



Research Article

Ayurvedic Diagnostic Parameters in The Assessment of Non-Alcoholic Fatty Liver Disease (NAFLD): A Clinical Observational Study

Dr. Vivek Awasthi ¹, Dr Rajesh Kumar ², Dr. Manoj Kumar Gupta ³, Dr. Nitin Urmalia ^{4*}
Dr. Hariom Parihar ⁵

¹Associate Professor, Department of Rasashastra evum Bhaishajya Kalpana, Sardar Patel Institute of Ayurvedic Medical Sciences and Research Centre, Lucknow, Uttar Pradesh, India

² Assistant Professor, Department of Rasha Sashtra & Bhaishajya Kalpana, Rajkiya Ayurvedic College & Hospital, Atarra, Banda, Uttar Pradesh, India

³Assistant Professor, Department of Rog Nidan & Vikriti Vigyan, Government Ayurvedic College and Hospital, Atarra, Banda, Uttar Pradesh, India

⁴ Associate Professor and H.O.D., Department of Agadatantra evum vidhi vaidyak, Govt Auto Ashtang Ayurvedic College, Indore, Madhya Pradesh, India

⁵Associate Professor and H.O.D., Department of Dravyaguna, Govt. Auto. Ashtang Ayurvedic College, Indore, Madhya Pradesh, India

Corresponding Author: * Dr. Nitin Urmalia

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Abstract

Background: Non-Alcoholic Fatty Liver Disease (NAFLD) is a common chronic liver disorder characterized by excessive accumulation of fat in the liver in individuals with no significant alcohol-related cause. It is strongly associated with obesity, insulin resistance, type 2 diabetes mellitus, dyslipidemia and sedentary lifestyle. Contemporary terminology increasingly uses the term Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD), reflecting the metabolic basis of the condition.

Ayurveda provides a comprehensive diagnostic methodology based on Nidana Panchaka, Dosha, Dushya, Agni, Ama, Srotas, Prakriti and Vikriti. Although there is no exact one-to-one classical equivalent of NAFLD, several Ayurvedic concepts may provide a useful framework for understanding metabolic disorders associated with hepatic steatosis.

Aim: To assess the role of selected Ayurvedic diagnostic parameters in patients with NAFLD and to study their association with anthropometric, biochemical and ultrasonographic findings.

Objectives: 1. To assess Prakriti and Vikriti in patients diagnosed with NAFLD.

2. To assess the status of Agni and clinical features suggestive of Ama.

3. To assess Meda Dushti and relevant Srotodushti features.

4. To study the relationship between Ayurvedic diagnostic parameters and BMI, waist circumference and metabolic parameters.

5. To assess the relationship between Ayurvedic parameters and ultrasonographic grading of fatty liver.

6. To explore the possibility of developing a standardized Ayurvedic diagnostic assessment framework for metabolic fatty liver disease.

Methodology: A hospital-based observational clinical study may be conducted in adult patients diagnosed with fatty liver by ultrasonography. Patients may be assessed using a structured

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Ayurvedic diagnostic proforma covering Prakriti, Vikriti, Agni, Ama, Koshtha, Mala, Meda Dushti, Nidana and Srotodushti. Anthropometric parameters, liver function tests, fasting blood glucose, HbA1c, lipid profile and ultrasonographic findings may be recorded. Appropriate statistical tests may be applied to determine associations and correlations.

Conclusion: An integrated assessment incorporating Ayurvedic diagnostic parameters and objective modern investigations may provide a useful research framework for studying metabolic fatty liver disease. However, Ayurvedic parameters should be validated prospectively before being considered independent diagnostic tools for NAFLD/MASLD.

KEYWORDS: Ayurveda, Roga Nidana, NAFLD, MASLD, Agni, Ama, Meda Dushti, Prakriti, Vikriti, Yakrit, Fatty Liver.

1. INTRODUCTION

Non-Alcoholic Fatty Liver Disease is a major metabolic liver disorder characterised by excessive hepatic fat accumulation in the absence of significant alcohol-related liver injury. The disease is closely associated with obesity, insulin resistance, type 2 diabetes mellitus, dyslipidemia and other metabolic abnormalities.

The increasing prevalence of overweight and obesity has contributed substantially to the growing burden of metabolic diseases. WHO identifies excessive body fat accumulation as an important health risk and emphasizes the association of obesity with diabetes and other chronic diseases.

