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# The prevalence of metabolic syndrome in patients with non-alcoholic fatty liver disease in Erbil city

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## Abstract

**Background and objectives:** Non-alcoholic fatty liver disease is the accumulation of fatty units in the liver in the absence of other triggers. Its development may have been primarily caused by metabolic syndrome, so the purpose of this study is to identify the prevalence of metabolic syndrome in non-alcoholic fatty liver disease and then to discover which parameter has the strongest link with non-alcoholic fatty liver disease.

**Methods:** This cross-sectional study of 90 participants more than 18 years old with non-alcoholic fatty liver disease diagnosed by sonography in Erbil from August 2022 to May 2023. In each individual, metabolic syndrome criteria were taken and measured according to the National Cholesterol Education Program's Adult Treatment Panel III criteria, which were diagnosed by having three or more of these criteria, and ultrasound was used for the grading of fatty liver.

**Results:** Metabolic syndrome were revealed in 69 (76.67%) of the participants. A higher proportion of patients were female 51 (56.67%) and male 39 (43.33%). It revealed a statistically significant correlation between gender and metabolic syndrome, with females and males having a corresponding 44 (49%) and 25 (28%) correlation, respectively. The most frequent factor was an expanded waist circumference in 66 (73.33%) of participants, followed by triglyceride in 62 (68.89%).

**Conclusion:** In this study, among patients with non-alcoholic fatty liver disease significant number of the subjects had metabolic syndrome, with an increased waist circumference being the most prevalent feature, followed by high triglyceride levels, hyperglycemia, hypertension, and low high-density lipoprotein.

**Keywords:** Metabolic syndrome, Non-alcoholic fatty liver disease.

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## Introduction

Non-alcoholic fatty liver disease (NAFLD) refers to the buildup of disproportionate triglyceride droplets in the liver of individuals who consume little or no alcohol.[1] Non-alcoholic fatty liver disease is a multisystem illness that affects many extra-hepatic organs, and the majority of patients also develop other illnesses like diabetes mellitus and cardiovascular disease. As a result, the cause of mortality is not a liver-related disease but rather the dysfunction of other extra-hepatic organs.[2] High-calorie meals and a sedentary lifestyle have been associated with the onset and advancement of NAFLD, as well as its progression into non-alcoholic steatohepatitis (NASH), which is characterized by inflammation, fibrosis, and eventually cirrhosis. Patients with NASH have a much higher death rate.[3] Currently, NAFLD is the most prevalent liver disorder in most patients,[4] it is asymptomatic and is diagnosed incidentally, either by mildly elevated liver enzymes or abdominal ultrasound.[5] It appears to be more common among patients with type 2 diabetes mellitus and obesity than in the general population.[6] There are currently no approved pharmacological treatments specifically; now the interventions mainly concentrate on lifestyle changes like dietary changes, weight loss, and physical exercise.[7] Although bariatric surgery has not been investigated prospectively specifically as a treatment for NASH, indirect evidence suggests it is effective at improving the histological features of NASH, including fibrosis. Medication choices, including vitamin E, pioglitazone, and pentoxifylline, are now recommended, especially for overweight patients.[8] The main principal risk factor for NAFLD is metabolic syndrome (MetS), which is primarily associated with insulin resistance due to abnormal adipose deposition and function. It consists of multiple risk factors for coronary heart disease, diabetes, and a fatty liver.[9] The components of the metabolic syndrome are hypertension,hypertriglyceridemia,hypergly cemia, low high-density lipoprotein, and abdominal obesity.[10] The dominance of MetS ranges from 40% to 70% in individuals with NAFLD across various studies.[11] Various epidemiological analyses have specified the probable correlation between NAFLD and MetS, which is currently thought to be a hepatic manifestation of MetS.[12] The purpose of this study is to identify the predominance of metabolic syndrome in non-alcoholic fatty liver disease and to discover which parameter has the strongest link.

