Nonalcoholic fatty liver disease in lean and obese patients in Saudi patients from a single center

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ABSTRACT

Background: Fatty liver is a disease caused by the accumulation of fat in the liver. It is one of the major risk factors for developing cirrhosis and hepatocellular carcinoma. Saudi Arabia is one of the most prevalent countries in diabetes and obesity; the overall prevalence of diabetes is 23.7% and obesity is 35.6%. **Aim:** To study the correlation between fatty liver finding on abdominal ultrasound (US) and their clinical and biochemical profile including BMI, blood glucose level, lipid profile, liver function tests, and blood pressure in both group lean and obese patients. **Methods:** Cross-sectional study of 346 fatty liver ultrasound-proven patients were enrolled in the study from January to May 2016 in King Saud Hospital- Qassim, Saudi Arabia. **Results:** Mean age of the participants was 50.3 years. Female participants were 55% of the cohort. Participants were divided based on their BMI: BMI <25 (lean), BMI of 25–30 (overweight and mild obesity), and BMI >30 (morbid obesity). We found that cholesterol (*P* = 0.007) and low-density lipoprotein (LDL) (*P* = 0.015) were higher in lean compared to others (5 and 3.1), respectively. Gamma-glutamyl transferase (GGT) was higher in mildly obese patients (113.2) and ALT, which was higher in lean patients (60.4). In addition, 34.5% of the overall patients had Diabetes Mellitus (DM). We found that HbA1c was lower in lean (7.3) compared to morbidly obese patients (7.6). Platelets counts were higher in morbidly obese patients (278) compared to other groups. **Conclusion:** High cholesterol and LDL strongly correlated with lean fatty liver patients. There was a significant relationship between the female gender and the risk of development of fatty liver. However, liver enzymes were within the normal range, except GGT, which was higher in all the groups, with the highest value in mildly obese patients. Therefore, they are not sensitive for diagnosing fatty liver patients.

Keywords: Fatty liver, metabolic syndrome, Saudi Arabia, ultrasound

Introduction

Fatty liver is defined as an accumulation of fat in the hepatocytes. Most commonly, this accumulation is due to high triglyceride (TG) levels.[1] The prevalence of this disease worldwide depends mainly on a patient's age. As the patient ages, the risks and prevalence of fatty liver increase. In people <20 years, the prevalence is <20%, while it may reach 60% in people >60 years. The prevalence of fatty liver in Saudi Arabia is estimated to be 16.6%.[2]

Fatty liver has been classified as either alcoholic or nonalcoholic. Alcoholic fatty liver is diagnosed when the consumption of alcohol is >20 g in females and 30 g in males. Nonalcoholic fatty liver disease is subdivided into two categories: (1) nonalcoholic fatty liver (NAFL) and (2) nonalcoholic steatohepatitis (NASH). NASH is differentiated from NAFL

Access this article online

Quick Response Code:

Website:
www.jfmpc.com

DOI:
10.4103/jfmpc.jfmpc_185_21

How to cite this article: Alsuhaibani KA, Althunayyan FS, Alsudays AM, Alharbi AA, Aljarallah BM. Nonalcoholic fatty liver disease in lean and obese patients in Saudi patients from a single center. J Family Med Prim Care 2021;10:3381-6.

by the presence of inflammation with injury to hepatocytes. NASH tends to develop into cirrhosis and hepatocellular carcinoma (HCC).[3,4]

Fatty liver disease is an asymptomatic condition in which the standard liver enzymes measured in routine clinical examinations cannot be used to diagnose the condition. Hence, a biopsy is still the most reliable mean for an accurate diagnosis. Noninvasive methods such as serum markers (miR-122, miR-34a, cytokeratin-18 fragments) and imaging studies such as magnetic resonance imaging (MRI), magnetic resonance spectroscopy (MRS), computed tomography (CT), and abdominal ultrasound (US) have been found to be reliable tools for differentiating NASH from simple nonalcoholic fatty liver disease (NAFLD).

