Journal of Chemical Health Risks

www.jchr.org

JCHR (2026) 16(3), 119-124 | ISSN:2251-6727

Clinical, Biochemical and Radiological Profile of MASLD in a Tertiary Care Hospital: A Cross-Sectional Study

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(Received: 16 March 2026 Revised: 14 April 2026 Accepted: 01 May 2026)

KEYWORDS

MASLD, Fibroscan, CAP score, Liver fibrosis, Obesity, Metabolic syndrome

ABSTRACT:

Background

Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD) is a major contributor to chronic liver disease and is strongly linked with metabolic abnormalities such as obesity, diabetes, and dyslipidemia. Non-invasive tools like Fibroscan are increasingly used for disease assessment.

Objective

To ascertain the clinical, biochemical, and radiological profile of patients with MASLD and their association with metabolic risk factors.

Methods

A hospital-based cross-sectional study was conducted among 63 MASLD patients. Clinical parameters, biochemical investigations, and Fibroscan findings (CAP and liver stiffness) were recorded. Statistical analysis included Chi-square test and Spearman correlation, with significance set at $p < 0.05$.

Results

The mean age was 44.75 ± 11.64 years, with 63.5% males. A high prevalence of obesity (82.5%) and dysglycemia (81%) was observed. Severe steatosis (S3) was present in 54% of patients. Most patients had early fibrosis (F0–F1), though ~19% had advanced fibrosis. BMI showed a significant association with CAP score ($p = 0.002$), while AST was significantly associated with fibrosis severity ($p = 0.007$).

Conclusion

MASLD is strongly associated with metabolic dysfunction, particularly obesity and dysglycemia. Anthropometric and biochemical parameters, along with Fibroscan, play a key role in disease assessment and risk stratification.

INTRODUCTION

Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD) represents a paradigm shift in the understanding of fatty liver disease, emphasizing the central role of metabolic dysfunction rather than exclusion of alcohol intake[1]. It encompasses a spectrum ranging from simple steatosis to metabolic dysfunction-associated steatohepatitis (MASH), fibrosis, cirrhosis, and hepatocellular carcinoma[2].

Globally, MASLD affects approximately one-third of the adult population, with an increasing burden in developing countries like India due to rapid urbanization, sedentary lifestyle, and dietary transitions[3–4]. Among individuals with Type 2 Diabetes

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JCHR (2026) 16(3), 119-124 | ISSN:2251-6727

Mellitus (T2DM), the prevalence is reported to be as high as 60–70%[5].

The pathogenesis of MASLD is multifactorial, involving insulin resistance, adipose tissue dysfunction, oxidative stress, and inflammatory pathways[6]. The classical "two-hit hypothesis" has now evolved into a "multiple-hit model," incorporating genetic predisposition, gut microbiota, and environmental factors[7].

MASLD is closely associated with metabolic syndrome components including obesity, hypertension, dyslipidemia, and hyperglycemia[8]. These factors not only contribute to hepatic steatosis but also accelerate progression to fibrosis and cirrhosis. Importantly, cardiovascular disease remains the leading cause of mortality in MASLD patients[9].

Early diagnosis is challenging due to its asymptomatic nature. While liver biopsy remains the gold standard, non-invasive tools such as Fibroscan (CAP and liver stiffness measurement) have gained importance for assessing steatosis and fibrosis[10].

Given the rising burden and variable clinical presentation, there is a need for integrated evaluation of clinical, biochemical, and radiological parameters. This study aims to bridge this gap by assessing these features and correlating them with metabolic risk factors in a tertiary care setting.

OBJECTIVE

To assess the clinical, biochemical, and radiological profile of MASLD patients and evaluate their association with metabolic risk factors.

