

# Metabolic Dysfunction-Associated Steatotic Liver Disease MASLD: Jordan's Perspective Based on Knowledge and Attitude Determinants

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**Purpose:** The most prevalent chronic liver disease in both developed and developing nations is Metabolic dysfunction-associated Steatotic Liver Disease (MASLD). The condition increases the risk of comorbidities and liver-related morbidity and mortality. The public's awareness and medical personnel's understanding are essential in creating countermeasures to stop the disease's spread; a positive attitude is essential for early screening. This study aimed to explore the knowledge and attitudes of Jordanians living in Amman toward MASLD to determine the public's awareness and medical personnel's understanding of the disease.

**Materials and Methods:** A cross-sectional study was conducted using an online self-administered questionnaire that included 5 items for knowledge and 8 for attitude. Demographic questions were also included to further examine how demographic factors affected knowledge and attitude.

**Results:** Among 906 responders, (63.4%) were females, and (36.6%) were males. The majority age group was 18–30 (56.2%). Only 49.5% had previous knowledge of MASLD, (44.6%) believed they were at risk of developing it. There is a statistical significance between age, gender, educational level, and having a good knowledge of MASLD and a positive attitude towards it ( $p < 0.05$ ).

**Conclusion:** Generally, Jordan's population has a fair knowledge of MASLD and a positive attitude towards it. Warranting more research into the reasons behind it, and more awareness campaigns.

**Keywords:** nonalcoholic fatty liver disease, NAFLD, MASLD, hepatic steatosis, liver health, patient education, public health awareness, medical literacy, Metabolic Dysfunction-Associated Steatotic Liver Disease

## Introduction

Non-alcoholic fatty liver disease (NAFLD), defined by the accumulation of fat in the liver in the absence of excessive amounts of alcohol, is one of the most common chronic liver diseases in the world.<sup>1</sup> NAFLD is a wide group of illnesses consisting of simple steatosis, steatosis with hepatitis, cirrhosis and hepatocellular carcinoma (HCC).<sup>2</sup> One in five adults worldwide have NAFLD, with prevalence higher in the Middle East and South America.<sup>3</sup> The primary cause of the rising prevalence of NAFLD around the world is the obesity epidemic.<sup>4</sup> The high incidence of NAFLD has significantly contributed to liver-related mortality and morbidity, and it is expected to be a significant factor in liver transplantation in the following years.<sup>5</sup>

The term NAFLD, which has been used to describe this condition for more than 20 years, has undergone significant nomenclature revisions. This stems from the absence of a well-defined pathophysiological framework and a long-standing discomfort with labels like “alcoholic” and “fatty” for the hepatic expression of a systemic metabolic disorder that is primarily associated with cardiovascular consequences. In this sense, the phrase “non-alcoholic” did not adequately describe the cause of the illness.<sup>6</sup> The new nomenclature was the result of a modified Delphi process led

by three large pan-national liver associations (EASL, AASLD, ALEH). The name chosen to replace NAFLD was metabolic dysfunction-associated steatotic liver disease (MASLD).<sup>7</sup>

Along with obesity, hyperlipidemia, and metabolic syndrome, diabetes mellitus (DM) is a recognized risk factor for MASLD.<sup>8</sup> MASLD was present in 34–94% of type 2 diabetes mellitus (T2DM) patients worldwide and 80.4% in Jordan.<sup>9,10</sup> High levels of hepatic fat fraction predisposing to MASLD are associated with higher blood pressure readings and an increased risk of hypertension.<sup>11</sup> It has also been linked to heart failure, renal dysfunction, myocardial remodeling, and alterations in arterial stiffness.<sup>12</sup> Additionally, a modest increase in low-density lipoprotein cholesterol has raised MASLD's prevalence significantly.<sup>13</sup> One of the most crucial steps in managing MASLD is lifestyle modification, including the level of physical activity, weight loss, and behavioral changes in eating habits.<sup>14</sup> A meta-analysis revealed that a Mediterranean diet (MD) could lower the risk of MASLD by 23%.<sup>15</sup> It is encompassed in MASLD treatment and management as well.<sup>17</sup> A more recent systematic review and meta-analysis carried by Del Bo' C et al<sup>16</sup> revealed the great potential of MD in enhancing the parameters of assessing MASLD severity, including liver function enzymes and fibrosis score. In addition, both liver stiffness and total cholesterol have decreased statistically significantly with the MD diet. Consequently, increasing population awareness of MASLD is crucial for disease prevention.

