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Prevalence of Non-Alcoholic Fatty Liver Disease in Patients of Metabolic Syndrome in a Patients Attending Tertiary Care Centre

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Abstract

Background: Non-alcoholic fatty liver disease and steatohepatitis now constitute the major etiology of chronic liver disease. Prevalence of non-alcoholic fatty liver disease is rising due to the change in lifestyle habits, diet and obesity. Metabolic syndrome is closely related with the pathogenesis of non-alcoholic fatty liver disease. Studies showed that prevalence of metabolic syndrome is rising in Indian population. This study was conducted to look into the current status of the metabolic syndrome in urban and rural population. **Methods**: The study was conducted among patients attending General Medicine OPD/IPD. Each participant was subjected to clinical examination, anthropometric measurements, laboratory investigations and abdominal ultrasound. NAFLD was diagnosed by ultrasound and metabolic syndrome was diagnosed based on modified NCEP: ATP III criteria. **Results**: The prevalence of NAFLD was found to be 20 % and was higher among male population (22.88%) as compared to females (18.24%). The prevalence of metabolic syndrome among NAFLD and control groups were 45% and 16% respectively. **Conclusion**s: Present study has shown moderate prevalence of NAFLD and metabolic syndrome among the rural population of western Uttar Pradesh with a more male predisposition.

Keywords: Metabolic syndrome, Non-alcoholic fatty liver disease, NAFLD

Introduction

Non-alcoholic fatty liver disease (NAFLD) encompasses a range of liver conditions, from simple steatosis to steatohepatitis, occurring in individuals with minimal alcohol consumption.[1] This spectrum can progress to cirrhosis and hepatocellular carcinoma. Recognized as a leading cause of chronic liver disease worldwide, NAFLD is characterized by the abnormal accumulation of triglycerides in hepatocytes.[2] In India, it is increasingly significant as a contributor to chronic liver conditions. Key risk factors include central obesity, type 2 diabetes mellitus (T2DM), hypertension, and dyslipidemia. Diagnosing NAFLD involves both invasive and non-invasive methods.[3] Liver enzyme levels, such as transaminases (ALT and AST), may be normal or elevated, meaning reliance on these alone can miss cases. Ultrasound offers 89% sensitivity and 93% specificity for detecting

steatosis, while computed tomography (CT) and magnetic resonance imaging (MRI) provide greater accuracy. However, liver biopsy remains the gold standard for a definitive diagnosis. NAFLD is closely linked to metabolic syndrome, a cluster of metabolic abnormalities that heighten the risk of cardiovascular disease and T2DM. Metabolic syndrome is defined by insulin resistance, central obesity, hypertension, and dyslipidemia, with additional risk factors including sedentary lifestyle, high-calorie diets, moderate alcohol use, smoking, psychosocial stress, and elevated pro-inflammatory cytokines. The exact mechanisms driving metabolic syndrome remain unclear, though recent research highlights oxidative stress as a key player in its development and related cardiovascular issues. The prevalence of NAFLD has risen alongside metabolic syndrome and its associated conditions, such as T2DM, obesity, and dyslipidemia.[4-6] Both NAFLD and metabolic syndrome share strong ties to insulin resistance and mitochondrial dysfunction, increasing the risk of T2DM and cardiovascular disease.[7-10] The National Cholesterol Education Program's Adult Treatment Panel III (NCEP ATP III) guidelines recommend using five criteria to diagnose metabolic syndrome: waist circumference, serum triglycerides, HDL cholesterol, blood pressure, and fasting plasma glucose. This study aimed to examine the clinical characteristics of NAFLD patients and explore its connection to metabolic syndrome, as defined by the modified NCEP ATP III criteria.[11]

Methods

We carried out a hospital-based cross-sectional study involving 200 participants. The study group was drawn from individuals visiting the general medicine outpatient (OPD) and inpatient (IPD) departments at the School of Medical Sciences and Research, Sharda University, Greater Noida. The study spanned from January 2024 to Dec 2024 and included adults aged 18 to 50 years. All participants provided written informed consent upon enrollment. To gather data on social, demographic, occupational, dietary, and medical histories, we distributed printed questionnaires. Height was measured using a portable stadiometer, while weight was recorded with an electronic weighing scale. Waist circumference was determined by measuring the smallest circumference between the lower edge of the ribcage and the iliac crest. Resting blood pressure was taken on the right upper arm after 20 minutes of rest, with participants seated, using a mercury sphygmomanometer. The serum lipid profile was assessed using the enzymatic CHOD-PAP method for total cholesterol and the GPO method for triglycerides. LDL cholesterol was calculated using the Friedewald equation:

LDL cholesterol = Total cholesterol - HDL cholesterol - (triglycerides / 2.2).

Liver function tests and fasting lipid profiles were performed with auto-analyzers. NAFLD was defined as fatty liver not caused by excessive alcohol intake (>20 grams/day), medications, toxins, infectious diseases, or other identifiable external factors. This study relied on ultrasound for diagnosis. Sonographic evidence of fatty liver was identified by a diffuse increase in parenchymal echogenicity, reduced visibility of portal veins, and greater sound attenuation by the liver. Metabolic syndrome was diagnosed using the NCEP-ATP III criteria, with modifications to waist circumference as outlined below:

Three or more of the following:

- Central obesity: waist circumference ≥90cm (male), ≥80cm (female)
- Hypertriglyceridemia: triglyceride ≥150 mg/dl or specific medication
- Low HDL cholesterol: <40mg/dl (male) and <50mg/dl (female) or specific medication.
- Blood Pressure: systolic blood pressure ≥130 mm Hg or diastolic blood pressure ≥85 mm Hg or specific medication
- Fasting plasma glucose ≥100 mg/dl or specific medication or previously diagnosed type 2 diabetes.