NAFLD represents a spectrum ranging from simple hepatic steatosis to steatohepatitis, fibrosis, cirrhosis and hepatocellular carcinoma. Modern assessment therefore focuses not only on the presence of hepatic steatosis but also on metabolic risk factors and the possibility of progressive liver fibrosis.

Recent international guidelines use the term Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD) for patients with hepatic steatosis in the presence of cardiometabolic risk factors. The 2024 EASL-EASD-EASO guideline provides a contemporary framework for screening, diagnosis, risk stratification and management of MASLD.

Ayurveda approaches disease diagnosis through a multidimensional framework. Nidana Panchaka, Dosha, Dushya, Agni, Ama, Srotas, Prakriti and Vikriti provide important components of clinical assessment.

There is no direct classical disease entity that can simply be equated with NAFLD. Therefore, it is scientifically inappropriate to state that NAFLD is identical to a particular Ayurvedic disease. Instead, Ayurvedic parameters can be studied as clinical phenotypic characteristics that may correlate with metabolic and hepatic findings.

The present research therefore proposes to examine whether measurable Ayurvedic diagnostic parameters demonstrate clinically meaningful relationships with conventional indicators of fatty liver disease.

2. Rationale of the Study

Current diagnostic assessment of fatty liver disease primarily depends on clinical history, anthropometric measurements, biochemical investigations and imaging.

However, metabolic abnormalities may develop before clinically significant liver dysfunction becomes apparent.

Ayurveda emphasizes assessment of the patient as a whole, including:

- dietary habits,
- lifestyle,
- digestive capacity,
- bowel habits,
- body constitution,
- metabolic status,
- Dosha predominance,
- tissue involvement and
- disease-specific clinical features.

The concepts of Agni Dushti, Ama, Meda Dushti and Srotodushti may therefore be investigated as potentially measurable clinical constructs.

A systematic study may help determine whether these parameters correlate with objective indicators such as BMI, waist circumference, triglycerides, glucose, ALT and ultrasonographic grade.

3. Ayurvedic Conceptual Framework

3.1 Agni

Agni is considered a fundamental factor responsible for digestion and metabolic transformation.

Different types of Agni Dushti described in Ayurveda include:

- Vishama Agni
- Tikshna Agni
- Manda Agni

In metabolic disorders, particular attention may be given to Manda Agni and symptoms indicating impaired digestion.

Possible clinical parameters

- Aruchi
- Avipaka
- Gaurava
- Adhmana
- Alasya
- Irregular appetite
- Postprandial heaviness
- Delayed digestion

A standardized scoring system should be developed before using these features for statistical analysis.

4. Ama

Ama is an important Ayurvedic concept associated with impaired digestion and metabolism.

Potentially assessable features include:

- Jihva coating

- Gaurava
- Aruchi
- Avipaka
- Daurbalya
- Mala abnormalities
- Indigestion
- Excessive lethargy

For research purposes, the presence and severity of these features should be converted into reproducible scores.

It should be emphasized that an Ama score proposed in a research study is an operational research construct and should not automatically be presented as a universally validated diagnostic scale.

5. Meda Dushti

Meda Dhatu is traditionally described as one of the seven Dhatus. The concept is particularly relevant to metabolic research because it deals with the body's adipose/fat-related component.

Clinical parameters potentially relevant to Meda Dushti include:

- Sthaulya
- Excess abdominal adiposity
- Gaurava
- Alasya
- Excessive sweating
- Reduced physical activity
- Increased body measurements

These parameters can be evaluated alongside BMI and waist circumference.

6. Dosha Perspective

Metabolic disorders may present with different combinations of Dosha involvement.

Kapha

Potentially relevant features:

- Gaurava
- Alasya
- Sthaulya
- Snigdhata
- Excessive accumulation

Pitta

Potentially relevant features:

- Metabolic activity
- Ushnata
- Appetite abnormalities
- Hepatic functional involvement

Vata

Potentially relevant features:

- Irregular appetite
- Variable bowel habits
- Irregular metabolism
- Chronic disease progression

The study should avoid assuming that every NAFLD patient has a fixed Dosha pattern. Instead, individual Vikriti should be assessed systematically.

7. Srotas Assessment

The following Srotas may be considered relevant:

Annava Srotas

Assessment may include:

- Aruchi
- Avipaka
- Adhmana
- Ajirna

Medovaha Srotas

Assessment may include:

- Sthaulya
- Excess adiposity
- Gaurava
- Excessive sweating

Rasavaha Srotas

Assessment may include general metabolic and nutritional abnormalities.

