (FMD), which reflects endothelium dependent vasodilatation, was calculated as the percentage increase in diameter from baseline to the maximum value which is obtained after the cuff deflation using the following formula:

$$FMD = \frac{d2-d1}{d1} \times 100$$

Where d2= Brachial artery diameter at 5 minute post cuff-deflation and d1 = Base line brachial artery diameter. The data was collected systematically and analyzed statistically according to the standard statistical methods.

## Results

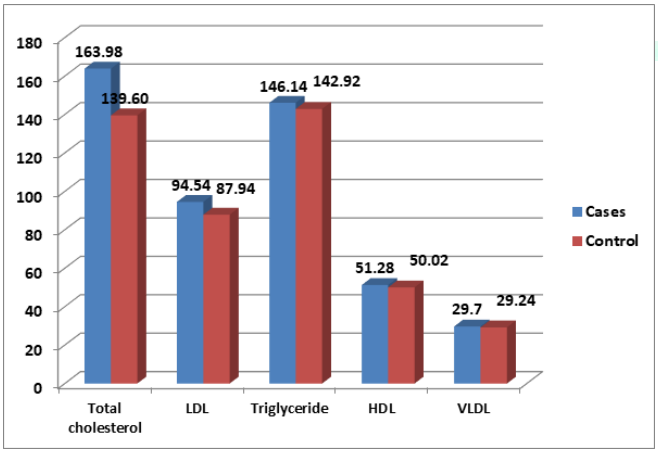


**Figure 1: Lipid Profile**

[Figure 1] shows that mean total cholesterol in cases was 163.9 mg/dl and in control was 139.6 mg/dl. The difference found to be significant (p< 0.05). The mean LDL level in cases was 94.5 mg/dl and in control was 87.9 mg/dl. The difference found to be significant (p< 0.05). The mean triglyceride level in cases was 146.1 mg/dl and in control was 142.92 mg/dl. The difference found to be significant (p< 0.05). The mean HDL level in cases was 51.2 mg/dl and in control was 50.02 mg/dl. The difference found to be non-significant (p> 0.05). The mean VLDL level in cases was 29.7 mg/dl and in control was 29.24 mg/dl. The difference found to be non-significant (p> 0.05).

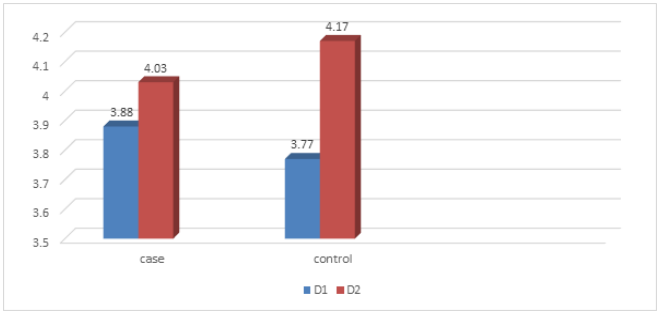


**Figure 2: Brachial Artery Diameter D1 & D2**

[Figure 2] shows that mean D1 in cases was 3.88 mm and in control was 3.77 mm. The difference found to be non-significant (p> 0.05). The mean D2 in cases was 4.03 mm and in controls was 4.17 mm. The difference found to be significant (p< 0.05).

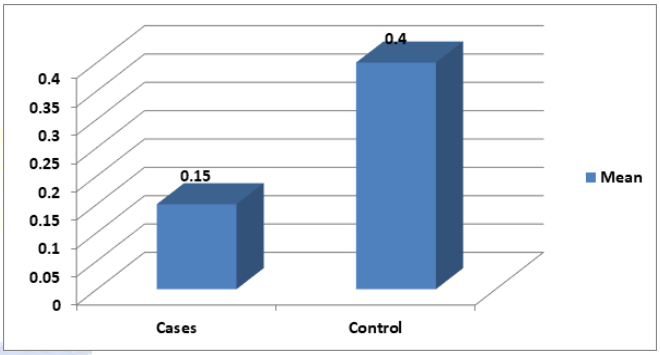


**Figure 3: Mean flow mediated Vasodilatation**

[Figure 3] shows that mean flow mediated vasodilatation in cases was 0.15 and in control was 0.40. The difference found to be highly significant (p< 0.05).