Results

A total of 200 patients who attended the General Medicine OPD/IPD of School of Medical Sciences & Research, Greater Noida, Uttar Pradesh were selected for the study. The study group comprised of 104 males and 96 females. The baseline demographic, anthropometric and biochemical characteristics of the study population is given in table 1.

Out of the 200 participants 40 had USG evidence of fatty liver. Thus, the prevalence of NAFLD was 20%. NAFLD was present among 19 (18.24%) females and 22 (22.88%) males. Prevalence of metabolic syndrome among NAFLD group and control group was found to be 45% and 16 % respectively. The overall prevalence of metabolic syndrome was 30.5%.

Liver biopsy was not done in any of the patient as it is not practical to do an invasive test in a healthy asymptomatic population limiting our study to be an ultrasound based study (Table 2).

Not even a single risk factor of metabolic syndrome was present in 9 (9%) cases and 21 (21%) controls, while one risk factor was present in 26(26%) cases and 33 (33%) controls. The presence of two risk factors were almost similar in both groups at 24 (24%) among cases and 26 (26%) among controls. Three risk factors were present in 28 (28%) of NAFLD group and 10 (10%) of controls. Four risk factors were noted in 10 (10%) and 5 (5%) of cases and controls respectively. All the components of metabolic syndrome were present in 3 (3%) of cases and 5 (5%) of controls (Table 3).

Table 1: Demographic, anthropometric and baseline biochemical characteristics of the study population.

Characteristics	Mean standard deviation
Age (years)	**45 ±15**
Weight (kg)	**56.14±10.68**
Height (cm)	**157.9±8.6**
Body Mass Index (kg/m^2)	**22.8±4.35**
Systolic blood pressure (mm Hg)	**124±15.85**
Diastolic blood pressure (mm Hg)	**72.16±17.62**
Fasting blood sugar (mg/dl)	**86.58±25.68**
Triglycerides (mg/dl)	**96.58±38.89**
HDL cholesterol(mg/dl)	**47.27±17.74**
SGOT	**32.65±13.2**
SGPT	**31 ±12.7**

Table 2: Prevalence of metabolic syndrome among study population

	NAFLD	Control	Total	P value
No of participants	100	100	200	
Prevalence of metabolic syndrome	**45 (45%)**	**16(16%)**	**61 (30.5%)**	**< 0.05**

Table 3: Comparison between NAFLD group and control group based on no of risk factors.

No. of risk factors	NAFLD group (N=100)	Control group (N=100)	p value
0	9 (9%)	21 (21%)	**< 0.05**
1	26 (26%)	33 (33%)	**< 0.05**
2	24 (24%)	26 (26%)	**< 0.05**
3	28 (28%)	10 (10%)	**< 0.05**
4	10 (10%)	5 (5%)	**< 0.05**
5	**3 (3%)**	**5 (5%)**	**< 0.05**

Discussion

The prevalence of NAFLD in the general population ranges from 10% to 24%. An ultrasound-based study from India reported a prevalence of 24.5%, while the present study found a prevalence of 20%, with males (22.88%) showing a higher rate than females (18.24%). These findings align with those of Singh et al. and indicate a moderate

prevalence of NAFLD in the general population. Compared to Western studies, the prevalence in this study is lower but still relatively high. This may be attributed to the sharp increase in obesity within the Indian population, which now has the second-largest diabetic population globally. The adoption of unhealthy Western dietary habits and sedentary lifestyles in India further contributes to the rising trend of NAFLD. Similarly, the prevalence of metabolic syndrome is increasing in India due to overlapping risk factors with NAFLD, including obesity, diabetes, and sedentary behavior. Many experts view NAFLD as the hepatic manifestation of metabolic syndrome. In this study, a strong link was observed between NAFLD and metabolic syndrome, with the prevalence of metabolic syndrome more than doubling in the NAFLD group (45%) compared to controls (16%). Liver histology also correlates closely with the number of risk factors present. This study found a higher number of metabolic syndrome risk factors in individuals with ultrasound-detected fatty liver compared to controls. However, as this study was conducted on a hospital-based population rather than the general population, the reported prevalence of both NAFLD and metabolic syndrome may be higher than actual community levels. Few studies have compared metabolic syndrome risk factors between healthy, asymptomatic individuals with NAFLD and those without fatty liver. In conclusion, ultrasound evidence of fatty liver should be regarded as a serious indicator of metabolic syndrome, and clinicians should proactively screen for NAFLD in patients with metabolic syndrome. A diagnosis of NAFLD in an asymptomatic patient should prompt attention to preventable aspects of both conditions. Patients should be counseled on dietary changes, regular exercise, weight loss, and the management of comorbidities with appropriate medications.

Conclusion

The current study revealed a moderate prevalence of NAFLD and metabolic syndrome among the patients of Greater Noida, Uttar Pradesh, with a notable predominance in males. Early diagnosis and targeted management are critical to halting disease progression and reducing complications. However, the study is limited by its small sample size and the demographic differences across various regions of India and the world.

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