Purishavaha Srotas

Assessment may include:

- Constipation
- Irregular bowel movements
- Abnormal stool consistency

Srotas assessment should be performed according to predefined operational criteria.

8. Nidana Panchaka-Based Assessment

The following components may be documented.

8.1 Nidana

Ahara-related factors

- Excessive Madhura Rasa
- Excessive Snigdha Ahara
- Guru Ahara
- Excessive calorie-dense food
- Frequent overeating
- Irregular meal timing
- Excessive processed food
- Sugar-sweetened beverages

Vihara-related factors

- Sedentary lifestyle
- Daytime sleeping
- Lack of exercise
- Prolonged sitting
- Irregular sleep

Modern evidence also emphasizes unhealthy dietary patterns and inadequate physical activity as important contributors to obesity and metabolic disease.

9. RESEARCH GAP

Several Ayurvedic concepts have theoretical relevance to metabolic disorders; however, there remains a need for **systematic clinical studies that:**

1. operationalize Ayurvedic diagnostic parameters;
2. use reproducible scoring systems;
3. correlate these parameters with objective investigations;
4. examine their relationship with ultrasonographic fatty liver grading; and
5. determine whether these parameters have independent predictive value.

The proposed study addresses this gap by combining Ayurvedic clinical assessment with conventional objective parameters.

10. AIM

To assess Ayurvedic diagnostic parameters in patients with Non-Alcoholic Fatty Liver Disease and to study their correlation with clinical, biochemical and ultrasonographic parameters.

11. OBJECTIVES

Primary objective

To assess the association between selected Ayurvedic diagnostic parameters and the severity of fatty liver.

Secondary objectives

1. To assess the predominant Prakriti and Vikriti pattern.
2. To assess Agni status.
3. To assess clinical features of Ama.
4. To assess Meda Dushti.
5. To assess relevant Srotodushti.
6. To assess dietary and lifestyle risk factors.
7. To correlate Ayurvedic parameters with BMI and waist circumference.
8. To correlate Ayurvedic parameters with fasting glucose and HbA1c.
9. To correlate Ayurvedic parameters with lipid profile.
10. To correlate Ayurvedic parameters with liver enzymes.
11. To correlate Ayurvedic parameters with ultrasonographic fatty liver grade.

12. MATERIALS AND METHODS

12.1 Study Design

A hospital-based observational cross-sectional clinical study is proposed.

12.2 Study Setting

The study may be conducted in the Department of Roga Nidana and Vikriti Vigyana of an Ayurvedic teaching hospital, in collaboration with the Department of Pathology/Radiology or an appropriate diagnostic facility.

12.3 Study Duration

A proposed duration of 12–18 months may be used depending on patient recruitment.

12.4 Sample Size

A pilot sample of 60–100 participants may be considered; however, the final sample size should be calculated using an appropriate statistical formula based on the primary outcome and expected effect size.

12.5 Study Population

Adult patients diagnosed with fatty liver by ultrasonography and satisfying predefined inclusion and exclusion criteria.

13. Inclusion Criteria

1. Adults aged 18–60 years.
2. Patients with ultrasonographic evidence of fatty liver.
3. Patients willing to participate.
4. Patients providing written informed consent.
5. Patients available for clinical and laboratory assessment.

14. Exclusion Criteria

1. Significant alcohol consumption.
2. Known viral hepatitis.
3. Established chronic liver disease of another etiology.
4. Drug-induced liver injury.
5. Pregnancy.
6. Known hepatocellular carcinoma.
7. Severe systemic illness affecting liver function.
8. Patients unwilling to participate.

15. Ayurvedic Diagnostic Assessment

A structured case-record form may contain:

- Parameter| Proposed assessment
- Prakriti| Vata/Pitta/Kapha and dual combinations
- Vikriti| Present Dosha predominance
- Agni| Sama/Vishama/Tikshna/Manda
- Ama| Standardized symptom score
- Koshtha| Mridu/Madhyama/Krura
- Jihva| Coating and appearance
- Mala| Frequency and consistency
- Nidana| Dietary and lifestyle factors
- Meda| Clinical and anthropometric assessment
- Srotas| Relevant Srotodushti features
- Nidra| Duration and quality
- Vihara| Physical activity
- Ahara| Dietary pattern

16. Modern Clinical Assessment

16.1 Anthropometric Parameters

- Height
- Weight
- BMI
- Waist circumference
- Hip circumference
- Waist-hip ratio

BMI may be calculated as:

BMI = Weight in kilograms / Height in metres²

WHO uses BMI as a commonly used measure of overweight and obesity, with adult overweight beginning at BMI ≥ 25 kg/m² and obesity at BMI ≥ 30 kg/m².

