FREQUENCY OF METABOLIC DYSFUNCTION-ASSOCIATED STEATOTIC LIVER DISEASE (MASLD) IN PATIENTS WITH METABOLIC SYNDROME

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Abstract

Background: *Metabolic syndrome (MetS) is characterized by several lipid and non-lipid factors that collectively contribute to an increased susceptibility to cardiovascular disease.*

Nonalcoholic fatty liver disease (NAFLD) is common in metabolic syndrome and burgeoning health concern on a global scale and is a contributor to the development of chronic liver disease,

Objective: *To determine the frequency of metabolic dysfunction-associated steatotic liver disease (MASLD) in patients with metabolic syndrome (MetS)*

Material & Methods: *This was cross sectional study, conducted from 10 August, 2024 to 28 February, 2025, on 149 cases of metabolic syndrome. All the patients would undergo treatment for MetS according to the standard guidelines of management. Presence of MASLD was labeled as per operational definition. Confidentiality of the data was ensured.*

Results: *The study was conducted on 149 cases with metabolic syndrome. In our study, mean age was 47.99 ±4.84 years, mean FBS was 147.83±70.29 mg/dL, mean HbA1c 7.04±1.56%, mean TG level was 204.97±91.50 mg/dL and mean BMI was 28.83±2.86 kg/m2.*

Mean waist in males was 97.59±4.84 cm and in females was 92.66±6.53 cm. Mean HDL in males was 43.25±5.99 mg/dL and in females was 45.77±5.40 mg/dL. Among all 149 cases, 88 (59.1%) cases were male and 61 (40.9%) cases were female, 89 (59.7%) cases had diabetes and 92 (61.7%) cases were hypertensive.

Among all 149 cases of metabolic syndrome, 59 (39.6%) cases were diagnosed with MASLD.

Conclusion: *In our study, a significant number of cases with metabolic syndrome was also diagnosed with MASLD. So, the authors have concluded that MASLD is a common ongoing ailment in metabolic syndrome. Routine screening for MASLD should be considered as mandatory in workup of cases with metabolic syndrome.*

INTRODUCTION

Metabolic syndrome (MetS) is characterized by several lipid and non-lipid factors that collectively contribute to an increased susceptibility to cardiovascular disease. The risk factors encompassed within MetS have been subject to varying definitions. In accordance with the diagnostic criteria established by the National Cholesterol Education Program Expert Panel (NCEP) and Adult Treatment Panel III (ATP III), metabolic syndrome encompasses abdominal obesity, elevated triglyceride levels, reduced levels of high-density lipoprotein (HDL) cholesterol, elevated blood glucose levels, and elevated blood pressure.[1]

The complexity of MetS lies in the interplay between these factors, which ultimately heighten the likelihood of developing cardiovascular complications.[2-3] Nonalcoholic fatty liver disease (NAFLD) is a burgeoning health concern on a global scale and is widely acknowledged as a primary contributor to the development of chronic liver disease, particularly in Western nations. Over the course of the past two decades, the prevalence of NAFLD has experienced a twofold escalation, indicative of its increasing impact on public health. It has been estimated that NAFLD affects approximately 25.2% of the global population.[4]

OBJECTIVE:

To determine the frequency of metabolic dysfunction-associated steatotic liver disease (MASLD) in patients with metabolic syndrome (MetS)

OPERATIONAL DEFINITIONS:

Metabolic Syndrome: According to the NCEP ATP III definition, metabolic syndrome is present if three or more of the following five criteria are met: waist circumference over 90 cm (men) or 80 cm (women) for people of Asia pacific region, blood pressure ≥130/85 mm Hg, fasting triglyceride (TG) level ≥150 mg/dl, fasting high density lipoprotein (HDL) cholesterol level less than 40 mg/dl (men) or 50 mg/dl (women) and fasting blood glucose ≥110 mg/dl [14].

Metabolic dysfunction-associated steatotic liver disease (MASLD): It was defined as hepatic steatosis seen on Ultrasound plus at least one of the following [13]:

• BMI ≥25kg/m2 or waste circumference > 94 cm in males and > 80 cm in females

• Fasting serum glucose ≥100mg/dl or HbA1c ≥ 5.7% or on treatment for type 2 diabetes

• Blood pressure ≥130/85mmHg or on treatment for hypertension

• Plasma triglycerides ≥150mg/dl or on lipid lowering treatment

• Plasma HDL-cholesterol ≤40/mg/dl in males and ≤50mg/dl in females or on lipid lowering treatment

MATERIALS AND METHODS:

Study Setting: Gastroenterology Department, Shaikh Zayed Hospital, Lahore.

Duration of Study: From 10 August, 2024 to 28 February, 2025

Study Design: Cross-sectional study

Sampling Technique: Non-probability consecutive sampling

Sample Size: The sample size of 149 patients is calculated using confidence levels as 95%, margin of error as 8% and prevalence of NAFLD as 45.2% in cases with MetS[12].

Inclusion Criteria:

Patient's age from 30-65 years of both genders presenting with metabolic syndrome (as per operational definition) to a tertiary care hospital.

