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Original Article

Non-alcoholic Fatty Liver Disease with Type 2 DM in Rural and Urban Areas in Bangladesh

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Abstract

Introduction: Non-alcoholic fatty liver disease (NAFLD) is a chronic liver condition that affects up to one-third of adults in developed nations. NAFLD refers to a group of non-alcoholic diseases that are histologically and clinically distinct. Fatty liver (NAFL, steatosis hepatitis) and steatohepatitis can lead to cirrhosis and rare cases of hepatocellular carcinoma.

Materials and Methods: This was a cross-sectional descriptive study conducted in the medicine department, Rajshahi medical college, Rajshahi, among ninety-one T2DM patients. The study population included outdoor patients as well as hospitalized consecutive 91 patients (50 Urban and 41 Rural) in the medicine department with type 2 DM diagnosed according to the American Diabetes Association (ADA) 2011 criteria. NAFLD was detected and graded using abdominal ultrasonography and blood pressure, BMI, waist circumference, HbA1c, lipid profile, and liver function tests. All data were analyzed by SPSS 16, and p-value <0.05 was assumed as statistically significant in this study.

Results: A total of 91 patients were enrolled during the study. NAFLD prevalence was higher in urban patients (54.54%) than in rural patients (45.45%). Males were affected more than female patients in both groups. Patients in the urban population had higher weight, waist circumference, hip circumference, and BMI and were diagnosed with NAFLD at a younger age than those in the rural group. Metabolic syndrome was shown to be prevalent in both groups.

Conclusion: The prevalence of NAFLD was shown to be greater in the urban population compared to the rural population, with male patients being more impacted than female patients. Although the risk factors for NAFLD were similar in both the study groups, better anthropometric parameters (lower weight), waist circumference, hip circumference, and BMI had a role in reduced prevalence of NAFLD in rural as compared to urban population patients.

Keywords: Non-Alcoholic, Fatty Liver Disease, Urban, Rural, BMI, DM.

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Introduction

Diabetes mellitus (DM) is one of the most common chronic non-communicable illnesses globally, posing significant public health and economic burden. The expense of managing DM in developed economies like the United States exceeds $100 billion each year.[1] It becomes much more problematic when it's related to Non-Alcoholic Fatty Liver Disease (NAFLD). NAFLD is "insulin resistance and hepatic fat accumulation

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in the absence of other identifiable causes of fat accumulation".[2] The proper NAFLD coexisting with DM diagnosis isn't yet accomplished, making the control plans challenging.[3] But for many years, NAFLD has gone unrecognized as the primary cause of liver disorders such as cirrhosis.[4] Patients developing cirrhosis from NAFLD are at approximately 75% risk of acquiring liver cancer.[5] The great challenge is that most patients do not manifest any overt signs and symptoms, and severe NAFLD can progress to liver failure.[6] The worldwide prevalence of NAFLD is 20% in the general population and 70% amongst people with type 2 diabetes.[7] NAFLD is supposed to be a hepatic manifestation of metabolic syndrome.[8] Patients with NAFLD usually have insulin resistance (IR) which increases lipolysis from the adipose tissue, and there is increased delivery of Free Fatty Acid (FFA) to the liver. This FFA undergoes lipid peroxidation or is esterified with glycerol to form triglycerides, leading to hepatic fat accumulation.[9] Hypertension, central obesity, and dyslipidemia are individual risk factors in the onset of NAFLD, even if the mechanism is still unknown. NAFLD, or non-alcoholic fatty liver disease, has become a worldwide public health issue due to the increasing prevalence of obesity and diabetes.[10] It has emerged as the commonest cause of chronic liver disease and abnormal liver function tests among adults in Western countries.[11]

