Lean but not Healthy: A Scoping Review of Non-Obese NAFLD and Its Nursing Implications in the Indian Context

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Summary

Non-alcoholic fatty liver disease (NAFLD) in individuals with normal body mass index (BMI), known as lean NAFLD, is emerging as a silent epidemic, especially in Asian populations including India. Despite normal weight, these individuals present metabolic abnormalities and liver damage. This article maps current evidence on lean NAFLD with an emphasis on its prevalence, pathophysiology, diagnosis, management, and the unique role of nurses in the Indian context. A scoping review was conducted following Arksey and O'Malley's framework and PRISMA-ScR guidelines. Literature published from 2015 to 2024 was searched in PubMed, Scopus, and Google Scholar using terms such as 'lean NAFLD', 'non-obese fatty liver', 'India', and 'nursing intervention' with Boolean operators. Studies relevant to the Indian population and nursing practice were prioritised. Lean NAFLD shows high prevalence in India despite low BMI profiles. It is associated with insulin resistance, visceral adiposity, and increased risk of cardiovascular and liver-related morbidity. Nurses are critical in screening, educating, and managing affected individuals, especially within non-communicable disease (NCD) frameworks. This review underscores the need for early identification strategies and nurse-led interventions to manage lean NAFLD in India. Integration into national health programmes and continuous nursing education are essential.

Key words: Non-alcoholic fatty liver disease, Nurse intervention

Non-alcoholic fatty liver disease (NAFLD) has become the most common chronic liver disease globally. While traditionally linked to obesity and metabolic syndrome, NAFLD in individuals with normal or low BMI, referred to as lean NAFLD, poses a diagnostic and public health challenge (Rastogi et al, 2022). Lean NAFLD often goes undetected due to the absence of obesity, despite underlying insulin resistance, dyslipidemia, and hepatic inflammation. In the Indian context, dietary transitions, sedentary lifestyles, and genetic predispositions contribute to this rising burden (Chakrabarti & Chattopadhyay, 2025). The dual burden of malnutrition and metabolic disorders further complicates disease identification and management. Nursing professionals play a vital role in early detection, lifestyle counselling, and coordination of care. This review seeks to map current literature on lean NAFLD and explore the implications for nursing practice in India.

NAFLD is a major global health concern, affecting nearly one-third of the adult population worldwide. While it is commonly associated with obesity, an increasing number of individuals with normal BMI are being diagnosed with lean NAFLD, especially in Asian populations. Lean NAFLD remains underdiagnosed due to the absence of overt obesity, despite comparable disease severity to non-lean NAFLD. Early detection and tailored management strategies are essential. Nurses, as primary points of contact in healthcare, are uniquely positioned to impact early intervention and patient outcomes. Given the lack of awareness and structured guidelines for lean NAFLD, this topic is highly relevant to clinical nursing practice.

This scoping review followed the framework developed by Arksey and O'Malley, further refined by Levac et al, and incorporated recommendations from the PRISMA-ScR (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews) guidelines. The review was conducted in five stages: (1) identifying the research question, (2) identifying relevant studies, (3) study selection, (4) charting the data, and (5) collating, summarising, and reporting the results.

Research Questions

This review was guided by the following research questions:

- What is the prevalence and clinical profile of lean NAFLD in non-obese individuals in India?

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- What are the pathophysiological mechanisms and risk factors involved?
- How is lean NAFLD diagnosed and managed, and what gaps exist in practice?
- What roles do nurses play in the identification, education, and intervention for lean NAFLD?

Search Strategy

A comprehensive literature search was conducted using PubMed, Scopus, Google Scholar, and the Cochrane Library. The search spanned publications from January 2015 to May 2024. The following key words and Boolean operators were used:

- 'lean NAFLD' or 'non-obese fatty liver' or 'non-obese NAFLD' and 'India' or 'Asian'; and 'nursing' or 'nurse-led intervention' or 'community health nurse'
- 'non-obese' and fatty liver disease' and 'screening' or 'diagnosis' and 'public health' or 'NCD'

Search filters included:

· English language
· Human studies
· Full-text available

Manual screening of reference lists of key studies was also done to identify additional relevant literature.

Inclusion and Exclusion Criteria

Inclusion criteria: Studies published between 2015 and 2024; Studies focusing on lean NAFLD or non-obese individuals with fatty liver disease; Research conducted in India or Asia with relevance to the Indian population; Articles addressing diagnostic, pathophysiological, epidemiological, or nursing aspects; Review articles, observational studies, guidelines, and reports.