MATERIALS AND METHODS

Study Design - Cross-sectional analytical study

Setting - Tertiary care hospital (General Medicine OPD)

Sample Size: n = 63 (calculated using BMI SD)

Inclusion Criteria

Patients aged ≥18 years diagnosed with MASLD based on Fibroscan evidence of hepatic steatosis along with at least one of the following metabolic risk factors:

- Overweight/Obesity (BMI ≥23 kg/m² for Asian population)
- Type 2 Diabetes Mellitus or Prediabetes
- Hypertension (≥130/85 mmHg or on treatment)
- Dyslipidemia (Triglycerides ≥150 mg/dL or low HDL)
- Increased waist circumference (≥90 cm in males, ≥80 cm in females)

Exclusion Criteria

- Alcoholic liver disease
- CKD
- Malignancy
- Congestive cardiac failure

Data Collection

Clinical: Age, gender, BMI, BP, waist circumference

Biochemical: FBS- Fasting Blood Sugar, PPBS – Postprandial Blood Sugar, HbA1c-Glycated Hemoglobin (Hemoglobin A1c), AST– Aspartate Aminotransferase, ALT– Alanine Aminotransferase, GGT– Gamma-Glutamyl Transferase, lipid profile - A panel including Total Cholesterol, Triglycerides, HDL (High-Density Lipoprotein), LDL (Low-Density Lipoprotein), and VLDL (Very Low-Density Lipoprotein)

Radiological: FIBROSCAN

1. CAP score (steatosis)
2. Liver stiffness (fibrosis)

Statistical Analysis

Software: SPSS v24

Tests: Chi-square, Fisher's exact, Spearman correlation

Significance: $p < 0.05$

RESULTS

A total of 63 patients were included. The mean age was 44.75 ± 11.64 years, with the majority (49.2%) in the 41–60 years age group. Males constituted 63.5% of the study population.

A high burden of metabolic risk factors was observed:

- Obesity: 82.5% (Obese I + II)

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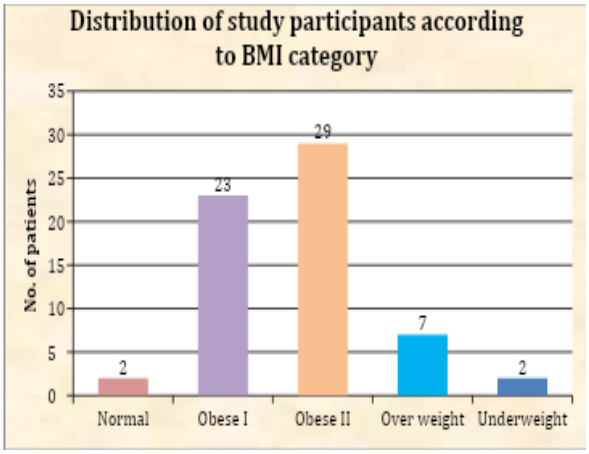
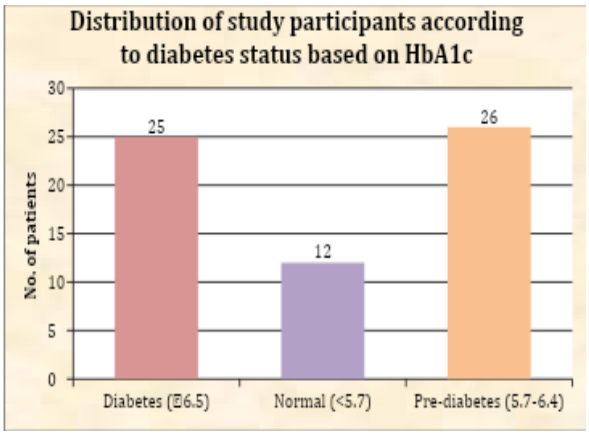
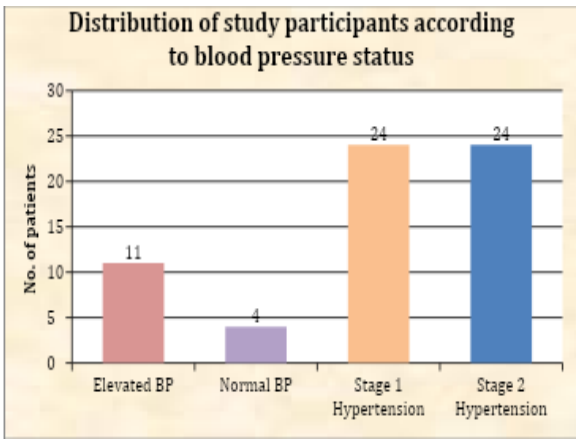
JCHR (2026) 16(3), 119-124 | ISSN:2251-6727



- Dysglycemia: 81% (prediabetes + diabetes)