16.2 Biochemical Parameters

The following investigations may be recorded:

- Fasting blood glucose
- HbA1c
- Total cholesterol
- LDL cholesterol
- HDL cholesterol
- Triglycerides
- AST/SGOT
- ALT/SGPT
- Alkaline phosphatase
- GGT
- Total bilirubin
- Direct bilirubin

17. Ultrasonographic Assessment

Ultrasonography of the abdomen may be used to identify hepatic steatosis and classify its severity according to the grading system adopted by the radiology department.

Possible categories may include:

Grade I

Mild hepatic steatosis.

Grade II

Moderate hepatic steatosis.

Grade III

Severe hepatic steatosis.

The exact radiological criteria and reporting format should be standardized before study initiation.

18. Proposed Ayurvedic Scoring System

For research purposes, a composite score may be developed.

A. Agni Score

Feature| Score

Normal appetite and digestion| 0

Mild disturbance| 1

Moderate disturbance| 2

Severe disturbance| 3

B. Ama Score

Potential features:

- Tongue coating
- Heaviness
- Indigestion
- Loss of appetite
- Lethargy
- Abdominal discomfort

Each feature may be graded from 0–2.

C. Meda Dushti Score

Potential components:

- Increased BMI
- Increased waist circumference
- Abdominal adiposity
- Excessive sweating
- Heaviness
- Reduced activity

The final scoring system should undergo content validation and reliability testing before being used as a validated diagnostic tool.

19. Statistical Analysis

Data may be entered into a statistical software package.

Descriptive statistics

- Mean
- Standard deviation
- Median
- Interquartile range
- Frequency
- Percentage

Inferential statistics

Depending on data distribution:

- Chi-square test
- Student's t-test
- Mann–Whitney U test
- ANOVA/Kruskal–Walli's test
- Pearson correlation
- Spearman correlation
- Logistic regression
- Multiple regression

A p-value < 0.05 may be considered statistically significant.

Where multiple comparisons are performed, an appropriate correction should be considered.

20. Expected Observations

The study may identify a pattern of association between:

Agni Dushti → Ama features → Meda Dushti → metabolic abnormalities → hepatic steatosis

However, this sequence should be treated as a research hypothesis rather than a predetermined conclusion.

Possible findings may include:

- Higher prevalence of Manda Agni.
- Increased frequency of Ama-associated symptoms.
- Higher prevalence of Kapha-predominant Vikriti.
- Increased Meda-related clinical features.
- Association between abdominal obesity and fatty liver grade.
- Association between metabolic abnormalities and Ayurvedic clinical scores.

21. Expected Correlations

The following correlations may be investigated:

- Ayurvedic parameter| Modern parameter
- Agni score| BMI
- Ama score| Triglycerides
- Meda score| Waist circumference

- Kapha predominance| BMI
 - Ama score| ALT/AST
 - Meda score| Triglycerides
 - Agni score| Fasting glucose
 - Composite Ayurvedic score| Ultrasonographic grade
- The direction and strength of these associations should be determined from actual study data and should not be assumed beforehand.

22. DISCUSSION

NAFLD/MASLD is fundamentally associated with metabolic dysfunction. Obesity, insulin resistance, dyslipidemia and sedentary lifestyle are major contributors to the development and progression of fatty liver disease.

The modern diagnostic approach uses metabolic risk assessment, laboratory parameters and imaging, with additional non-invasive fibrosis assessment when appropriate. The 2024 EASL-EASD-EASO guideline emphasizes systematic assessment of individuals at risk of MASLD and risk stratification for clinically significant liver fibrosis.

Ayurveda, in contrast, assesses the individual through a combination of etiological, constitutional and clinical parameters.

The concept of Agni may be explored as an Ayurvedic construct representing digestive and metabolic capacity. Ama may be investigated as a clinical construct associated with impaired digestion and metabolism. Meda Dushti provides another potentially relevant framework for studying abnormal adiposity.