In one study comparing NAFLD patients to normal individuals, the serum marker, miR-122, was elevated ~7.3-fold in NAFLD patients. In addition, it was found that miR-122 and miR-34a are higher in the NASH group in comparison with the NAFLD group. Furthermore, cytokeratin-18 fragments were found to be very reliable tools for differentiating between NASH and NAFLD with a median of 516.7 and 234 U/L in both the NASH and NAFLD groups and normal individuals, respectively.[5]

Liver MRIs and MRSs have numerous advantages over CT and US imaging as CT imaging is more hazardous due to its higher radiation levels and US imaging has a limited capability to give accurate anatomical details. Moreover, MRS measures the lipids in all adipose tissue and compares them to the liver's fat content. In mild steatosis, MRI has a sensitivity of 85% and a specificity of 100%, while for moderate to severe steatosis, the sensitivity is 80% and the specificity is 95%. Besides MRI, CT has a specificity of 95%–100% and a sensitivity of 73%–100% for detection of steatosis. By utilizing US in macrovesicular steatosis, a sensitivity of 60.9% and a specificity of 100% were demonstrated. On the contrary, microvesicular steatosis showed less specific and sensitive (73% and 43%, respectively) results than macrovesicular steatosis.[5,6]

Multiple biochemical markers have been noticed in patients diagnosed with fatty liver. One study showed all lipid profiles were elevated by different percentages, with the exception of high-density lipoprotein (HDL). As expected, TGs showed an increase in 67.14% of the cases, total cholesterol in 45.71%, low-density lipoprotein (LDL) in 34.28%, and HDL in 25.71% of a cohort consisting of 70 patients, while HDL was low in 62.85% of these cases.[7] Fatty liver is associated with elevation of liver enzymes to the upper normal range.[8] In addition, patients with higher serum lipoproteins, HDL, and TG levels have a higher chance of fatty liver.[9]

Many risk factors have been found to have a strong correlation with NAFLD and NASH, mainly high body mass index (BMI), waist circumference, and steatosis level.[10] In people with BMI <25, there is a 5% risk of developing fatty liver, whereas, in people with BMI >30, 33.3% have fatty liver.[11] In addition, type 2 diabetes (DM), high blood pressure, hypercholesterolemia, older age, metabolic syndrome, male gender, abnormal lipoproteins, and obesity have been proven to be the most important predictors for the development of this disease.[8,12] In addition, inflammatory bowel disease (IBD) has shown a relationship with fatty liver especially in older IBD patients versus non-IBD patients (46 ± 13 versus 42 ± 14 y; P = 0.018) and later onset (37.2 ± 15.3 versus 28.7 ± 23.8; P = 0.002).[13] The expected rates of NASH and NAFLD are predicted to be increased in 2030 with the concurrent increase in obesity and DM rates in both countries. Furthermore, the expected prevalence of NASH is predicted to be more than NAFLD due to the aging population.[14]

Treatment of fatty liver mainly aims to treat the risk factors, namely obesity and metabolic syndrome. In a cohort of 36 patients, the effects of weight loss on fatty liver and other metabolic syndrome criteria were compared. Weight loss and weight reduction surgeries were the main two common interventions used to decrease fatty liver. It has been estimated that a decrease in weight by 10% will produce changes in fatty liver imaging findings. In one study involving gastric band placement, there were significant decreases in LDL (from 3.7 ± 1.5 to 3.4 ± 1.2 mmol/l), glycosylated hemoglobin (HbA1c; from 6.2 ± 2.0% to 5.3 ± 0.9%), and fasting plasma insulin levels (from 22.4 ± 16.7 to 10.6 ± 8.3 mu/l), and considerable increases in insulin sensitivity (from 28.0 ± 12 to 56.0 ± 33.0 HOMA%S) and HDL levels (from 1.20 ± 0.38 mmol/l to 1.35 ± 0.46 mmol/l).[15] Intentional and post-bariatric surgery-related weight losses have proven to significantly improve fatty liver histological appearances.[15,16]

Methods

This was a cross-sectional study to assess the risk factors and correlation of US-diagnosed fatty liver. Patients who underwent abdominal US for various indications in a tertiary center (King Saud Hospital-Qassim, Saudi Arabia) from January 2016 until May 2016 were enrolled. A total of 346 fatty liver US-diagnosed patients were included in the study.