The prevalence of Non-alcoholic fatty liver disease (NAFLD) varies in different study populations, with a prevalence of 15%–30% in Western populations and 9-40% in Asian countries. The prevalence increases to 58% in overweight individuals and can be as high as 90% in obese individuals.[12] NAFLD is found in 60% of patients with mixed hyperlipidemia and 83% of those with mixed hyperlipidemia and an elevated serum alanine aminotransferase (ALT).[13] An increasing incidence of NAFLD is reported in Asian countries like Japan and China.[14] There has been an increased incidence of diabetes and obesity in India in the last two decades; it is logical to expect an increase in NAFLD incidence in India. Bangladesh is the next-door neighbor of India and hence supposed to run the same risk. NAFLD prevalence in Type 2 DM patients is about 75%, and Diabetes mellitus is observed in 18%–45% of NAFLD patients.[15] Compared with non-diabetic subjects, people with type 2 diabetes appear to have an increased risk of developing NAFLD and have a higher risk of developing fibrosis and cirrhosis. More than a quarter of adults in developed nations are losing their lives or jobs due to this disease. Even though there are International Diabetes Federation (IDF) reports regarding the projected prevalence of type 2 DM to reach 1 million in Ethiopia, the number of patients developing fatty liver disease already acquiring DM is given less attention by health professionals.[16] Type 2 DM and obesity were associated with NAFLD to affect the liver worldwide. The findings of some research also try to speculate on the cardiovascular disease (CVD) risk of having NAFLD among type 2 diabetic patients with NAFLD as compared to type 2 diabetic patients without NAFLD. These associations could help clinicians to identify people with NAFLD who need more intensive therapy to decrease their risk of future CVD events.[17] Many scientific data across industrialized nations identify the cause and risk factors for NAFLD among type 2 diabetic patients.[18] However, the effect of NAFLD on the Asian population is completely ignored. Thus, it is widely feared that it may cause harsh public health and economic consequences in this part of the world. Therefore, this research aims to know the prevalence of NAFLD in urban and rural populations in our district and to compare demographic profiles, anthropometric measurements, and lipid profiles in the study group.

Materials and Methods

This population was adults with type 2 DM attending Indoor and Outdoor Patient descriptive cross-sectional inquiry in the medical field at the Department of Medicine, Rajshahi Medical College Hospital, Rajshahi, Bangladesh, from July 2015 to June 2017.

Sample Size: Ninety-one cases of Type 2 DM patients and Purposive sampling method.

Dependent and Independent variables: NAFLD, Metabolic syndrome, Age, Sex, Hypertension, BMI, Waist circumference, Duration of DM, Control of DM, Serum TG, Serum HDL cholesterol, Serum LDL cholesterol, Serum Total cholesterol, HbA1c, Serum AST, Serum ALT, AST: ALT and BAAT score. The study population included outdoor patients and 91 hospitalized patients (50 Urban and 41 Rural) in the medicine department with type 2 diabetes diagnosed according to the American Diabetes Association (ADA) 2011 criteria. Patients with a history of chronic liver disease of any etiology. The study excluded the space-occupying lesion of the liver, alcohol consumption >20 g/day, and drug intake like Tamoxifen, Corticosteroids, Amiodarone, and Oestrogen. The study group was divided into the rural population (Group I) and the urban population (Group II). A detailed history grading the demographic details, physical activity, diet, and personal habits were obtained from the patients. After assessing anthropometric parameters, these patients were subjected to laboratory investigations and ultrasonography. Subjects were considered as cases if they had fatty liver according to the standard criteria accepted by the American Gastroenterology Association. NAFLD Grade I-Minimal diffuse increase in the fine echoes. The liver appears bright compared to the cortex of the kidney, and with normal visualization of the diaphragm and intrahepatic vessel borders, NAFLD Grade II-Moderate diffuse increase in the fine echoes. Slightly impaired visualization of the intrahepatic vessels and diaphragm, NAFLD Grade III-Marked increase in the fine echoes. Poor or no visualization of intrahepatic vessels and diaphragm and poor penetration of the poster Io segment of the right lobe of the liver.[19] Metabolic syndrome in the study group was detected according to International Diabetes Federation (IDF) criteria.

Sample collection

91 cases of type 2 DM were included in this study. The diagnosis of type 2 DM was based on performing FBS, PPBS, and HbA_1c and checking previous treatment records. After meeting the inclusion and exclusion criteria, patients with type 2 DM were admitted to the inpatient department and attended the outpatient medicine department. Rajshahi medical college hospital was included in the study. The age of the patient ranged from 42 to 71 years. Among them, 61 were male, and 30 were female.

Variables used in this study

procedure of Data Analysis:

The study's numerical results were evaluated, and statistical methods were used to determine the significance of any discrepancies. After processing all available information, statistical analysis was performed using computer-based SPSS-16 (Statistical Package for Social Science). Data were expressed in percentage, frequencies, mean and standard deviation. Continuous data were expressed as mean ± standard deviation (SD), and dichotomous data represented percentages. Continuous variables were compared through the student's t-test, and the chi-square test was applied to the categorical variables.