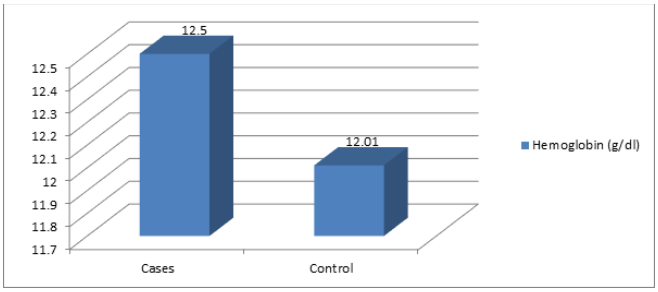


**Figure 4: Hemoglobin (g/dl)**

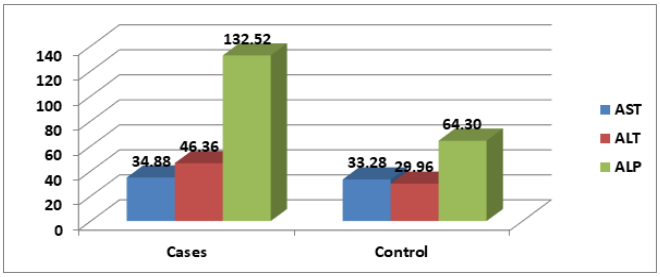


**Figure 5: Liver Enzymes**

[Figure 4] shows that mean hemoglobin in cases was 12.5 g/dl and in controls was 12.01 g/dl. The difference found to

be non-significant (p> 0.05).

[Figure 5] shows mean AST level in cases was 34.88 units/l, ALT was 46.36 units/l and ALP was 132.52 units/l. In control, AST level was 33.28 units/l, ALT was 29.96 units/l and ALP was 64.30 units/l. The difference was found to be significant for ALT and ALP (p< 0.05).

## Discussion

In the last two decades, nonalcoholic fatty liver disease (NAFLD) has been increasingly recognized as the most common liver disease in Western countries. Estimates obtained from clinical series, autopsy studies, and convenience samples of the general population suggest that 20% to 30% of individuals in Western countries have NAFLD. The prevalence of fatty liver in the general population of India has been shown to be as high as 24%5 which is similar to that reported from some of the western countries, where it parallels the prevalence of obesity. These estimates, however, need to be confirmed in representative samples of the general population.[6]

In our study, we included 50 non-alcoholic fatty liver disease subjects (cases) and 50 healthy volunteers (controls) without any fatty liver disease. There were 26 male and 24 female in cases and 28 male and 22 female in control.

We found that in control group, mean age of male was 47.2 years and in female was 46.5 years. In control, mean age of male was 46.4 years and in female was 45.8 years. In present study, mean hemoglobin level of cases was 12.5 ± 1.6 g/dl and in control subjects it was 12.01 ± 1.5 g/dl, with P value being 0.08. The mean fasting blood glucose level of cases was 96.04 ± 6 mg/dl and random blood glucose was 113.92 ± 9.4 mg/dl, and in controls fasting blood glucose was 94.8 ± 4.5 mg/dl and random blood glucose was 114.5 ± 10.3 mg/dl. There was no statistically significant difference among any of these values. Li et al,[7] found that fasting blood glucose (FBG) was 5.12 ± 0.82 mmol/l i.e. 92.16 ± 14.76 mg/dl.

It was found that liver enzymes such as ALT and ALP show significant difference in both cases and control group. ALT in cases was 46.3 ± 5.56 IU/L and in controls, was 29.9 ± 4.42 IU/L with P value being 0.001 showing significant difference. We found that lipid profile such as total cholesterol, LDL and triglyceride, show significant difference between cases and control. However our results are in agreement with Li et al,[7] who found that the means of serum lipid profiles including total cholesterol (TC), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) were all within the normal range.

We found that mean D1 brachial artery diameter in cases was 3.88 ± 0.25 mm whereas in control it was 3.77 ± 0.32 mm. The difference was statistically insignificant with P>0.05. We found that mean D2 was 4.03 ± 0.25 mm in cases and 4.17 ± 0.29 mm in controls. This difference is statistically significant. Khan et al,[8] found that mean baseline brachial artery diameter (mm) was 3.84 ± 0.67 and mean flow mediated dilatation (FMD) was 6.52 ± 0.65.

We found that flow mediated vasodilatation in cases was 0.15 ± 0.04 and in control was 0.40 ± 0.10. The FMD was found to be statistically significant in this study with P<0.001. Our results matched with the findings of Shukla et al,[9] wherein he found that percentage change in FMD among NAFLD patients (13.54±3.65%) was found to be lower than that in controls (16.84±4.61%) Benjamin et al,[10] found that greater liver fat was modestly associated with lower flow-mediated dilation and lower peripheral arterial tonometry ratio.

## Conclusion

Authors found that Non-alcoholic fatty liver disease (NAFLD) is a growing global health problem, affecting almost a quarter of the world's population. NAFLD is highly prevalent in the elderly and is closely associated with components of metabolic syndrome. The mean FMD in brachial artery of patients with non-alcoholic fatty liver disease is below normal range. Reduced percent FMV is associated with NAFLD.

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**How to cite this article:** Sandhu PS, Singh J, Chander R, Kaur A. Association of Fatty Liver Severity and Endothelial Function in Non-Alcoholic Fatty Liver Disease (NAFLD) Patients. Asian J. Med. Res. 2020;9(1):ME13-ME16.
DOI: dx.doi.org/10.21276/ajmr.2020.9.1.ME4

**Source of Support:** Nil, **Conflict of Interest:** None declared.