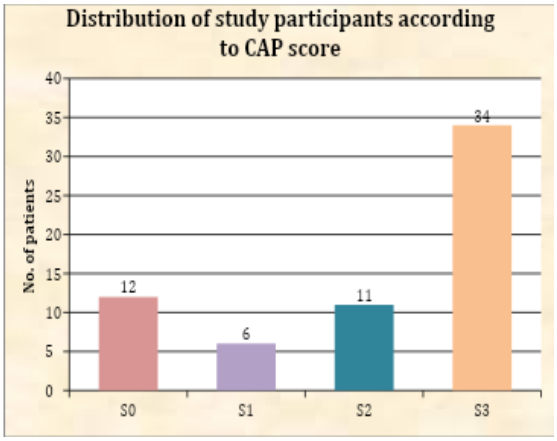
- Hypertension: ~76% (Stage 1 + Stage 2)



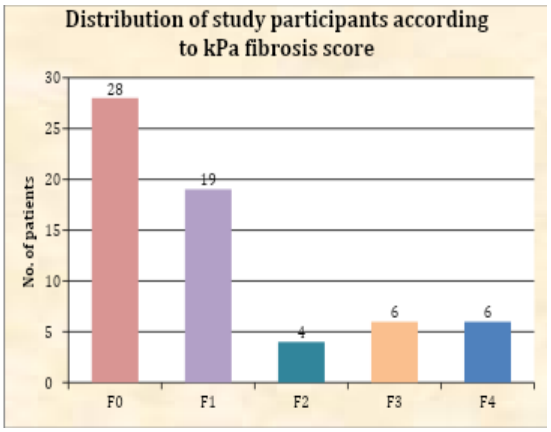
The mean BMI was 31.15 ± 8.91 kg/m², indicating predominant obesity.

Fibroscan Findings

- Severe steatosis (S3): 54%

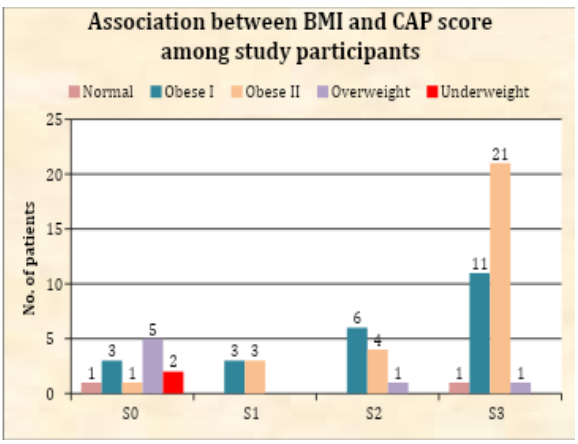


- Early fibrosis (F0–F1): 74.6%
- Advanced fibrosis (F3–F4): ~19%



Key Associations

- BMI vs CAP score: Significant association ($p = 0.002$)



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JCHR (2026) 16(3), 119-124 | ISSN:2251-6727

Table 1 Association between BMI and CAP score

Parameters			CAP Score				Total	p-value
			S0	S1	S2	S3		
BMI	Normal	Count	1	0	0	1	2	0.002
		%	8.3%	0.0%	0.0%	2.9%	3.2%	
	Obese I	Count	3	3	6	11	23	
		%	25.0%	50.0%	54.5%	32.4%	36.5%	
	Obese II	Count	1	3	4	21	29	
		%	8.3%	50.0%	36.4%	61.8%	46.0%	
	Over weight	Count	5	0	1	1	7	
		%	41.7%	0.0%	9.1%	2.9%	11.1%	
	Underweight	Count	2	0	0	0	2	
		%	16.7%	0.0%	0.0%	0.0%	3.2%	
Total		Count	12	6	11	34	63	
		%	100.0%	100.0%	100.0 %	100.0 %	100.0%	

Table1. depicts the association between BMI and CAP score. Most participants with S3 steatosis were in Obese II category (21 participants, 61.8%), followed by Obese I (11 participants, 32.4%). This association was found to be statistically significant (p=0.002)

- AST vs fibrosis stage: Significant association (p = 0.007)

