

ORIGINAL ARTICLE

ASSESSMENT OF METABOLIC STEATOSIS USING ULTRASOUND-BASED ELASTOGRAPHY IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

Seema Yasmin¹, Syeda Zurriat Fatima²¹ Associate Professor Community Medicine Department, Shahida Islam Medical College, Lodhran² 4th year MBBS, Shahida Islam Medical College, Lodhran**ABSTRACT:**

Introduction: Liver steatosis has high prevalence seen in diabetics. The diseases of steatosis liver progresses rapidly in these patients. Diabetes when combined with metabolic associated liver disease shows poor outcomes as cirrhosis and increases the rate of mortality.

Objective: : The objective of research undertaken was assessment of metabolic-associated liver steatosis disorder under the ultrasonic guidance in diabetics.

Methods: Participants with diabetes (n=150) were enrolled. Both genders between 30-60 years were selected from OPD of a Private-sector Teaching Hospital, Lodhran, between January, 2025, and June, 2025, following approval from the institution's ethical review committee. Transient elastography was performed for all participants using the TOUCH 502 Fibro Scan device (France) with an M-probe by an experienced radiologist.

Results: According to the established cutoff values, 55 participants (36.67%) showed no fibrosis (F0), while 39 (26%) had mild fibrosis (F1), 28 (18.67%) had moderate fibrosis (F2), and 16 (10.67%) had severe fibrosis (F3). Cirrhosis (F4) was identified in 12 participants (8.0%), as illustrated in Figure 2. Overall, NAFLD was detected in 57% of individuals with type 2 diabetes mellitus. Regarding gender distribution, NAFLD was more common in males (57.1%) compared to females (42.8%).

Conclusion: : Early preventive measures should be taken for diabetics who can develop metabolic associated steatosis of liver

Keywords: Metabolic steatosis, fatty liver, diabetics, Liver fibrosis, cirrhosis, fibro scan

INTRODUCTION:

Nonalcoholic steatosis due to metabolic disorders of liver is alarming, encompassing conditions such as nonalcoholic steatohepatitis (NASH) and simple fatty liver (NAFL)¹. Since most individuals with NAFLD remain asymptomatic, the condition is often underdiagnosed and its true occurrence underestimated. Since most individuals with NAFLD remain asymptomatic, the condition is often underdiagnosed and its true burden underestimated.² Worldwide, the percentage of steatosis due to metabolic reasons in diabetics is estimated to lie between 36% and 97%.^{3,6} Research indicates that when NASH is first diagnosed, about 30–40% of p-

atients already have advanced liver fibrosis, while roughly 10–15% have progressed to cirrhosis.^{4,7} Speedy increase in the rate of non-transmissible diseases as adiposity, type 2 diabetes mellitus (T2DM), malignancy, and cardiac problems are driving the increase in these liver related health conditions.^{8, 10} High glucose levels in blood progresses the pathological deposition of fat in the liver.^{11,13} People suffering from this ultimately end up in cirrhosis or death.^{14,17} Additionally, individuals with diabetes face more than double the risk of death from cirrhosis compared to the general on.^{5,7} Because NASH is often asymptomatic and liver biopsy is not routinely performed, this study evaluated the burden of metabolic steatosis in diabetics.

METHODS

Correspondence: Seema Yasmin

Shahida Islam Medical College, Lodhran

Email: drseemarizvi222@gmail.com

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Participants with diabetes (n=150) were enrolled. Both genders between 30-60 years were selected from OPD of a Private-sector Teaching Hospital, Lodhran,

Between January, 2025, and June, 2025, following approval from the institution's ethical review committee.

Inclusion Criteria:

1. Diabetics
2. Participants of both genders.
3. Adults of 30 and 60 years age.

Exclusion Criteria:

1. Patients with secondary diabetes.
- 2 Individuals consuming approximately 20 grams or more of alcohol per day.
3. Patients taking medications known to induce hepatic steatosis.
- 4.. Individuals with a history of viral hepatitis.
5. Patients with untreated thyroid disorders.

Each participant provided informed consent after explaining the study objectives and procedures in detail.

Data collected from each participant included age, sex, weight and record of serum glucose of a period of last 3 months,

Liver function tests were also assessed. Serum lipid profile parameters were recorded. All participants were screened for viral markers and were negative.

Fibro Scan Investigation:

Transient elastography was performed for all partic-

ipants using the TOUCH 502 Fibro Scan device (France) with an M-probe by an experienced radiologist. The device's automated probe selection system (M or XL probe) was used to select the appropriate probe .

Liver stiffness measurements, which reflect the degree of hepatic fibrosis, were recorded in kilopascals (kPa).

Liver Steatosis was classified using CAP values as follows: S0 (<237 dB/m, normal), S1 (237–259 dB/m as mild) , S2 (259–291 dB/m, as moderate) and S3 (291–400 dB/m as severe).

Fibrosis was classified using liver stiffness measurements as F1 (5.5–8.0 kPa, mild), F2 (8.0–10.0 kPa, moderate), F3 (11.0–16.0 kPa, severe), and F4 (>16.0 kPa, cirrhosis), with the FibroScan system automatically assigning stages from F0 to F4.

Categorical variables were presented as frequencies and percentages, and continuous variables as mean $\pm$ standard deviation (SD).