Exclusion criteria: Articles focusing solely on alcoholic liver disease; Studies unrelated to NAFLD or those lacking full text; Case reports or animal studies unless relevant to pathophysiology

Study Selection and Data Extraction

All articles were independently screened by a single reviewer in two stages: title/abstract screening and full-text review. Relevant data were charted using a standardised form, capturing details like author, year, country, study design, population, key findings, and relevance to nursing. Due to the scope of the review, no formal quality appraisal was conducted, in alignment with scoping review methodology.

The search yielded 1,238 articles, of which 71 met the inclusion criteria after screening. The findings are organised into five key thematic areas: epidemiology, pathophysiology, diagnostic approaches, management strategies, and nursing implications.

Epidemiology of Lean NAFLD in India

In a survey conducted by a premier quaternary Delhi-based hospital on 6186 individuals, 56 percent had fatty liver, out of which 11 percent were lean. Recent studies report that 10-20 percent of NAFLD cases in India occur in individuals with a normal BMI, qualifying as 'lean' NAFLD (Sarin, 2024). Despite not being overweight by conventional standards, these individuals exhibit significant metabolic disturbances. Regional studies from Tamil Nadu and Maharashtra have identified lean NAFLD prevalence ranging between 8-19 percent in general populations (Gupta et al, 2020; Shukla et al, 2022). Genetic predisposition, dietary transitions, and urbanisation contribute to this trend, particularly among younger and middle-aged adults (Kumar et al, 2021; Rao RS et al, 2020).

Pathophysiology and Risk Factors

Lean NAFLD patients often exhibit **visceral adiposity, insulin resistance,** and **mitochondrial dysfunction** without overt obesity (Sharma et al, 2019; Mehta et al, 2019). Indian populations are known to have 'metabolically obese' phenotypes despite normal BMI, marked by higher waist-to-hip ratios, dyslipidemia, and elevated liver enzymes (Bhardwaj et al, 2021). Risk factors include:

- High carbohydrate intake
- Sedentary lifestyle
- Low muscle mass (sarcopenia)
- Polycystic ovarian syndrome (PCOS)
- Hypothyroidism and genetic variants like **PNPLA3**

Diagnostic Challenges

Standard diagnostic criteria, such as BMI cut-offs, are often insufficient in lean NAFLD. Imaging (ultrasound, transient elastography) and liver enzyme levels may be non-specific or underestimated in lean individuals. Many Indian studies emphasise the need to lower the BMI threshold or incorporate waist circumference or waist-hip ratio and metabolic markers for effective diagnosis.

Management Strategies

Management relies heavily on **lifestyle interventions**, especially dietary modification and increased physical activity. Pharmacologic agents such as vitamin E, pioglitazone, or newer antidiabetics (GLP-1 agonists, SGLT2 inhibitors) have shown benefit in selected cases. Indian guidelines remain non-specific for lean NAFLD, indicating a gap in clinical recommendations tailored to this subgroup.

Role of Nurses in the Indian Context

Nurses, particularly community health nurses, are strategically positioned to identify at-risk individuals, educate patients on lifestyle changes, and monitor progress. Nurse-led NCD clinics under India's **National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS)** can integrate liver screening protocols. Moreover, nurses can conduct anthropometric assessments, interpret lab reports, and engage in culturally tailored counselling.

Lean NAFLD presents a unique paradox in modern hepatology: individuals who appear metabolically healthy by traditional standards (normal BMI) are nonetheless at significant risk of hepatic steatosis, fibrosis, and cardiovascular disease (Rastogi et al, 2022; Sarin, 2024). This review highlights the growing prevalence of lean NAFLD in the Indian population and emphasises the critical need to rethink screening, diagnosis, and management strategies.

Re-evaluating Obesity-Centric Models

Traditional NAFLD paradigms are anchored in the obesity framework, which overlooks a significant subset of Indian patients who are non-obese but exhibit high visceral fat and insulin resistance (Gupta et al, 2020). As Indian adults often possess a 'thin-fat phenotype' with increased central adiposity, waist circumference, and metabolic syndrome indicators may serve as better risk predictors than BMI alone.

Emerging evidence suggests that lean NAFLD is **not a milder form** of fatty liver disease. In fact, several cohort studies have demonstrated comparable or worse liver fibrosis in lean versus obese NAFLD individuals when matched for age and sex (Shukla et al, 2022). This reinforces the need for India-specific guidelines that incorporate ethnicity-adjusted cut-offs and context-sensitive risk stratification tools.

Gaps in Diagnosis and Awareness

A major barrier to lean NAFLD diagnosis is **low clinical suspicion**. Physicians and nurses may dismiss fatty liver findings in non-obese individuals as clinically insignificant (Kumar et al, 2021). Further, awareness among patients is lacking, partly due to the asymptomatic nature of early-stage NAFLD and cultural perceptions linking liver disease only with alcohol use or obesity (Patel et al, 2023).