Data collection instruments

Data were collected from the electronic medical records of the patients. The following parameters were included in the working sheet: (1) demographic data, including age, sex, and nationality; (2) vital signs, including pulse and blood pressure; (3) anthrobiometric measurements, including height, weight, and BMI; (4) metabolic parameters, including blood glucose levels, HbA1c, lipid profiles, and liver enzymes; and (5) comorbid diseases.

Ethical considerations

Confidentiality of the participants was ensured. This research was approved by the Regional Ethical Committee in the general director of health affairs in the Qassim region.

Statistical analysis

After the data were collected, they were entered into the statistical software, SPSS, for data tabulation, data cleaning, and subsequent statistical data analysis. The data findings were organized into different sections based on the objectives of the research study. Initially, a descriptive analysis was reported as proportions for categorical variables and mean ± standard deviation for continuous variables [Table 1]. The correlation presented in Table 2 was calculated using Pearson's correlation coefficient. The univariate analysis in Table 3 was done using an independent *t*-test for continuous variables and Chi-squared test for categorical variables. The multivariate analysis in Table 4 was calculated using regression analysis.

Results

Three-hundred forty-six (346) patients were enrolled in this study. The mean age (in years) of participants was 50.3 ± 15.0. This proportion was divided into two groups as ≤50 years old consisting of 177 participants or 51.2% and >50 years old consisting of 169 participants or 48.8%. Out of these numbers, 153 (44.2%) of them were males, while 193 (55.8%) of them were females. The mean BMI of the patients was 30.1 ± 5.7. These results were divided into two categories: (1) high risk (BMI >30) and (2) low risk (BMI ≤30) fatty liver. The high-risk group consisted of 128 participants (37.0%), and low risk had 218 participants (63.0%). The mean systolic blood pressure (SBP) of the patients was 143 ± 23.8 mmHg while the diastolic blood pressure (DBP) was 77.2 ± 12.6 mmHg. The participants' mean fasting blood glucose (FBG) was 93.2 ± 78.2 mmol/L. Their total cholesterol had a mean level of 04.7 ± 0.1 mmol/L. The mean HDL of the participants was 01.2 ± 01.4 mmol/L while the mean low-density lipoprotein (LDL) was 02.8 ± 0.9 mmol/L. The mean TG level was 01.8 ± 01.5 mmol/L, and the mean aspartate aminotransferase (AST) was 26.9 ± 36.4 iu/l. The mean value of the alanine aminotransferase (ALT) was 42.9 ± 68.0 iu/l, while the mean value of alkaline phosphatase (ALP) was 100.0 ± 55 iu/l. Furthermore, the mean value of gamma-glutamyl transferase was 89.2 ± 148.8 iu/l, and the participants' mean total bilirubin was 08.6 ± 09.6 mg/dl; the mean value of direct bilirubin was 4.2 ± 06.7 mg/dl. The mean value of albumin was

38.3 ± 05.9 g/l, and the mean HbA1c count was 07.3 ± 01.8, while the mean value of platelet was 269.6 ± 86.6 K/cu.

Figure 1 shows the frequency distribution of comorbid diseases for fatty liver patients. The results are presented as number and percentage (%) for 346 patients who were enrolled in this study. Sixty-eight (34.5%) of the patients had diabetes mellitus (DM), 25 (12.7%) of them had hypertension (HTN), 13 (6.6%) of them had gall stones, eight (4.1%) had hypothyroidism, and 92 (46.7%) had other chronic diseases.