In 2020, Younossi et al<sup>17</sup> assessed knowledge and associated factors among physicians of different specialties globally, where knowledge surveys covering the epidemiology/pathogenesis, diagnostics, and treatment of MASLD were completed electronically by hepatologists, gastroenterologists, endocrinologists, and primary care physicians from 40 countries over 2 years. It found that only 42.7% and 66.2% of primary care physicians and endocrinologists, respectively, correctly identified pathologic criteria for MASLD diagnosis. Compared with 70.9% and 79.5% of gastroenterologists and hepatologists, respectively, who could correctly identify pathologic criteria for MASLD diagnosis. The research concluded the presence of a global significant knowledge gap in the identification, diagnosis, and management of MASLD. There has yet to be research on public awareness of MASLD among the Jordanian population despite the increasing burden of this disease worldwide, including in Jordan, especially with the high prevalence of obesity and DM in Jordan. Knowledge and attitudes are essential components in creating strategies for preventing and treating MASLD. In our cross-sectional study, we aimed to assess the Jordanian's knowledge and attitude toward MASLD.

## Material and Methods

### Study Design and Population

This study was carried out using online survey items that were developed by the researchers based on the most relevant information needed to categorize the participants into different knowledge levels and attitude patterns. In this national cross-sectional study, a link to an online self-administered questionnaire was shared with Jordanians through social media platforms and in-person interactions. All Jordanians were eligible for participation in this study, except those under 18 years old.

The Total Number of responses submitted through social media platforms and in-person interactions from the 17th of October to the 14th of December 2022 was 906, recruited through convenience sampling.

### Questionnaire

Eight different co-authors selected the survey items that were subsequently reviewed and approved by the senior author who had eight years of experience in Hepatology and Gastroenterology at the time. This was followed by a check of both logical and content validity in accordance with the study objectives. Subsequently, the questionnaire was translated and presented in two languages (Arabic and English) to ease the comprehension of the survey responders. Then a pilot test with 25 responses was conducted to assess the questionnaire's internal readability and validity. The value of Cronbach's alpha for the knowledge subscale was 0.5 while for the attitude subscale was 0.078 values. The value of the overall scale was 0.773. Higher scores in the knowledge and attitude domains indicated a favorable response, meaning knowledgeable and expressing a positive attitude.

The first domain collected socioeconomic characteristics including age, gender, monthly income, level of education, profession, alcohol consumption, and history of chronic illness. In addition to two other question items relating to whether being diagnosed with MASLD or having family members with MASLD.

The second domain assessing knowledge, included five items and the answer options for four of them were either “Yes” and “No”. The items aimed to determine whether respondents had heard about MASLD before, its high prevalence, dangerous complications, and associated risks with certain diets. The last item was included with multiple checkbox answers to explore responders’ impressions of their risk of developing MASLD, which encompassed obesity, diabetes, smoking, alcohol consumption, and genetics as risk factors. The option “Yes” denotes the correct response, while the option “No” denotes an incorrect response, and the risk factors were grouped together for assessment. Those who correctly answered four items or more were deemed to have “good knowledge”, whereas those who answered correctly on three items, two items, or below were deemed to have “fair knowledge” and “poor knowledge”, respectively.

The third and final question domain included eight items structured to evaluate the attitude pattern, and the options for all items were “Yes” and “No”. Starting with a question on their stance on undergoing medical screening for MASLD, Obesity, hypertension, and dyslipidemia as contributors to MASLD spread. Also, items were included to check their attitude towards exercise’s role in preventing MASLD, and the possible risks of cirrhosis and cancer development associated with MASLD. If respondents correctly answered six or more items, they were considered to have a “Positive attitude”, while those who answered correctly between four and five items were considered to have a “Satisfactory attitude.” Finally, respondents who answered three items or fewer correctly were deemed to have a “Negative attitude” toward MASLD.