The review highlights a need for routine incorporation of **waist circumference, ALT/AST levels**, and **dietary/lifestyle screening** into primary health assessments, especially in NCD clinics. Nurses can lead this effort through structured risk assessments and longitudinal tracking, particularly in rural and semi-urban populations.

The Crucial Role of Nurses

Nurses are the first point of contact in India's tiered healthcare system and hold immense potential in early identification and intervention for NAFLD (Rao et al, 2020). Their roles may include:

- Conducting **screening camps** using simple anthropometric tools;
- Providing **counselling on dietary habits** (e.g., reducing polished rice, sugar intake);
- Encouraging **physical activity** tailored to cultural norms;
- Supporting **medication adherence** and referral for specialist care;
- Participating in **community awareness drives** under initiatives like Ayushman Bharat Yojana.

Their contributions are particularly impactful in areas underserved by hepatologists or gastroenterologists, helping bridge gaps between specialised, community care.

Public Health and Policy Implications

Despite being a significant contributor to liver morbidity, NAFLD is not yet a **national health programme priority** in India. Given the rising incidence of lean NAFLD, particularly among young adults, screening guidelines must be integrated into existing programmes such as NPCDCS (Sharma et al, 2019; Bhardwaj et al, 2021). A collaborative model involving **physicians, nurses, and public health practitioners** can ensure scalable, cost-effective responses.

There is also a growing body of evidence supporting **nurse-led lifestyle clinics,** such as those used in diabetes and hypertension control. Similar frameworks can be adapted for NAFLD management, particularly in areas with limited access to tertiary care.

Limitations and future directions: As this was a single-author scoping review, independent verification and quality grading of the included studies were not performed. Nevertheless, methodological transparency was maintained, and the findings provide a comprehensive overview of existing literature. Future work should include systematic reviews or mixed-method studies to evaluate the effectiveness of nursing-led interventions for lean NAFLD.

Nursing Implications

The increasing prevalence of lean NAFLD in India underscores the critical role of nurses in the early

detection, management, and prevention of liver disease. Nurses are uniquely positioned to act as **health educators** and **advocates**, promoting healthy lifestyle choices and facilitating disease awareness among high-risk populations.

Early identification and screening: Nurses can conduct **community screening initiatives** to identify individuals at risk of lean NAFLD. These can involve simple measures like:

- **Measuring waist circumference**, which is a better predictor of metabolic syndrome than BMI in Indian populations (Sarin et al, 2024).
- **Identifying early signs** such as non-specific abdominal discomfort, fatigue, or unexplained weight changes.
- **Screening for comorbidities** like diabetes and dyslipidemia, which are often present in patients with lean NAFLD.

Lifestyle modification education: Nurses can provide ongoing support by m**onitoring disease progression** through regular follow-ups where necessary, encouraging adherence to health-promoting behaviours, and e**mpowering patients** to take responsibility for their health, fostering a sense of control over their condition.

Given the absence of pharmacologic solutions in many cases, **lifestyle interventions** are the cornerstone of lean NAFLD management. Nurses can educate patients about d**ietary modifications**, such as reducing intake of refined carbohydrates, processed foods, and high-fructose corn syrup; e**ncouraging physical activity** tailored to individual capabilities and preferences, like walking or yoga; s**tress reduction techniques**, as stress exacerbates metabolic dysfunction and liver inflammation.

Patient follow-up and support: **Monitoring disease progression** through regular follow-ups, where necessary, encouraging adherence to health-promoting behaviours, and e**mpowering patients** to take responsibility for their health, fostering a sense of control over their condition.

Community health programmes: Nurses can play a pivotal role in public health campaigns aimed at raising awareness about the risks of lean NAFLD. They can partner with **public health organisations** to educate communities on **screening programmes**, liver health, and obesity prevention, helping to shift the focus from a purely obesity-centric view of metabolic diseases.

Conclusion

Lean NAFLD is a significant but often overlooked condition in India. This scoping review demonstrates that **non-obese individuals** are increasingly affected by NAFLD, a disease traditionally associated with obesity. Given the unique metabolic profile of the Indian population, it is essential to revisit the current diagnostic and management paradigms. Nurses are crucial in the early identification, education, and ongoing management of this condition. By integrating lean NAFLD screening into existing health frameworks and leveraging the expertise of nurses, India can reduce the burden of liver disease and improve long-term health outcomes.

Future research should focus on evaluating the efficacy of nurse-led interventions, exploring culturally specific dietary patterns, and assessing the effectiveness of early screening strategies for lean NAFLD.

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