Table 1: Descriptive analysis for participants' sociodemographic characteristics (*n*=346)

Factor	Results
Age in Years	50.3±15.0
≤50 years old	177 (51.2%)
>50 years old	169 (48.8%)
Gender	
Male	153 (44.2%)
Female	193 (55.8%)
BMI (kg/m²)	30.1±05.7
Fatty Liver High Risk (>30)	128 (37.0%)
Fatty Liver Low Risk (≤30)	218 (63.0%)
SBP (mmHg)**	143.4±23.8
DBP (mmHg)**	77.2±12.6
FBG (mmol/L)**	93.2±78.2
Cholesterol (mmol/L)**	04.7±01.1
HDL (mmol/L)**	01.2±01.4
LDL (mmol/L)**	02.8±0.9
Triglycerides (mmol/L)**	01.8±01.5
AST (iu/l)**	26.9±36.4
ALT (iu/l)**	42.9±68.0
ALP (iu/l)**	100.0±55.0
GGT (iu/l)**	89.2±148.8
Total Bilirubin (mg/dl)**	08.6±09.6
Direct Bilirubin (mg/dl)**	04.2±06.7
Albumin (g/l)**	38.3±05.9
HBA1c**	07.3±01.8
Platelet (K/cu)**	269.6±86.6

*Results are expressed as mean±standard deviation, number, and percentage (%). BMI - Body Mass Index. **SBP - Systolic Blood Pressure (*n*=89), DBP - Diastolic Blood Pressure (*n*=89), FBG - Fasting Blood Glucose (*n*=261), Cholesterol (*n*=251), HDL - High-Density Lipoprotein (*n*=187), LDL - Low-Density Lipoprotein (*n*=185), Triglycerides (*n*=247), AST - Aspartate Aminotransferase (*n*=337), ALT - Alanine Aminotransferase (*n*=341), ALP - Alkaline Phosphatase (*n*=277), GGT - Gamma-Glutamyl Transferase (*n*=122), Total Bilirubin (*n*=301), Direct Bilirubin (*n*=255), Albumin (*n*=299), HBA1c – Hemoglobin (*n*=174), Platelet (*n*=334)
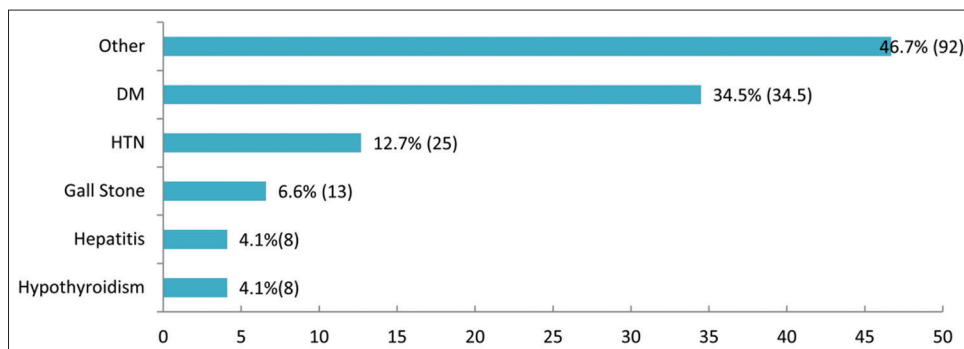

Figure 1: Comorbid diseases in fatty liver patients

Table 2: Correlation between classification of BMI among liver enzymes and other metabolic parameters (*n*=346)