## Statistical Analysis

The information was taken from Google Forms and converted to an Excel spreadsheet before being entered into the Statistical Package for Social Sciences (SPSS) version<sup>18</sup>. Descriptive analysis was used to display categorical variables as percentages and frequencies while presenting numerical variables as a mean and standard deviation to evaluate the data quantitatively. Normality was tested using the Shapiro–Wilk test. The Mann–Whitney *U*-test was conducted to assess potential differences in means among variables. A *p*-value of less than 0.05 was considered statistically significant.

## Ethical Approval

The Institutional Review Board (IRB) in the University of Jordan and its Hospital has examined and authorized the conduct of this study with the scientific committee approval number: (IRB/JUH/787.212.2023). Additionally, this study was conducted in accordance with the Declaration of Helsinki. The questionnaire began with a brief explanation of the study’s objectives, and participants were asked to submit and agree to a consent declaration. At all times, confidentiality was preserved.

## Results

### Demographic Characteristic

A total of 906 participants completed the questionnaire. Among these, 509 respondents (56.2%) fell within the age range of eighteen to thirty. Female participants comprised 574 individuals, accounting for 63.4% of the total. Only 320 participants (35.3%) were either studying or employed in medical fields. Furthermore, 565 respondents (62.4%) reported having a monthly income of less than 750 JDs. Lastly, 685 participants (75.6%) reported possessing a bachelor’s degree or higher. [Table 1.](#) demonstrated the participants’ demographic.

### Participants’ Medical Profile

A total of 180 participants reported a history of chronic illnesses, accounting for 19.9% of the respondents. Only twenty-two participants had a history of MASLD, representing 2.4% of the total. Additionally, sixty-five participants reported having family members with MASLD, which constituted 7.2% of the total. Finally, 136 respondents reported consuming alcohol, making up 15.0% of the sample. [Table 2.](#) demonstrates participants’ medical profiles.

**Table 1** Respondents Demographics

Item	Frequency n(%)
<b>Age</b>	
18–30	509 (56.2%)
>30	397 (43.8%)
<b>Sex</b>	
Female	574 (63.4%)
Male	332 (36.6%)
<b>Monthly income</b>	
<750 JD	565 (62.4%)
>750 JD	341 (37.6%)
<b>Education level</b>	
Bachelor's degree or higher	685 (75.6%)
Primary, secondary, and college	221 (24.4%)

**Abbreviation:** JD, Jordanian Dinar.

**Table 2** Respondents Medical Profile

Item	Frequency n(%)
<b>History of chronic disease</b>	
Medically free	726 (80.1%)
Having history of chronic illness	180 (19.9%)
<b>History of NAFLD</b>	
Yes	22 (2.4%)
No	884 (97.6%)
<b>Family members with NAFLD</b>	
Yes	65 (7.2%)
No	841 (92.8%)
<b>Alcohol consumption</b>	
Yes	136 (15.0%)
No	770 (85.0%)

## Knowledge and Attitude Toward MASLD Among Participants

The mean score for total knowledge was  $3.17 \pm 1.24$  (Mean  $\pm$  SD) while for attitude was  $6.41 \pm 1.65$  (Mean  $\pm$  SD). [Table 3](#) demonstrates the mean and median for total knowledge and attitude scores.

Regarding age groups, a statistically significant difference emerged. Participants aged 18–30 exhibited higher mean scores in both knowledge (Mean  $\pm$  SD:  $3.27 \pm 1.17$ ) and attitudes (Mean  $\pm$  SD:  $6.60 \pm 1.62$ ) compared to those above 30 years (Knowledge: Mean  $\pm$  SD:  $3.05 \pm 1.32$ , Attitude: Mean  $\pm$  SD:  $6.17 \pm 1.66$ ), with p-values of 0.018 and <0.001, respectively. Gender-wise analysis revealed a noteworthy difference in attitudes, with female respondents (Mean  $\pm$  SD:  $6.52 \pm 1.59$ ) scoring higher than their male counterparts (Mean  $\pm$  SD:  $6.23 \pm 1.75$ ), with a p-value of 0.02.