## Patients and methods

This is a cross-sectional study included ninety patients in outpatient internal medicine departments in Erbil Teaching Hospital, Erbil City, Iraq, from August 2022 to May 2023. Exclusion criteria were age under 18 years, alcohol intake of more than 30 grams per day for men and more than 20 grams per day for women, jaundice, HBsAg positivity, hepatitis C antibody positivity, primary biliary cholangitis, autoimmune hepatitis, Wilson disease, and history of taking medications that cause fatty liver. (NCEP-ATPIII) criteria were used to determine if MetS was present, as shown in Table (1). The existence of three or more of the characteristics was referred to as MetS .[13]

**Table (1):** Measures of metabolic syndrome

| Variables | NCEP/ATP- III criteria |
|---|---|
| Abdominal obesity | Waist circumference>102 cm in men and >88 cm in women |
| Hyperglycemia | FBS≥110 mg/dl |
| Hypertension | SBP/DBP≥130/85 |
| Hypertriglyceridemia | TG≥150 mg/dl |
| Low HDL-C level | <40 mg/dl in men and <50 mg/dl in women |

Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters.[14] A BMI of equal or more than 25 categorized as overweight in our study. Areas



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of hyper echogenicity on ultrasonography were used. Following are grades for the degree of echogenicity: grade 1: slight increase in fine echoes; grade 2: moderate increase in fine echoes; grade 3: diffuse increase in fine echoes with non-visualization of the intrahepatic vessel borders.[15] The data was analyzed using IBM SPSS Statistics version 26, which included both descriptive and inferential statistics. A P-value of $\leq 0.05$ was also declared statistically significant. The Pearson Chi-Square was also employed to determine the significance of relationships between independent and dependent variable pairs. The Scientific Ethical Committee of the Kurdistan Higher Council of Medicine Specialty (KHCMS) provided its approval for this study. Each participant offered an informed written consent, and confidentiality was obtained.

## Results

This study included 90 individuals with a mean age of 48.22 ± 11.27 years, and the most prevalent age group was 40–49, accounting for 32.22% of all participants. Women outnumbered men, with 39 men (43.33%) and 51 women (56.67%). The majority of them (83.3%) were married, (73.33%) lived in cities, (44.44%) were illiterate, and (37%) were housewife. A BMI of greater than 25 was identified in (98.89%) of participants, indicating that obesity is a major determinant in the development of fatty liver. The characteristics of the participants are provided in Table (2).

**Table (2):** The frequency and proportion of research variables' descriptive characteristics

| Gender | Frequency | Percent |
|---|---|---|
| Male | 39 | 43.33 |
| Female | 51 | 56.67 |
| Urban | 66 | 73.33 |
| Rural | 24 | 26.66 |
| Illiterate | 40 | 44.44 |
| Primary | 20 | 22.22 |
| Secondary | 19 | 21.12 |
| University | 11 | 12.22 |
| Housewife | 33 | 37 |
| Teachers | 11 | 12 |
| Taxi driver | 7 | 8 |
| Other occupations | 39 | 43 |
| Smoker | 38 | 42.22 |
| Non smoker | 52 | 57.78 |
| Married | 75 | 83.33 |
| Not Married | 15 | 16.67 |
| BMI/ normal | 1 | 1.11 |
| Overweight | 89 | 98.89 |
| Hypertension | 35 | 38.89 |
| Diabetes mellitus | 29 | 32.22 |
| Ischemic heart disease | 5 | 5.56 |
| Heart failure | 2 | 2.22 |

The mean for waist circumference was 102.1 ± 8.68 cm, triglyceride was251.74 ± 191.85, FBS was 145.81 ± 68.26, HDL was 45.24 ± 12.73, and systolic/diastolic blood pressure were 128.17 ± 15.06/80.67 ± 6.46, Table (3).

**Table (3):** The standard deviation of participants variables

| Variables | Mean ± SD | Range |
|---|---|---|
| Age (year) | 48.22 ± 11.27 | 21 to 82 |
| Height (cm) | 165 ± 7.56 | 153 to 183 |
| Weight (kg) | 87.91 ± 9.8 | 60 to 110 |
| Body Mass Index | 32.42 ± 4.2 | 24.03 to 44.06 |
| Waist circumference (cm) | 102.1 ± 8.68 | 80 to 128 |
| Systolic blood pressure (mmHg) | 128.17 ± 15.06 | 110 to 160 |
| Diastolic blood pressure (mmHg) | 80.67 ± 6.46 | 60 to 100 |
| Triglyceride (TG) | 251.74 ± 191.85 | 63 to 1095 |
| FBS | 145.81 ± 68.26 | 67 to 401 |
| High density lipoprotein (HDL) | 45.24 ± 12.73 | 28 to 57 |



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Grade one fatty liver was the commonest among all three grades; it was in 56% of participants, followed by grade two, which was in 42%, and grade three, which was in only 2% of participants. MetS was identified in 76.67% of subjects. Males and females had a statistically significant variation: 49% of females had MetS, while only 28% of males had MetS, with a P-value of 0.014, Figure (1).

