Section: General Medicine

Original Research Article

PREVALENCE OF NON-ALCOHOLIC FATTY LIVER DISEASE IN LEAN INDIVIDUALS IN CENTRAL INDIA: A CROSS-SECTIONAL OBSERVATIONAL STUDY

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ABSTRACT

Background: Non-alcoholic fatty liver disease (NAFLD) is increasingly recognized among non-obese individuals, particularly in Asian populations. Lean NAFLD represents a distinct phenotype with underlying metabolic derangements. **Aim:** To determine the prevalence of NAFLD in lean individuals and evaluate its association with metabolic and biochemical parameters.
Materials and Methods: This cross-sectional study included 400 lean individuals (BMI <23 kg/m²). Anthropometric measurements, fasting plasma glucose (FPG), glycated hemoglobin (HbA1c), lipid profile, alanine aminotransferase (ALT), and aspartate aminotransferase (AST) were recorded using standard methods. NAFLD was diagnosed using ultrasonography and transient elastography (FibroScan) based on standard criteria, including controlled attenuation parameter (CAP) and liver stiffness measurement (LSM).
Results: NAFLD was detected in 82 individuals (20.5%). Ultrasonography identified 74 cases (18.5%), while FibroScan detected an additional 8 cases (2%). Subjects with NAFLD had significantly higher FPG, HbA1c, triglycerides, and lower HDL cholesterol ($p < 0.001$). ALT and AST levels were significantly elevated. Significant fibrosis (LSM ≥7.0 kPa) was observed in 11% of NAFLD cases.
Conclusion: NAFLD is prevalent in lean individuals and is better detected using combined ultrasonography and FibroScan. Metabolic abnormalities, particularly dysglycemia and dyslipidemia, are strongly associated.
Keywords: Lean NAFLD, FibroScan, HbA1c, Dyslipidemia, India.

INTRODUCTION

Non-alcoholic fatty liver disease (NAFLD) has emerged as the most widespread chronic liver disorder globally and represents a growing public health concern.[3] While it is commonly linked to obesity and metabolic syndrome, recent evidence highlights a considerable burden among individuals with normal body weight, particularly in Asian populations, where prevalence estimates range from 10% to 20%.[1,10]

In lean individuals, NAFLD often remains undetected because the absence of obesity masks underlying metabolic risk factors. However, this group frequently exhibits metabolic disturbances such as insulin resistance, abnormal lipid profiles, and impaired glucose regulation.[2,4] The concept of the "metabolically obese but normal weight" (MONW) phenotype is especially relevant in the Indian context, where visceral adiposity tends to be higher even at lower BMI values.[11]

Emerging Indian data further suggest that NAFLD is increasingly prevalent even among non-obese individuals and may be associated with early metabolic dysfunction and increased cardiovascular risk.[8,9] This underscores the need for early identification and risk stratification in this subgroup.

Advances in non-invasive diagnostic tools, especially transient elastography (FibroScan), have enhanced the ability to detect hepatic steatosis and fibrosis. These technologies provide greater accuracy than ultrasonography alone and allow for better characterization of NAFLD in lean populations.[6]

The present study was designed to estimate the prevalence of NAFLD among lean adults in Central India using both ultrasonography and FibroScan, and

to explore its association with metabolic and biochemical parameters.

MATERIALS AND METHODS

Study Design and Participants

A cross-sectional study was conducted among 400 lean individuals (BMI <23 kg/m²) aged ≥18 years.

Inclusion Criteria

- BMI <23 kg/m²
- Age ≥18 years
- No significant alcohol intake

Exclusion Criteria

- Known liver disease
- Viral hepatitis (HBsAg, anti-HCV positive)
- Alcohol intake >20 g/day
- Use of hepatotoxic drugs

Clinical and Anthropometric Assessment

- Height, weight, BMI
- Waist circumference

Biochemical Assessment

Fasting venous blood samples were collected after overnight fasting. The following parameters were measured using standardized laboratory methods.[7]

- Fasting plasma glucose (FPG)
- Glycated hemoglobin (HbA1c)
- Lipid profile
- ALT and AST

Diagnosis of NAFLD

NAFLD was diagnosed using a combination of imaging modalities:

1. Ultrasonography:

Presence of hepatic steatosis based on increased echogenicity.[6]

2. Transient Elastography (FibroScan):

- Controlled Attenuation Parameter (CAP):
  - ≥248 dB/m → hepatic steatosis (S1 or higher)
- Liver Stiffness Measurement (LSM):
  - ≥7.0 kPa → significant fibrosis

Participants fulfilling either ultrasonographic or FibroScan criteria for steatosis were classified as having NAFLD.[7]

Statistical Analysis

Continuous variables were expressed as mean ± SD and compared using Student's t-test. Categorical variables were expressed as percentages and compared using chi-square test. A p-value <0.05 was considered statistically significant.