Monthly income proved to be another factor influencing knowledge, as participants with incomes exceeding 750 JDs exhibited a significantly higher mean knowledge score (Mean  $\pm$  SD:  $3.30 \pm 1.30$ ) compared to those with incomes below 750 JDs (Mean  $\pm$  SD:  $3.10 \pm 1.20$ ), with a p-value of 0.01. In terms of medical background, participants affiliated with

**Table 3** Knowledge and Attitude of Respondents

Item	Mean $\pm$ SD	Median (Q1–Q3)
Knowledge (out of 5)	$3.17 \pm 1.24$	3 (2–4)
Attitude (out of 8)	$6.41 \pm 1.65$	7 (6–8)

medical fields, whether through study or employment, obtained significantly higher scores in both knowledge (Mean  $\pm$  SD:  $3.79 \pm 1.02$ ) and attitudes (Mean  $\pm$  SD:  $6.80 \pm 1.49$ ) than those without such affiliations (Knowledge: Mean  $\pm$  SD:  $2.83 \pm 1.22$ , Attitude: Mean  $\pm$  SD:  $6.20 \pm 1.70$ ), with p-values  $<0.001$ . Considering medical history, participants with a history of chronic illnesses demonstrated a significantly higher knowledge score (Mean  $\pm$  SD:  $3.40 \pm 1.26$ ) compared to medically free respondents (Mean  $\pm$  SD:  $3.11 \pm 1.23$ ), with a p-value  $<0.01$ . Conversely, those without chronic illnesses had a higher mean attitude score (Mean  $\pm$  SD:  $6.48 \pm 1.60$ ) than those with such a medical history (Mean  $\pm$  SD:  $6.14 \pm 1.81$ ), with a p-value of 0.02.

Lastly, participants with a history of MASLD or family members with MASLD showed significantly higher knowledge scores (History of MASLD: Mean  $\pm$  SD:  $4.59 \pm 0.67$ , Family members with MASLD: Mean  $\pm$  SD:  $4.26 \pm 0.94$ ) compared to those without such associations (No history: Mean  $\pm$  SD:  $3.14 \pm 1.23$ , No family members: Mean  $\pm$  SD:  $3.09 \pm 1.22$ ), with p-values  $<0.001$  in both cases. Table 4. demonstrates the Mann–Whitney *U*-tests among participants' knowledge and attitude from one side and their demographic and medical profile from another side. Concerning the impressions of factors contributing to the high-risk category, a notable 235 respondents (33.0%) cited decreased exercise activity as the most reported factor. In contrast, genetics was reported as the least influential factor, with only 15 respondents (2.0%) mentioning it. Figure 1. demonstrated the impressions of being at high risk of NAFLD.

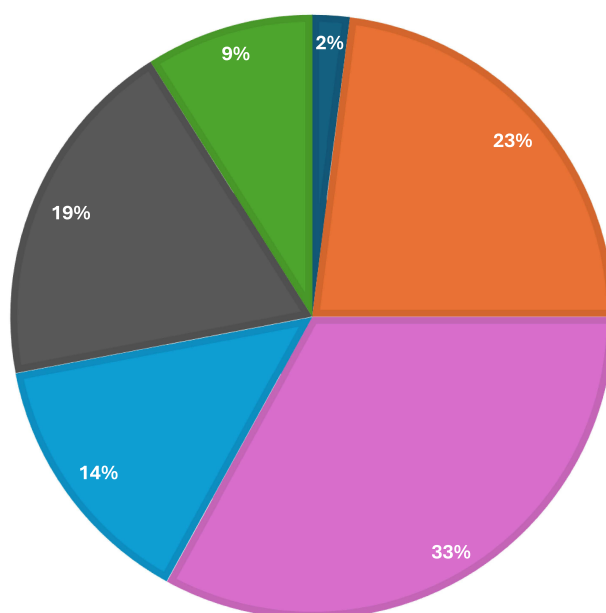
**Table 4** Mann–Whitney *U*-Tests Among Respondents' Knowledge and Attitude