Exclusion Criteria:

• Patients not willing to participate in the study

• Patients known to have chronic liver disease (shrunken liver with irregular margins on ultrasonically)

• Patients known to be alcoholic (determined on history and medical record)

• Patients known to have autoimmune hepatitis (determined on history and medical record)

• Patients known to have viral hepatitis (determined on history and medical record)

Data collection procedure:

After taking approval from hospital's Ethical Committee and an informed consent from patients, total 149 patients with MetS presenting to the OPD of Shaikh Zayed Hospital and fulfilling the selection criteria were included in the study. A pre-designed proforma was used to collect the information regarding *Physical parameters:* Height, weight, BMI, abdominal width, *Blood samples:* Fasting lipid profile (Cholesterol, Triglycerides, HDL), Fasting BSL, HbA1c, Albumin, ALT, AST, CBC, Anti-HCV Ab, HbsAg, and other special tests, if required and *Imaging:* Ultrasonography of abdomen. The results were collected and noted in the proforma by researcher himself. All the patients would undergo treatment for MetS according to the standard guidelines of management. Presence of MASLD was labeled as per operational definition. Confidentiality of the data was ensured.

Data analysis:

Data was entered and analyzed using SPSS v25.0. Numerical variable i.e. age was summarized as mean and standard deviation, while qualitative variables like gender and presence of NAFLD was presented in the form of frequency and percentages. Data was stratified for age, gender, BMI, diabetes (BSR >200 mg/dl) and hypertension (BP >140/90mmHg) of the patient. Chi-square test was applied to check statistical significance post-stratification and p-value ≤0.05 was used as statistically significant.

RESULTS AND TABLES:

The study was conducted on 149 cases with metabolic syndrome. In our study, mean age was 47.99 ±4.84 years, mean FBS was 147.83±70.29 mg/dL, mean HbA1c 7.04±1.56%, mean TG level was 204.97±91.50 mg/dL and mean BMI was 28.83±2.86 kg/m2. (Table # 01)

Mean waist in males was 97.59±4.84 cm and in females was 92.66±6.53 cm. Mean HDL in males was 43.25±5.99 mg/dL and in females was 45.77±5.40 mg/dL. (Table # 02)

Among all 149 cases, 88 (59.1%) cases were male and 61 (40.9%) cases were female, 89 (59.7%) cases had diabetes and 92 (61.7%) cases were hypertensive.

Among all 149 cases of metabolic syndrome, 59 (39.6%) cases were diagnosed with MASLD. (Table # 03)

Stratification of presence of MASLD in metabolic syndrome was done with regards to age groups (p=0.145), gender (p=0.61), diabetes (p=1.00) and hypertension (p=1.00). (Table # 04-07)

Table # 01: Means and standard deviation of Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	149	30.00	62.00	47.99	8.19
FBS (mg/dL)	149	70.00	385.00	147.83	70.29
HbA1c %	149	4.90	12.30	7.04	1.56
TGs (mg/dL)	149	125.00	645.00	204.97	91.50
HDL (mg/dL)	149	31.00	58.00	44.28	5.87
Waist (cm)	149	75.00	112.00	95.57	6.08
Height (m)	149	1.55	1.83	1.71	0.07
Weight (kg)	149	49.00	110.00	84.28	10.49
BMI	149	19.38	39.25	28.83	2.86

Table # 02: Means and standard deviation of Waist and HDL in males and females

Gender		N	Minimum	Maximum	Mean	Std. Deviation
Male	Waist (cm)	88	83.00	112.00	97.59	4.84
	HDL (mg/dL)	88	31.00	58.00	43.25	5.99
Female	Waist (cm)	61	75.00	111.00	92.66	6.53
	HDL (mg/dL)	61	33.00	57.00	45.77	5.40

Table # 03: Distribution of MASLD among study cases

MASLD		Frequency	Percent
	Yes	59	39.6
	No	90	60.4
	Total	149	100

Table # 04: Stratification of MASLD with regards to Age groups*

			MASLD		Total	
			Yes	No		
Age groups	Up to 40 years of age	Count	15	14	29	
		% within Age groups	51.7%	48.3%	100.0%	0.145
	41 years and above	Count	44	76	120	
		% within Age groups	36.7%	63.3%	100.0%	
Total		Count	59	90	149	
		% within Age groups	39.6%	60.4%	100.0%	

*There was no statistically significant difference in frequency of MASLD in both age group in Metabolic syndrome cases.

Table # 05: Stratification of MASLD with regards to Gender*

			MASLD		Total	
			Yes	No		
Gender	Male	Count	33	55	88	
		% within Gender	37.5%	62.5%	100.0%	
	Female	Count	26	35	61	0.61
		% within Gender	42.6%	57.4%	100.0%	
Total		Count	59	90	149	
		% within Gender	39.6%	60.4%	100.0%	

*There was no statistically significant difference in frequency of MASLD in both genders Metabolic syndrome cases.