RESULTS

The study included 400 lean individuals with a mean age of 38.7 ± 11.2 years, of whom 57% were male. The average BMI was 21.6 ± 1.1 kg/m², and the mean waist circumference measured 84.2 ± 7.5 cm. NAFLD was diagnosed in 82 participants, yielding a prevalence of 20.5%, which is consistent with previously reported Asian data.[1,10] Ultrasonography identified 74 cases (18.5%), while FibroScan detected an additional 8 cases (2%), thereby improving the overall diagnostic yield.[6] Among those with NAFLD, 11% demonstrated significant fibrosis, defined as a liver stiffness measurement (LSM) ≥7.0 kPa, confirming that lean NAFLD is not a benign condition.[12]

Table 1: Comparison Between NAFLD and Non-NAFLD Groups Demographic Profile of Patients

Parameter	NAFLD (n=82)	Non-NAFLD(n=318)	p-value
Age (years)	41.5 ± 10.6	38.0 ± 11.3	0.03
BMI (kg/m²)	22.2 ± 0.7	21.4 ± 1.2	<0.01
Waist circumference (cm)	89.1 ± 6.5	83.0 ± 7.2	<0.001
FPG (mg/dL)	103.2 ± 11.8	92.6 ± 10.4	<0.001
HbA1c (%)	5.9 ± 0.6	5.3 ± 0.5	<0.001
Triglycerides (mg/dL)	180.2 ± 34.8	131.8 ± 27.9	<0.001
HDL (mg/dL)	38.2 ± 6.0	45.5 ± 7.2	<0.001
ALT (U/L)	48.1 ± 14.9	27.9 ± 9.2	<0.001
AST (U/L)	40.3 ± 12.1	26.1 ± 8.4	<0.001

DISCUSSION

This study demonstrates that approximately 20.5% of lean adults in Central India are affected by NAFLD, a prevalence consistent with earlier reports from Indian and Asian populations.[1,8,10] The combined use of ultrasonography and FibroScan improved detection compared to ultrasonography alone, reinforcing the utility of transient elastography in identifying early hepatic steatosis.[6]

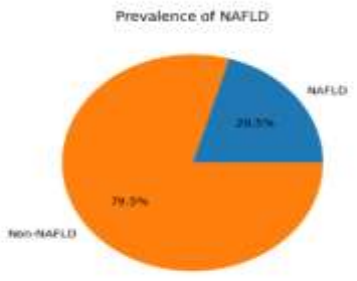

Figure 1: Prevalence of NAFLD in lean individual

A notable finding was the strong association between NAFLD and impaired glucose metabolism. Elevated HbA1c levels among affected individuals suggest

underlying insulin resistance, which is known to promote hepatic fat accumulation through increased lipogenesis and oxidative stress.[2,4] This supports the role of HbA1c as a useful screening marker in lean individuals, where BMI alone does not adequately reflect metabolic risk.[11]

Dyslipidemia was also prominent, with higher triglyceride levels and reduced HDL cholesterol in the NAFLD group.[8] This lipid pattern is characteristic of the "metabolically obese normal weight" (MONW) phenotype, frequently observed in Asian Indians due to their predisposition to visceral adiposity despite normal BMI.[11]

Importantly, FibroScan revealed significant fibrosis in 11% of lean NAFLD cases, highlighting that this condition is not benign.[12] The progression of liver injury in lean individuals may be driven by a combination of insulin resistance, central fat distribution, and genetic predispositions such as PNPLA3 polymorphisms.[4]

From a public health perspective, reliance on obesity-based screening strategies risks underdiagnosis in India. Broader approaches incorporating metabolic markers (HbA1c, lipid profile) alongside non-invasive imaging such as FibroScan could improve early detection and help prevent disease progression.

Limitations

- Single centre based cross sectional study
- Ultrasonography limitations
- Lack of insulin resistance markers

CONCLUSION

NAFLD affects approximately one-fifth of lean individuals in Central India. Combined use of ultrasonography and FibroScan improves detection and risk stratification. Screening should include lean individuals, especially those with metabolic abnormalities.

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