Characteristics	Knowledge (out of 5)	P-value	Attitude (out of 8)	P-value
	Mean $\pm$ SD		Mean $\pm$ SD	
<b>Age</b>		<b>0.02</b>		<b>&lt;0.001</b>
18–30	3.27 $\pm$ 1.17		6.60 $\pm$ 6.17	
>30	3.05 $\pm$ 1.32		6.17 $\pm$ 1.66	
<b>Sex</b>		<b>0.83</b>		<b>0.02</b>
Female	3.18 $\pm$ 1.22		6.52 $\pm$ 1.59	
Male	3.15 $\pm$ 1.28		6.23 $\pm$ 1.75	
<b>Monthly income</b>		<b>0.01</b>		<b>0.70</b>
<750 JD	3.10 $\pm$ 1.20	336(27)	6.41 $\pm$ 1.63	
>750 JD	3.30 $\pm$ 1.30	92(23.2)	6.42 $\pm$ 1.69	
<b>Education level</b>		<b>0.90</b>		<b>0.40</b>
Bachelor's degree or higher	3.17 $\pm$ 1.25		6.44 $\pm$ 1.65	
Primary, secondary, and college	3.17 $\pm$ 1.23		6.34 $\pm$ 1.66	
<b>Studying or working in medical fields</b>		<b>&lt;0.001</b>		<b>&lt;0.001</b>
Yes	3.79 $\pm$ 1.02		6.80 $\pm$ 1.49	
No	2.83 $\pm$ 1.22		6.20 $\pm$ 1.70	
<b>History of Chronic disease</b>		<b>0.004</b>		<b>0.02</b>
Yes	3.40 $\pm$ 1.26		6.14 $\pm$ 1.81	
No	3.11 $\pm$ 1.23		6.48 $\pm$ 1.60	
<b>History of NAFLD</b>		<b>&lt;0.001</b>		<b>0.10</b>
Yes	4.59 $\pm$ 0.67		6.00 $\pm$ 1.60	
No	3.14 $\pm$ 1.23		6.42 $\pm$ 1.65	
<b>Family members with NAFLD</b>		<b>&lt;0.001</b>		<b>0.50</b>
Yes	4.26 $\pm$ 0.94		6.31 $\pm$ 1.70	
No	3.09 $\pm$ 1.22		6.42 $\pm$ 1.65	
<b>Alcohol consumption</b>		<b>0.996</b>		<b>0.28</b>
Yes	3.15 $\pm$ 1.26		6.24 $\pm$ 1.83	
No	3.17 $\pm$ 1.24		6.44 $\pm$ 1.61	

Abbreviation: JD, Jordanian Dinar.

## IMPRESSIONS OF NAFLD RISK FACTORS

■ Genetic ■ Obesity ■ Decreased exercise activity ■ Diabetes ■ Smoking ■ Alcohol consumption



**Figure 1** Impressions of MASLD Risk Factors.

## Discussion

This study aimed to explore and provide valuable insights into the knowledge and attitudes of Jordanians toward MASLD. Overall, the study found that respondents generally displayed fair knowledge and a positive attitude. However, younger age groups tended to perform better. Although a significant number of respondents held a bachelor's degree or higher, this was unexpectedly not associated with more favorable survey responses. On the other hand, monthly income showed a significant association with the perception of MASLD. The study also examined the knowledge and attitudes of participants currently studying or employed in medical fields. While they demonstrated substantially better awareness of MASLD, their knowledge and understanding of the disease were deemed only satisfactory.

These findings are concerning, as MASLD is a growing public health concern in Jordan and regionally.<sup>3,19</sup> Obesity, a major risk factor for MASLD, is a chronic disease leading to many other noncommunicable chronic diseases, and its prevalence is rising in the Middle East.<sup>20–22</sup> Several factors contribute to the increasing prevalence of obesity, including the excess intake of high-calorie food, insufficient physical activity, and a sedentary lifestyle characterized by prolonged periods of sitting.<sup>23–25</sup> Additionally, with the fast pace of modern life, people have less time for meals. However, few studies have examined the association between the habit of fast eating and metabolic diseases and concluded frequent fast eating is associated with an increased risk of MASLD.<sup>26</sup>

The lack of proper awareness of the condition and its risk factors can lead to delayed diagnosis, inadequate treatment, and poor health outcomes. These results have important implications for healthcare providers in Jordan and suggest a need for targeted education and presentations to increase knowledge and awareness of MASLD among medical professionals. By improving their knowledge and understanding, there is potential for better identification and management of the disease, ultimately leading to improved outcomes in the community.