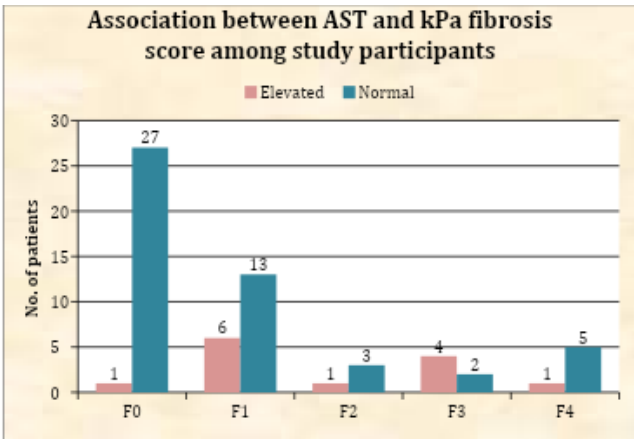

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Table 2 Association between AST and fibrosis stage

Parameter			kPa Score					Total	p-value
			F0	F1	F2	F3	F4		
AST	Elevated	Count	1	6	1	4	1	13	0.007
		%	3.6%	31.6%	25.0%	66.7%	16.7%	20.6%	
	Normal	Count	27	13	3	2	5	50	
		%	96.4%	68.4%	75.0%	33.3%	83.3%	79.4%	
Total		Count	28	19	4	6	6	63	
		%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Table 2 depicts the association between AST and fibrosis stage. Among participants with elevated AST, most were in F3 category (4 participants, 66.7%). Among normal AST participants, most were in F0 category (27 participants, 96.4%). This association was found to be statistically significant (p=0.007).

Correlation

BMI and CAP score showed significant positive correlation

AST correlated strongly with fibrosis indicator – kPa

DISCUSSION

The present study provides a comprehensive evaluation of the clinical, biochemical, and radiological profile of MASLD patients and highlights its strong association with metabolic risk factors.

The majority of patients belonged to the middle-aged group, which is consistent with the known epidemiology of MASLD, where disease manifestation typically occurs during the most metabolically active years of life[11]. The male predominance observed in this study aligns with prior literature, possibly reflecting lifestyle-related risk factors and differential fat distribution patterns.

A key finding of this study is the high prevalence of obesity (82.5%), reinforcing its central role in MASLD pathogenesis. The significant association between BMI and CAP score (p = 0.002) underscores the impact of adiposity on hepatic fat accumulation. This finding is supported by previous studies demonstrating that increased adiposity contributes directly to hepatic steatosis and disease progression[12–13].

Dysglycemia was present in more than 80% of participants, highlighting the importance of insulin resistance in MASLD. Chronic hyperglycemia promotes hepatic lipogenesis and oxidative stress, accelerating disease progression[14]. The strong correlation between fasting glucose and HbA1c further validates the metabolic burden in this cohort.

Despite significant steatosis, liver enzymes remained within normal limits in many patients, emphasizing that normal transaminases do not exclude MASLD. This observation is consistent with earlier studies that have shown MASLD can be present even in patients with normal ALT levels[15].

Fibroscan findings revealed that while most patients had early fibrosis, a notable proportion (~19%) already had advanced fibrosis. This indicates that MASLD can progress silently, reinforcing the need for early screening and risk stratification.

Another important observation was the significant association between AST and fibrosis stage (p = 0.007). Elevated AST was more commonly seen in advanced fibrosis stages, suggesting its utility as a surrogate marker of disease severity. This finding is supported by

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previous studies identifying AST as an independent predictor of fibrosis progression in MASLD[16].

Correlation analysis also demonstrated significant relationships between obesity markers (BMI, waist circumference) and steatosis, as well as between liver enzymes and fibrosis indicators. These findings collectively suggest that simple clinical and biochemical parameters can serve as useful predictors of disease severity when combined with imaging.

Interestingly, lipid parameters and hypertension did not show strong independent associations with disease severity in this study. This may be attributed to the limited sample size or the multifactorial nature of MASLD, as described in previous literature[17].

Overall, this study highlights the importance of an integrated approach combining clinical assessment, metabolic profiling, and non-invasive imaging for accurate evaluation of MASLD.

CONCLUSION

Metabolic dysfunction–associated steatotic liver disease (MASLD) is commonly observed in individuals with underlying metabolic risk factors, underscoring its close link with metabolic health disturbances. Among these, obesity stands out as the most significant predictor of hepatic fat accumulation. Serum AST levels can aid in estimating the severity of liver fibrosis, while Fibroscan offers a reliable, non-invasive method for the assessment of liver pathology.

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