However, these concepts should not be considered equivalent to insulin resistance, hepatic steatosis or biochemical liver injury unless validated through appropriate scientific studies. The principal strength of this research approach is therefore the operationalization and validation of Ayurvedic parameters, rather than simply mapping modern disease terminology onto classical disease names.

23. Clinical Significance

If significant and reproducible associations are identified, Ayurvedic parameters may have potential utility in:

1. Clinical phenotyping of patients with metabolic disorders.
2. Identification of individuals requiring further investigation.
3. Development of standardized Ayurvedic assessment tools.
4. Integrative research in metabolic liver disease.
5. Patient stratification for future interventional studies.
6. Development of validated Ayurvedic clinical scoring systems.

Importantly, these potential applications require prospective validation.

24. Limitations

1. A cross-sectional study cannot establish causality.
2. Ultrasonography has limitations in quantifying hepatic fat and fibrosis.
3. Ayurvedic constructs such as Ama and Agni require operational definitions.

4. Inter-observer variation may occur during Ayurvedic assessment.
5. Dietary and lifestyle information may be affected by recall bias.
6. The study may be conducted in a single centre.
7. A relatively small sample may limit generalizability.
8. Liver biopsy, where clinically indicated, may provide more definitive histological assessment but is not routinely required for every patient.
9. Ayurvedic parameters should not be considered independent diagnostic tests until their sensitivity, specificity and predictive values have been established.

25. Ethical Considerations

The study should be initiated only after approval from the Institutional Ethics Committee.

Participants should receive adequate information regarding:

- Study purpose
- Procedures
- Potential benefits
- Possible risks
- Confidentiality
- Voluntary participation
- Right to withdraw

Written informed consent should be obtained before enrolment.

26. Future Scope

Future research may focus on:

1. Development of an Ayurvedic NAFLD/MASLD Score

A validated score incorporating:

- Agni
- Ama
- Meda
- Dosha
- Prakriti
- dietary factors
- lifestyle factors

could be developed.

2. Diagnostic Accuracy Study

Sensitivity, specificity, positive predictive value and negative predictive value could be calculated.

3. Prospective Cohort Study

Patients could be followed longitudinally to determine whether baseline Ayurvedic parameters predict progression of metabolic liver disease.

4. Interventional Study

Validated Ayurvedic parameters could be used as secondary outcomes in future clinical trials.

5. Digital Ayurvedic Assessment

A structured digital questionnaire or clinical decision-support tool could potentially be developed after validation.

27. CONCLUSION

NAFLD, increasingly termed MASLD in contemporary clinical guidelines, represents an important metabolic liver disorder associated with obesity, dysglycemia, dyslipidemia and lifestyle-related risk factors.

Ayurveda offers a multidimensional diagnostic framework involving Nidana Panchaka, Agni, Ama, Meda, Dosha, Dushya, Srotas, Prakriti and Vikriti.

The present study proposes to investigate whether selected Ayurvedic parameters demonstrate meaningful relationships with objective clinical, biochemical and ultrasonographic findings in patients with fatty liver disease.

Rather than assuming direct equivalence between NAFLD and a classical Ayurvedic disease, the proposed research focuses on clinical correlation and validation of Ayurvedic diagnostic constructs.

If validated through well-designed clinical studies, these parameters may contribute to an integrative framework for metabolic disease assessment and may provide a foundation for future diagnostic scoring systems.

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Proposed Research Hypothesis

Null Hypothesis (H₀): There is no significant association between selected Ayurvedic diagnostic parameters and clinical, biochemical or ultrasonographic parameters in patients with NAFLD.

Alternative Hypothesis (H₁): Selected Ayurvedic diagnostic parameters show a statistically significant association with one

or more clinical, biochemical or ultrasonographic parameters in patients with NAFLD.

Proposed Outcome

The primary outcome of the study will be the relationship between a predefined Ayurvedic diagnostic profile and ultrasonographic severity of hepatic steatosis.

Secondary outcomes will include correlations between Ayurvedic parameters and BMI, waist circumference, glucose, lipid profile and liver enzymes.

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About the author



Dr. Nitin Urmaliya is an Associate Professor and Head of the Department of Agadatantra evam Vidhi Vaidyak at Government Autonomous Ashtang Ayurvedic College, Indore, Madhya Pradesh, India. His academic and professional work focuses on Agadatantra, Ayurvedic toxicology, and forensic medicine within the field of Ayurveda.