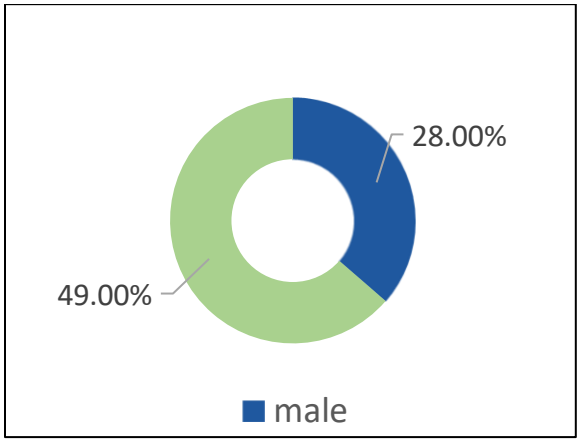


**Figure (1):** Association between Gender and Metabolic Syndrome

Among the criteria examined, waist circumference was the most commonly observed criterion, present in (73.33%). High TG was found in (68.89%), hyperglycemia in (67.78%), hypertension in (65.56%), and low HDL in (64.44%), Figure (2).

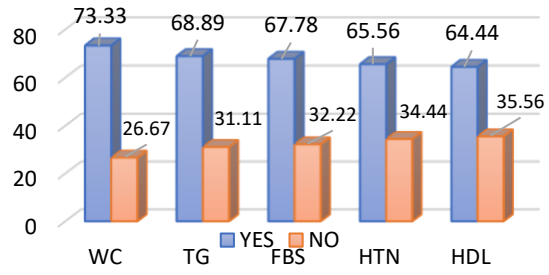


**Figure (2):** The percentage of participants with various MetS criteria

The correlation of grades by ultrasound and Metabolic Syndrome Criteria was discovered to be not significant. MetS was discovered in 39% of patients with grade 1 fatty liver, 37% with grade 2, and 1% with grade 3. There was no variation (P > 0.05) among BP, TG, HDL, FBS, and WC with various degrees of fatty liver. There was an uncritical relationship between MetS and fatty liver grade (P > 0.05). It revealed a statistically negligible relationship between gender and grades of fatty liver in the U/S.

## Discussion

In this study, ninety participants were analyzed, and the predominance of metabolic syndrome was estimated to be 76.67%. In population-based research, the prevalence was found to be 67%.[16] A study about the prevalence of MetS was conducted on Iraqi patients, and the result was 79% of MetS patients had NAFLD.[17] It has been observed that nearly 90% exhibit more than one feature. Additionally, approximately 33% meet the criteria for three or more components.[18] Individual components have been related to a higher probability of getting steatosis. The prevalence can vary between studies due to several reasons, including the characteristics of the population studied and the diagnostic criteria utilized. Research conducted in Karbala, Iraq, discovered that the greatest percentage of patients were between the ages of 40 and 49.[19] Which is similar to our study, implying that individuals in this age group had a higher prevalence of NAFLD than other age groups.[20] In another study, it was observed that 66% of males and 65% of females met the criteria. These findings suggest a high prevalence of MetS among individuals, regardless of gender, similar to research in Australia that stated a greater predominance of MetS in men than women while in our study, [21] it was observed that the proportion of females was higher than males, with 49% of females and 28% of males, may be attributed to various factors, including the sociodemographic characteristics, lifestyle patterns of the study population, and because most of the women