In terms of attitudes towards MASLD, our study found that most participants viewed MASLD as a serious health problem, which is a positive finding. However, a significant proportion of participants believed that the prevalence of MASLD is not high in Jordan, while a similar proportion expressed concern about being at risk of developing the condition. The study included a large and diverse sample of participants from Jordan. Data were collected on various



factors related to MASLD, including demographic information, lifestyle behaviors, and medical history, which allowed for a comprehensive analysis of the risk factors associated with MASLD in the Jordanian population. It also provides insights into the knowledge and attitudes of medical personnel, serving as a starting point for further research on MASLD in Jordan and potentially informing future studies in this area.

In Saudi Arabia, Alamri et al<sup>27</sup> assessed the perception of the Taif population regarding MASLD based on knowledge and attitude determinants, using a validated self-administered questionnaire to collect data for the study from 454 participants, it was found that the number of participants who had family members with MASLD had a significantly higher level of knowledge. The vast majority of those polled in this study had a favorable or satisfactory attitude toward MASLD. The age group of 31–40 years showed a significantly ( $P=0.048$ ) higher proportion of participants with a positive attitude when compared to other age groups. It is also important to note that females with good knowledge and positive attitudes toward MASLD outnumbered male participants. The authors concluded that Taif residents have less knowledge of MASLD, but their attitude is encouraging.

Our study also found that participants who were aware of MASLD and its risk factors displayed encouraging attitudes toward adopting health-promoting behaviors, such as regular exercise and healthy eating. Aerobic exercise lasting for more than 4 weeks has been shown to reduce weight and liver fat.<sup>18</sup> Therefore, gaps in knowledge represent missed opportunities to prevent the onset of MASLD through lifestyle interventions. Public health campaigns focused on educating the population about healthy eating habits, regular physical activity, and reducing risk factors like obesity could effectively reduce the incidence of MASLD. This suggests that increasing knowledge and awareness of MASLD could positively impact health behaviors and outcomes.

Finally, the new nomenclature of MASLD was not agreed upon and published yet at the time of survey data collection. However, the available data on NAFLD can still be widely used for MASLD as demonstrated in the literature by Song et al.<sup>28</sup>

## Conclusion

The study sheds light on the prevalent knowledge deficit regarding Non-Alcoholic Fatty Liver Disease (recently named MASLD) among the Jordanian population, highlighting the need for targeted educational initiatives. Several factors appear to contribute to this knowledge deficit. Age, for instance, plays a significant role, with younger participants exhibiting lower levels of awareness. Income levels also influence knowledge, as those with higher incomes demonstrate a better understanding of MASLD. Furthermore, individuals without a medical background show lower awareness, emphasizing the potential impact of educational background on knowledge levels. Interestingly, despite a notable proportion of respondents holding bachelor's degrees or higher, this study unexpectedly found that higher education was not consistently associated with improved knowledge outcomes. Gaps in public knowledge and perception may also hinder the development of effective health policies. If MASLD is not widely recognized as a significant public health threat, there may be insufficient efforts and policies for MASLD-specific initiatives. Additional investigations could delve into the efficacy of current educational strategies, cultural perceptions surrounding liver health, and the accessibility of information. While the study does not explicitly identify the specific reasons for the knowledge deficit in younger individuals with higher educational backgrounds, several potential factors could contribute to this phenomenon. One possible explanation may be a lack of targeted educational programs addressing MASLD in academic curricula, resulting in a gap in knowledge acquisition despite formal education. Additionally, younger individuals might be less exposed to health-related information or preventive measures due to a perception of lower susceptibility to health issues. Cultural or lifestyle factors may also play a role in influencing the prioritization of health education. Understanding these factors can inform the development of tailored awareness campaigns, bridging the knowledge gap and fostering a more informed and proactive approach towards preventing and managing MASLD in Jordan.

This study is the first of its kind in Jordan; the results necessitate further investigations into reasons contributing to the knowledge deficit in MASLD. The reliance on an online survey might have introduced selection bias, as it may not capture the views of a less tech-savvy or older population. A separate study for both individuals in the medical field and outside of it is advised. Awareness campaigns aimed at MASLD are recommended to increase public knowledge and further enhance attitudes toward it.

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## Disclosure

The author(s) report no conflicts of interest in this work.

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