Results

A total of 91 patients were enrolled during the study. NAFLD prevalence was higher in urban patients (54.54%) than in rural patients (45.45%). Males were affected more than female patients in both groups [Table 1]

Table 1: Group Wise Distribution of Study Population (N=91)

Total number of subjects subject		Group A (n=50)		Group B (n=41)	
		Rural Area		Urban Area	
		Number	Percentage	Number	Percentage
Non-NAFLD	58	35	70	23	56
NAFLD	33	15	30	18	44

Table 2: Comparison of anthropometric variables in the study population (N=91)

Variables	Group A (Rural NAFLD)		Group B (Urban NAFLD)	
	Mean	SD	Mean	SD
Weight (kg)	63.56	7.84	70.66	6.64
Height (cm)	167.89	6.88	164.54	5.45
Waist Circumference (cm)	86.23	6.54	85.23	3.79
Hip Circumference (cm)	88.67	7.43	90.45	3.88
Waist Hip Ratio	0.96	0.04	0.87	0.03
BMI	23.54	2.96	24.8	2.45

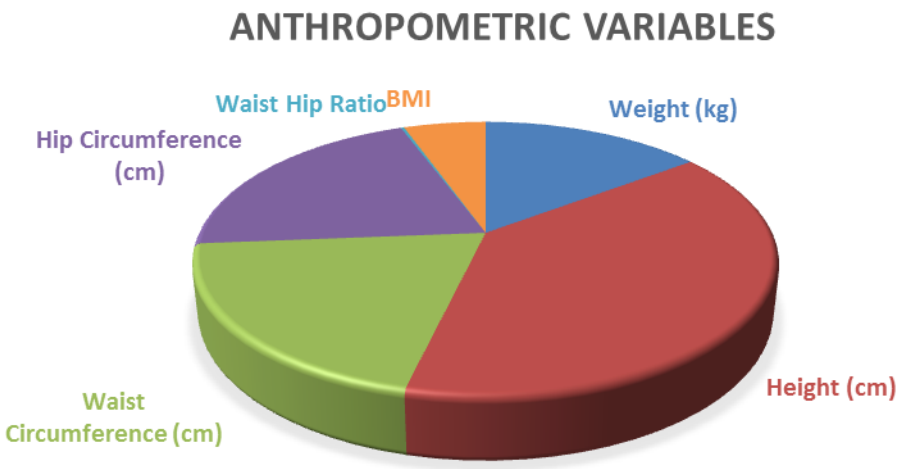

Fig 1: Comparison of anthropometric variables in the study population (N=91)

Table 3: Comparison of Hematological/Biochemical Parameters in Study Population (N=91)

Parameters	Group A		Group B	
	Mean	SD	Mean	SD
Fasting blood Sugar	190.13	40.23	182.12	40.24
PP	270.01	60.34	265.12	65.20
HbA1c	7.56	0.79	7.50	0.76
Serum cholesterol (mg/dl)	170.12	50.12	164.21	35.24
Serum triglycerides (mg/dl)	202.56	112.34	180.12	75.32
Serum HDL (mg/dl)	40.14	8.18	42.6	9.12
Serum LDL (mg/dl)	87.32	36.54	82.13	26.44
Serum VLDL (mg/dl)	40.76	20.22	35.12	12.65
Fasting Insulin	8.12	2.12	9.13	4.02
HOMA-IR	3.54	1.2	4.01	1.37

In this study Comparison of Hematological/Biochemical Parameters in Study Population was significantly associated with the presence of fatty liver in T2DM patients. HbA1c was significantly associated with the presence of NAFLD Group A mean 7.56 and group-B 7.50 and Serum triglycerides (mg/dl) level group-A 202.56 and group-B 180.12 so that with SD (0.79-0.76) and (112.34-75.32 respectively) [Table-3].