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in this study were unemployed and predominantly engaged in household activities with low physical activity levels, this could contribute to higher rates of obesity and the development of other components of MetS. Sedentary lifestyles and reduced physical activity are known risk factors for metabolic syndrome, as they can lead to weight gain, insulin resistance, and dyslipidemia. It was found that 80% of patients with NAFLD were overweight, this finding suggests a strong association between NAFLD and excess body weight, and in our study, almost all the participants had a high BMI (98.89%); that difference may be because most of our middle-aged population is overweight and has a sedentary lifestyle. In a study conducted in Mosul, Iraq, the result was the high prevalence rate of NAFLD among the obese (68%).[22] A case control study performed in Sulaymaniyah showed that people with NAFLD had higher mean serum TG, LDL, and cholesterol levels and lower mean HDL values than those without NAFLD. Compared to the control group, there was a statistically significant difference in the lipid profile and NAFLD cases.[23] In descriptive research, it was discovered that increasing waist circumference, and low high density lipoprotein values, were the most predominant factors.[24] According to a report, the prevalence was 29.9%, with elevated TG levels and high blood pressure being the most prevalent risk factors while in our study, [25] the waist circumference was the highest, followed by a high TG. Research in the United States, found that the most prevalent feature was an increased waist circumference, which aligns with the findings of this study.[26] Our study has various limitations that should be noted. First and foremost, the total number of participants was limited. primarily due to the constraints of limited time and resources in a governmental hospital setting. This small sample size may affect the generalizability of our findings to a larger population. Furthermore, it would be reasonable if we could conduct another study that compares a control group of patients with no NAFLD with a NAFLD group.

## Conclusion

This study discovered that the vast majority of NAFLD patients had MetS, with increased waist circumference being the most prevalent factor, followed by high TG levels, hypertension, hyperglycemia, and low HDL. Female participants had a higher percentage of metabolic syndrome than male participants, which was statistically significant.

## Recommendations:

To obtain a more comprehensive understanding of the association and prevalence of MetS in NAFLD within our specific region, it is indeed essential to conduct a larger study population. which can potentially help prevent patients from developing further complications associated with MetS.

## Conflict of interest:

The authors confirm that they are free of any conflicts of interest.

## References

1. Chalasani N, Younossi Z, Lavine JE, Charlton M, Cusi K, Rinella M, et al. The diagnosis and management of nonalcoholic fatty liver disease: Practice guidance from the American Association for the Study of Liver Diseases. Hepatology. 2018;67(1):328–57.
2. Armstrong MJ, Adams LA, Canbay A, Syn WK. Extrahepatic complications of nonalcoholic fatty liver disease. Hepatology. 2014;59(3):1174–97.
3. Angulo P, Kleiner DE, Dam-Larsen S, Adams LA, Bjornsson ES, Charatcharoenwitthaya P, et al. Liver