Table # 06: Stratification of MASLD with regards to Diabetes*

			MASLD		Total	
			Yes	No		
Diabetes	Yes	Count	35	54	89	
		% within Diabetes	39.3%	60.7%	100.0%	
	No	Count	24	36	60	1.00
		% within Diabetes	40.0%	60.0%	100.0%	
Total		Count	59	90	149	
		% within Diabetes	39.6%	60.4%	100.0%	

*There was no statistically significant difference in frequency of MASLD in both diabetics and non-diabetics Metabolic syndrome cases.

Table # 07: Stratification of MASLD with regards to Hypertension*

			MASLD		Total	
			Yes	No		
Hypertension	Yes	Count	36	56	92	

		% within Hypertension	39.1%	60.9%	100.0%	
	No	Count	23	34	57	1.00
		% within Hypertension	40.4%	59.6%	100.0%	
Total		Count	59	90	149	
		% within Hypertension	39.6%	60.4%	100.0%	

*There was no statistically significant difference in frequency of MASLD in both hypertensive and non-hypertensive Metabolic syndrome cases.

DISCUSSION:

The prevalence of NAFLD in Asia has increased from 25.3 percent in 1999-2005 to 33.9 percent in 2012-2017 elucidating its rise in Eastern countries as well.[5] In the specific context of Pakistan, a study conducted in a hospital setting revealed the overall prevalence of NAFLD in 20-65 years old at an alarming 47 percent highlighting its significance within the population.[6] NAFLD can be considered as the hepatic representation of the metabolic syndrome.[7] The development of NAFLD is strongly associated with the metabolic syndrome as reflected by the fact that approximately 90% of the patients with NAFLD have more than one feature of metabolic syndrome and about 33% have three or more criteria.[8]

Furthermore, with the addition of each of the components of the metabolic syndrome the risk of steatosis increases exponentially. The presence of the metabolic syndrome is associated with a potentially progressive and severe liver disease.[8-9]

A study conducted by Roesch-Dietlen F et al. included 337 participants, who were divided into four groups: Normal Weight, Overweight, Obese, and Type 2 Diabetes patients. Individuals with a history of hepatitis or alcohol consumption were excluded. Among the participants, 53 cases (15.72%) showed signs of Nonalcoholic Fatty Liver Disease. The prevalence ranged from 7.14% to 7.76% in those with normal weight and overweight, 14.15% in obese individuals, and 28% in those with diabetes. Of all participants, 73.58% were female and 28.41% were male. The average age of the group was 48.11 years, with similar ages found in both normal weight and obese participants. The average age for those in the overweight group was 61.5 years, while diabetics had an average age of 56.42 years.[10] Our study was conducted on 149 cases with metabolic syndrome. In our study, mean age was 47.99 ±4.84 years. 88

(59.1%) cases were male and 61 (40.9%) cases were female, 89 (59.7%) cases had diabetes and 92 (61.7%) cases were hypertensive. Among all 149 cases of metabolic syndrome, 59 (39.6%) cases were diagnosed with MASLD.

A total of 385 participants with NAFLD were evaluated. Based on the NCEP-ATPIII criteria, 57.6% were diagnosed with metabolic syndrome, while at least one component of metabolic syndrome was present in 91.4% of those exhibiting radiologic signs of fatty liver. A higher proportion of NAFLD patients were male. The most frequently observed components of metabolic syndrome in these individuals were increased waist circumference, followed by low high-density lipoprotein (HDL) levels.[11] Vice versa in our study, a significant number of cases with metabolic syndrome was also diagnosed with MASLD. Majority of our metabolic syndrome cases were males and majority were also diabetic and hypertensive.

In a study conducted by Iftikhar R et al., 491 adult males diagnosed with metabolic syndrome (MetS) who visited the outpatient department of CMH Okara were included. Among them, 222 (45.2%) individuals with metabolic syndrome were diagnosed with fatty liver disease (MASLD). The mean BMI of the patients with metabolic syndrome was 26.1±0.89 kg/m².[12] Similarly in our study, 59 (39.6%) out of 149 cases of metabolic syndrome were diagnosed with MASLD. Mean BMI of our metabolic syndrome cases was 28.83±2.86 kg/m2.

Another observational and analytical study was conducted on patients attending both the OPD and inpatient departments of the Department of Medicine at G.G.S. Medical College and Hospital in Faridkot. The study included 100 patients diagnosed with metabolic syndrome according to the NCEP ATP III criteria. Like our study, ultrasonography was used to assess the presence of fatty liver. The findings revealed that 73% of patients with metabolic syndrome had fatty liver, compared to 38% in the control group, a difference that was statistically significant.[13] That percentage was much higher than

that of our study, where 59 (39.6%) out of 149 cases of metabolic syndrome were diagnosed with MASLD.

CONCLUSIONS:
In our study, a significant number of cases with metabolic syndrome was also diagnosed with MASLD. So, the authors have concluded that MASLD is a common ongoing ailment in metabolic syndrome. Routine screening for MASLD should be considered as mandatory in workup of cases with metabolic syndrome.

CONFLICT OF THE INTEREST:
There was no conflict of interest of any author involved in the study.

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