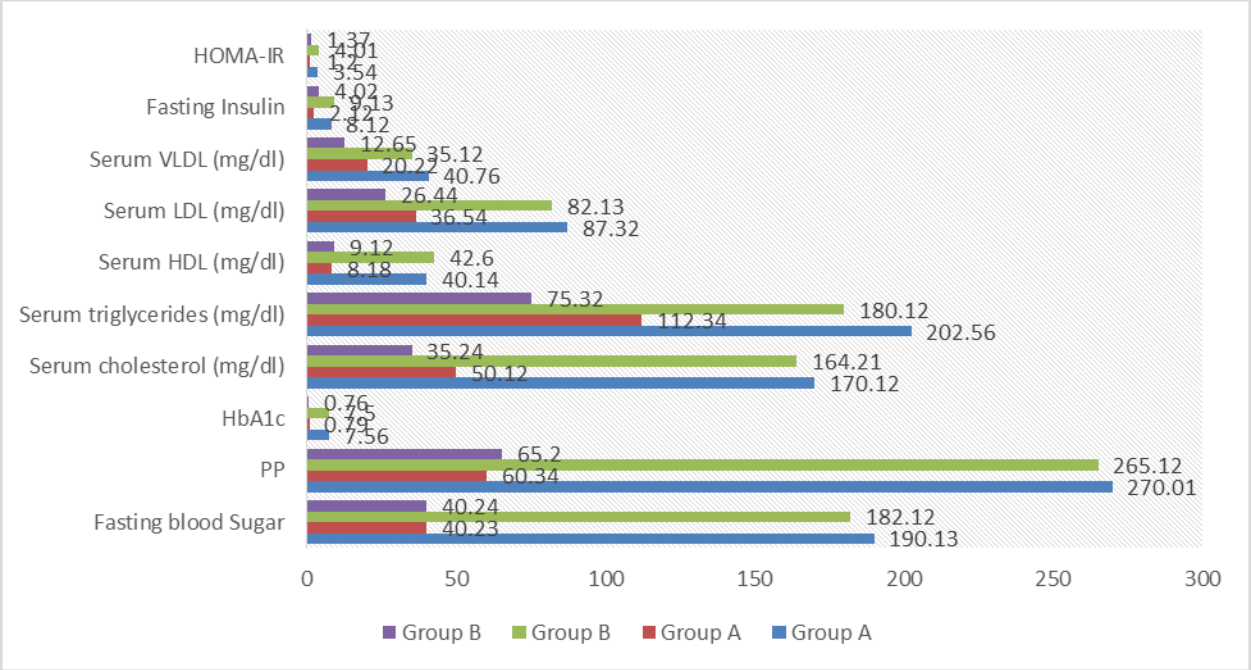

Fig 2: Comparison of Hematological/Biochemical Parameters in Study Population.

Urban population, patients exhibited higher weight, waist circumference, hip circumference, and BMI and had an earlier age of presentation of NAFLD than the rural population. Both groups showed a high prevalence of metabolic syndrome [Table 2-3]. The finding also highlighted that the risk factors for NAFLD also depend on the overall demographic profile and environmental settings. The present study's findings also supported the view that the impacts of diet on the prevalence of NAFLD might vary from one environment to another.

Discussion

NAFLD was more prevalent in the urban population (54.54 %) than in the rural population (45.45 %). The mean age of the rural NAFLD group was significantly higher than the urban NAFLD group, thus indicating a possible delay of NAFLD onset in rural compared to urban diabetic patients. Although NAFLD was detected more in males than females in both groups, no significant association between gender and NAFLD prevalence could be seen. One of the reasons for the higher prevalence of males in the rural group could be the gender-biased difference in health-seeking behavior in a male-dominated society like ours. We observed that NAFLD patients in the urban population exhibited higher weight, waist circumference, hip circumference, and BMI than the rural population. NAFLD and T2DM have a poorer prognosis in terms of higher frequency of cirrhosis and mortality.[20] NAFLD is more commonly seen in T2DM patients, and it is now an important public health issue. NAFLD is associated with various features of metabolic syndrome like obesity, hypertension and hypertriglyceridemia, and low HDL. NAFLD is an integral part of the metabolic syndrome, which comprises a cluster of abnormalities. Such as hyperglycemia, hypertriglyceridemia and low HDL, hypertension, and obesity with insulin resistance as a central pathogenic factor. This cross-sectional descriptive study was conducted in Rajshahi medical college's medicine department. This study was designed to determine the ultrasonographic proportion of NAFLD in subjects with T2DM. Ultrasonography has a sensitivity and specificity of 83% and 100%, respectively, compared with histological findings as to the standard gold method in detecting fatty liver.[21] Ultrasonography is a validated tool for screening NAFLD without a liver biopsy.[22] Ninety-one patients with T2DM were included in this study who met the inclusion criteria and were admitted to an inpatient or attended the outpatient department of medicine in Rajshahi medical college hospital. Out of the five components of metabolic syndrome, diabetes is the risk factor most frequently associated with NAFLD. This study further documented the proportion of the other components of metabolic syndrome, namely obesity, elevated blood pressure, elevated triglyceride, and low HDL cholesterol. We tried to determine if there was a significant association of these factors to NAFLD in study subjects. Liver function tests were also done to assess any derangement.