RESULTS

Among the 150 participants, 72 (48%) were male and 78 (52%) were female. The mean age was 46.03 ± 13.09 years (range: 30–60 years). The glycosylated hemoglobin was $7.4\% \pm 1.49\%$, indicating a generally suboptimal level of glycemic control among the participants, with notable inter-individual variation.

Baseline clinical and biochemical Features of subjects are summarized in Table 1.

Table1

Baseline clinical and biochemical Features of subjects (n = 150)

Variable	Category/Measure	Value
Total participants	—	150
Gender	Male	72 (48%)
	Female	78 (52%)
Age (years)	Range	30–60
	Mean $\pm$ SD	46.03 $\pm$ 13.09
HbA1c (%)	Mean $\pm$ SD	7.4 $\pm$ 1.49
Duration of T2DM (years)	Median	6.5
ALT (>40 IU/L)	Mean $\pm$ SD	69 $\pm$ 3.2
AST (>40 IU/L)	Mean $\pm$ SD	66 $\pm$ 2.5
Total cholesterol (<200mg/dL)	Mean $\pm$ SD	266 $\pm$ 2.6
LDL (<100mg/dL)	Mean $\pm$ SD	164 $\pm$ 3.3
Triglyceride (<150 mg/dL)	Mean $\pm$ SD	345 $\pm$ 4.5
HDL (<45 mg/dL)	Mean $\pm$ SD	34 $\pm$ 1.4
BMI (kg/m ²)	Mean $\pm$ SD	29.53 $\pm$ 5.34

The findings of steatosis are illustrated in Table 2.

Table 2. Distribution Of Hepatic Steatosis Stages of diabetics as Assessed By Transient Elastography (Fibroscan)

Steatosis Grade	CAP Range (dB/m)	Number of Patients	Percentage
S0 (No steatosis)	<237	62	41.33%
S1 (Mild steatosis)	237.0–259.0	26	17.33%
S2 (Moderate steatosis)	259.0–291.0	26	17.33%
S3 (Severe steatosis)	291.0–400.0	36	24%

Abbreviations: CAP, controlled attenuation parameter. Besides, 55 participants (36.67%) showed no fibrosis (F0), while 39 (26%) had mild fibrosis (F1), 28 (18.67%) had moderate fibrosis (F2), and 16 (10.67%) had severe fibrosis (F3). Cirrhosis (F4) was identified in 12 par

ticipants (8.0%), as illustrated in Figure 2. Overall, NAFLD was detected in 57% of individuals with type 2 diabetes mellitus. Regarding gender distribution, NAFLD was more common in males (57.1%) compared to females (42.8%) Table 3.

Table 3 Distribution Of Fibrosis Stages And Percentages in Diabetics (n = 150)A

Variable	Category	n (%)
Fibrosis stage	F0 (No fibrosis)	55 (36.67)
	F1 (Mild fibrosis)	39 (26.00)
	F2 (Moderate fibrosis)	28 (18.67)
	F3 (Severe fibrosis)	16 (10.67)
	F4 (Cirrhosis)	12 (8.00)
NAFLD detection	Present	(57.00)
Gender distribution of NAFLD	Male	(57.10)
	Female	(42.80)

DISCUSSION

Across the globe, cases of NAFLD are rising sharply, mirroring the growing prevalence of excessive adiposity and insulin resistance syndrome.¹⁸ Non-alcoholic fatty liver disease is widely prevalent across global populations, with research indicating rates of approximately 18% to 42% in regions such as Europe and the United States, while studies from various parts of Asia report prevalence ranging from about 8% to 44%.^{9,12} To the best of our knowledge, this is the first investigation conducted in Lodhran, South Punjab, to estimate the prevalence of hepatic steatosis other than the alcohol abuse.

Based on CAP cut-off values, more than half of individuals with type 2 diabetes were found to have NAFLD, with varying degrees of steatosis ranging from none to severe. Our findings further suggest that a considerable proportion of these patients may progress to non-alcoholic steatohepatitis, increasing the risk of advanced fibrosis and cirrhosis similar to another research trial.¹⁹

In contrast to our findings, prior studies report substantial heterogeneity in the distribution of hepatic fibrosis stages which may be due to the differing diagnostic thresholds and staging criteria across investigations.²⁰

Different studies often rely on a range of non-invasive tools and, less commonly, invasive methods to stage liver fibrosis, which can lead to variation in reported findings.^{20,21} Besides CAP-based assessment, commonly used approaches include transient elastography (FibroScan) with liver stiffness measurements, serum biomarker panels, and proprietary tests like FibroTest. Imaging techniques are also employed for more precise evaluation. In

some settings, liver biopsy remains the reference standard for definitive staging, although it is less frequently used due to its invasive nature.¹⁹

In this study, a smaller proportion of NAFLD patients showed moderate fibrosis compared to studies that used lower cutoff values, but it was higher than findings from studies that applied similar cutoff thresholds.¹⁵

Contrary to our findings, many studies have reported a strong association between increasing age and higher fibrosis scores (kPa), whereas our study did not observe a significant relationship between age and advanced fibrosis.⁹ Nonetheless, some studies have reported that diabetics have a higher incidence of liver fibrosis irrespective of age.^{3,6} This is consistent with our study.

Consistent with our findings, another study also found no significant association regarding gender.

CONCLUSION

Early preventive measures should be taken for diabetics who can develop metabolic associated steatosis of liver

DECLARATION OF INTEREST: The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS:

A.I.: Data collection, data analysis, literature review, write-up and references

A.G.: Conceptualization, proofreading, and final editing of manuscript

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