https://doi.org/10.56056/amj.2024.299

Fibrosis, but No Other Histologic Features, Is Associated With Long-term Outcomes of Patients With Nonalcoholic Fatty Liver Disease. Gastroenterology. 2015;149(2):389-397.e10.
4. Farrell GC, Larter CZ. Nonalcoholic fatty liver disease: From steatosis to cirrhosis. Hepatology. 2006;43(S1):S99–112.
5. Heidelbauch J, Bruderly M. Cirrhosis and Chronic Liver Failure: Part I Diagnosis and evaluation. 2006; Available from: https://repositori.uji.es/xmlui/handle/10234/187818/
6. Byrne CD, Targher G. NAFLD: A multisystem disease. J Hepatol. 2015;62(1):S47–64.
7. Konerman MA, Jones JC, Harrison SA. Pharmacotherapy for NASH: Current and emerging. J Hepatol. 2018;68(2):362–75.
8. Rinella ME, Sanyal AJ. Management of NAFLD: a stage-based approach. Nat Rev Gastroenterol Hepatol. 2016;13(4):196–205.
9. Muzurović E, Mikhailidis DP, Mantzoros C. Non-alcoholic fatty liver disease, insulin resistance, metabolic syndrome and their association with vascular risk. Metabolism. 2021; 119:154770.
10. Dobrowolski P, Prejbisz A, Kuryłowicz A, Baska A, Burchardt P, Chlebus K, et al. Metabolic syndrome – a new definition and management guidelines. Arch Med Sci AMS. 2022;18(5):1133–56.
11. Fattahi MR, Niknam R, Safarpour A, Sepehrimanesh M, Lotfi M. The Prevalence of Metabolic Syndrome in Non-alcoholic Fatty Liver Disease; A Population-Based Study. Middle East J Dig Dis. 2016:131–7.
12. Katsiki N, Perez-Martinez P, Anagnostis P, Mikhailidis DP, Karagiannis A. Is Nonalcoholic Fatty Liver Disease Indeed the Hepatic Manifestation of Metabolic Syndrome Curr Vasc Pharmacol. 2018;16(3):219–27.
13. Adults NCEP. Evaluation, and Treatment of High Blood Cholesterol in. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (adult Treatment Panel III): Final Report. Available from: https://www.nhlbi.nih.gov/files/docs/resources/heart/atp-3-cholesterol-full-report.pdf/
14. Flegal KM, Kit BK, Orpana H, Graubard BI. Association of all-cause mortality with overweight and obesity using standard body mass index categories. JAMA. 2013;309(1):71–82.
15. Wall LB, Teefey SA, Middleton WD, Dahiya N, Steger-May K, Kim HM, et al. Diagnostic Performance and Reliability of Ultrasonography for Fatty Degeneration of the Rotator Cuff Muscles. J Bone Joint Surg Am. 2012;94(12):e83.
16. Golabi P, Otgonsuren M, de Avila L, Sayiner M, Rafiq N, Younossi ZM. Components of metabolic syndrome increase the risk of mortality in nonalcoholic fatty liver disease (NAFLD). Medicine (Baltimore). 2018;97(13): e0214.
17. Al-Bayati, Sabihah M; Sabbar, Rafid A. Prevalence of nonalcoholic fatty liver disease in type 2 diabetic Iraqi patients. Journal of the Arab Board of Health Specializations. 2018; 19(1): 11-8.



https://doi.org/10.56056/amj.2024.299

18. Marchesini G, Bugianesi E, Forlani G, Cerrelli F, Lenzi M, Manini R, et al. Nonalcoholic fatty liver, steatohepatitis, and the metabolic syndrome. Hepatology. 2003;37(4):917–23.
19. Qassam, S.A., Ahmed Z K., Nada, SZ. The role of biochemical markers in the assessment of Non-alcoholic fatty liver disease in young Iraqi people. I Iraq Med. J. 2019; *3*(2). Retrieved from https://iraqmedj.org/index.php/imj/article/view/638/
20. Bertolotti M, Lonardo A, Mussi C, Baldelli E, Pellegrini E, Ballestri S, et al. Nonalcoholic fatty liver disease and aging: Epidemiology to management. World J Gastroenterol WJG. 2014;20(39):14185–204.
21. Cameron AJ, Magliano DJ, Zimmet PZ, Welborn T, Shaw JE. The Metabolic Syndrome in Australia: Prevalence using four definitions. Diabetes Res Clin Pract. 2007 S;77(3):471–8.
22. Faris M, Al-Abachi K. Prevalence of Nonalcoholic Fatty Liver Diseases Among Obese Adults in Mosul City. Pak J Med Health Sci. 2021; 15:2711–5.
23. Talabani BK, Rasul HH. Determination of Risk Factors and their Association with Certain Laboratory Tests of Nonalcoholic Fatty Liver Individuals in Sulaimani City/Kurdistan Region of Iraq. Univ Thi-Qar J Med. 2022;24(2):1–13.
24. Paudel MS, Tiwari A, Mandal A, Shrestha B, Kafle P, Chaulagai B, et al. Metabolic Syndrome in Patients with Non-alcoholic Fatty Liver Disease: A Community Based Cross-sectional study. Cureus. 2019.
25. Zakerkish M, Assarzadeh A, Seyedian SS, Jahanshahi A. Prevalence of Metabolic Syndrome and Related Factors in Patients with Non-alcoholic Fatty Liver. Jundishapur J Chronic Dis Care. 2022;11(1).
26. Patton HM, Yates K, Unalp-Arida A, Behling CA, Huang TTK, Rosenthal P, et al. Association Between Metabolic Syndrome and Liver Histology Among Children with Nonalcoholic Fatty Liver Disease. Am J Gastroenterol. 2010;105(9):2093–102.



https://doi.org/10.56056/amj.2024.299