The study population was primarily urban, middle-class, and from various occupations. The relationship between anthropometric parameters and NAFLD is well established. However, the variable impact of different anthropometric parameters has been shown in different studies. Anthropometric parameters such as BMI and waist/hip ratio have been associated with the causation of NAFLD and its outcome. The dependence of NAFLD on anthropometric measurements is much more pronounced in type 2 diabetes mellitus patients, where many workers have found NAFLD to be a universal finding among obese patients. The present study also revealed that the prevalence of metabolic syndrome was significantly higher in urban than rural groups. In both groups, metabolic syndrome was significantly associated with NAFLD. This fact re-emphasized and confirmed that instead of a single risk factor, a combination of several variables has a synergistic effect on the occurrence of NAFLD. This finding agrees with the observations of previous studies to the extent that NAFLD is often considered the hepatic component of metabolic syndrome. This single parameter in itself can explain the difference in the prevalence

of NAFLD between rural and urban areas. It could explain the multifactorial relationship of NAFLD and also the lack of empiricism for univariate relationships. Although most NAFLD patients in our study were non-vegetarian, there is a varied opinions regarding the effect of diet on the prevalence of NAFLD. Choi *et al*. believed that a vegetarian diet does not protect against NAFLD.[23] However, some other studies believed that diet might have a role in the prevalence and treatment of NAFLD. All these studies indicate that the relationship between diet and NAFLD is not empirical. The present study's findings also supported the view that the impact of diet on the prevalence of NAFLD might vary from one environment to another. The finding also highlighted that the risk factors for NAFLD also depend on the overall demographic profile and environmental settings.

Conclusion

Our research found a greater frequency of NAFLD in urban residents than in rural residents, with male patients being more severely impacted than female patients. Rural patients exhibited superior anthropometric characteristics (lower weight, waist circumference, hip circumference, and BMI) that contributed to a lower prevalence of NAFLD than Urban patients, even though both groups had identical risk factors.

Conflict of interest: None declared

References

1. Angulo P. Nonalcoholic fatty liver disease. *N Engl J Med*. 2002;346(16):1221-1231. doi:10.1056/NEJMra011775
2. Browning JD, Szczepaniak LS, Dobbins R, et al. prevalence of hepatic steatosis in an urban population in the United States: impact of ethnicity. *Hepatol Baltim Md*. 2004;40(6):1387-1395. doi:10.1002/hep.20466
3. Roden M. Mechanisms of Disease: hepatic steatosis in type 2 diabetes--pathogenesis and clinical relevance. *Nat Clin Pract Endocrinol Metab*. 2006;2(6):335-348. doi:10.1038/ncpendmet0190
4. Ong JP, Pitts A, Younossi ZM. Increased overall mortality and liver-related mortality in non-alcoholic fatty liver disease. *J Hepatol*. 2008;49(4):608-612. doi:10.1016/j.jhep.2008.06.018
5. Kallwitz ER, Kumar M, Aggarwal R, et al. Ethnicity and non-alcoholic fatty liver disease in an obesity clinic: the impact of triglycerides. *Dig Dis Sci*. 2008;53(5):1358-1363. doi:10.1007/s10620-008-0234-x
6. Dabelea D, Pihoker C, Talton JW, et al. Etiological approach to characterization of diabetes type: the SEARCH for Diabetes in Youth Study. *Diabetes Care*. 2011;34(7):1628-1633. doi:10.2337/dc10-2324
7. Harnois F, Msika S, Sabaté JM, et al. prevalence and predictive factors of non-alcoholic steatohepatitis (NASH) in morbidly obese patients undergoing bariatric surgery. *Obes Surg*. 2006;16(2):183-188. doi:10.1381/096089206775565122
8. Farrell GC, Larter CZ. Non-alcoholic fatty liver disease: from steatosis to cirrhosis. *Hepatol Baltim Md*. 2006;43(2 Suppl 1):S99-S112. doi:10.1002/hep.20973
9. Marchesini G, Marzocchi R, Agostini F, Bugianesi E. Nonalcoholic fatty liver disease and the metabolic syndrome. *Curr Opin Lipidol*. 2005;16(4):421-427. doi:10.1097/01.mol.0000174153.53683.f2
10. Tominaga K, Kurata JH, Chen YK, et al. prevalence of fatty liver in Japanese children and relationship to obesity. An epidemiological ultrasonographic survey. *Dig Dis Sci*. 1995;40(9):2002-2009. doi:10.1007/BF02208670
11. McCullough AJ. Thiazolidinediones for non-alcoholic steatohepatitis--promising but not ready for prime time. *N Engl J Med*. 2006;355(22):2361-2363. doi:10.1056/NEJMe068232
12. Bedogni G, Miglioli L, Masutti F, Tiribelli C, Marchesini G, Bellentani S. Prevalence of and risk factors for non-alcoholic fatty liver disease: the Dionysos nutrition and liver study. *Hepatol Baltim Md*. 2005;42(1):44-52. doi:10.1002/hep.20734
13. Boza C, Riquelme A, Ibañez L, et al. Predictors of non-alcoholic steatohepatitis (NASH) in obese patients undergoing gastric bypass. *Obes Surg*. 2005;15(8):1148-1153. doi:10.1381/0960892055002347
14. Amarapurkar D, Kamani P, Patel N, et al. prevalence of non-alcoholic fatty liver disease: population based study. *Ann Hepatol*. 2007;6(3):161-163.
15. de Oliveira CP, de Mello ES, Alves VAF, Saviero SM, Strauss E. Changes in histological criteria lead to different prevalences of non-alcoholic steatohepatitis in severe obesity. *Ann Hepatol*. 2007;6(4):255-261.
16. Browning JD. Statins and hepatic steatosis: perspectives from the Dallas Heart Study. *Hepatol Baltim Md*. 2006;44(2):466-471. doi:10.1002/hep.21248
17. Misra A, Vikram NK. Insulin resistance syndrome (metabolic syndrome) and obesity in Asian Indians: evidence and implications. *Nutr Burbank Los Angel Cty Calif*. 2004;20(5):482-491. doi:10.1016/j.nut.2004.01.020
18. Medina J, Fernández-Salazar LI, García-Buey L, Moreno-Otero R. Approach to the pathogenesis and treatment of nonalcoholic steatohepatitis. *Diabetes Care*. 2004;27(8):2057-2066. doi:10.2337/diacare.27.8.2057

19. Williams CD, Stengel J, Asike MI, et al. prevalence of non-alcoholic fatty liver disease and non-alcoholic steatohepatitis among a largely middle-aged population utilizing ultrasound and liver biopsy: a prospective study. *Gastroenterology*. 2011;140(1):124-131. doi:10.1053/j.gastro.2010.09.038

20. Viswanathan V, Kadiri M, Medimpudi S, Kumpatla S. Association of non-alcoholic fatty liver disease with diabetic microvascular and macrovascular complications in South Indian diabetic subjects. *Int J Diabetes Dev Ctries*. 2010;30. doi:10.4103/0973-3930.70861

21. Contos MJ, Sanyal AJ. The clinicopathologic spectrum and management of non-alcoholic fatty liver disease. *Adv Anat Pathol*. 2002;9(1):37-51. doi:10.1097/00125480-200201000-00005

22. Lonardo A, Bellini M, Tartoni P, Tondelli E. The bright liver syndrome. Prevalence and determinants of a "bright" liver echopattern. *Ital J Gastroenterol Hepatol*. 1997;29(4):351-356.

23. Merat S, Yarahmadi S, Tahaghoghi S, et al. Prevalence of Fatty Liver Disease among Type 2 Diabetes Mellitus Patients and its Relation to Insulin Resistance. *Middle East J Dig Dis MEJDD*. 2009;1(2):74-79. doi:10.15171/middle

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