Factor	Classification of BMI			*P*
	<25 (*n*=49)	**25-30 (*n*=168)**	**>30 (*n*=129)**	
FBG (mmol/L)	66.4±72.3	100.2±75.4	93.9±82.1	0.077
Cholesterol (mmol/L)	05.0±01.2	04.7±01.0	04.4±0.9	**0.007§**
HDL (mmol/L)	01.2±0.7	01.5±02.2	01.0±0.3	0.181
LDL (mmol/L)	03.1±01.1	02.9±0.9	02.6±0.8	**0.015§**
Triglycerides (mmol/L)	02.0±01.2	01.7±0.9	01.8±02.2	0.413
AST (iu/l)	30.8±29.5	24.9±27.9	28.1±46.7	0.569
ALT (iu/l)	60.4±74.5	41.7±66.5	37.9±67.1	0.146
ALP (iu/l)	111.2±62.5	97.5±46.8	98.7±61.4	0.348
GGT (iu/l)	99.1±157.8	113.2±181.9	50.7±61.9	0.101
Total Bilirubin (mg/dl)	08.1±05.5	09.2±12.3	07.9±06.5	0.550
Direct Bilirubin (mg/dl)	03.4±02.2	04.9±08.8	03.7±04.5	0.302
Albumin (g/l)	38.4±05.3	38.5±06.3	38.0±05.5	0.832
HBA1c	07.3±01.8	07.0±01.8	07.6±01.8	0.112
Platelet (K/cu)	262.1±84.7	264.9±89.5	278.3±83.6	0.349

*Results are expressed as mean±standard deviation. Legend: BMI - Body Mass Index, FBG - Fasting Blood Glucose, HDL - High-Density Lipoprotein, LDL - Low-Density Lipoprotein, AST - Aspartate aminotransferase, ALT - Alanine Aminotransferase, ALP - Alkaline Phosphatase, GGT - Gamma-Glutamyl Transferase, HbA1c - Hemoglobin. *P value has been calculated using one-way analysis if variance (Anova). §Significant value

Table 3: Univariate analysis for the association between sociodemographic characteristics versus fatty liver risk factor as high-risk versus low-risk (*n*=346)

Factor	Fatty Liver Risk Factor		*P*∞
	High risk (*n*=128)	**Low risk (*n*=218)**	
Age in Years			
≤50 years old	60 (46.9%)	117 (53.7%)	0.222
>50 years old	68 (53.1%)	101 (46.3%)	
Gender			
Male	41 (32.0%)	112 (51.4%)	**<0.001§**
Female	87 (68.0%)	106 (48.6%)	
Cholesterol (mmol/L)	04.4±0.9	04.8±01.1	**0.007§**
HDL (mmol/L)	01.0±0.3	04.8±01.9	0.097
LDL (mmol/L)	02.6±0.8	03.0±0.9	**0.004§**
Triglycerides (mmol/L)	01.8±02.2	01.7±0.9	0.685
AST (iu/l)	28.2±46.9	26.2±28.3	0.629
ALT (iu/l)	37.9±67.4	45.8±68.4	0.307
ALP (iu/l)	98.6±61.4	100.8±51.2	0.743
GGT (iu/l)	50.7±61.8	110.2±176.1	**0.034§**
Total Bilirubin (mg/dl)	07.9±06.5	08.9±11.0	0.388
Direct Bilirubin (mg/dl)	03.7±04.5	04.6±07.8	0.340
Albumin (g/l)	38.0±05.5	38.5±06.1	0.544
HbA1c	07.6±01.8	07.1±01.8	**0.047§**
Platelet (K/cu)	277.7±83.6	264.7±88.2	0.186

*Results are expressed as number (%) and mean±standard deviation. Legend: BMI - Body Mass Index, FBG - Fasting Blood Glucose, HDL - High-Density Lipoprotein, LDL - Low-Density Lipoprotein, AST - Aspartate aminotransferase, ALT - Alanine Aminotransferase, ALP - Alkaline Phosphatase, GGT - Gamma-Glutamyl Transferase, HbA1c - Hemoglobin. *P value has been calculated using the Chi-squared test. §Significant value considering the level of significance when *P*≤0.05

Table 2 presents the correlation between classification of BMI among liver enzymes and other metabolic parameters for 346 patients. Analysis for correlation revealed that cholesterol ($P = 0.007$) and LDL levels ($P = 0.015$) were both statistically correlated with the BMI classification. Other liver enzymes and metabolic parameters were not statistically correlated.

In the univariate analysis [Table 3] for the association between sociodemographic characteristics and risk factors of fatty liver, it was revealed that gender ($P < 0.001$), cholesterol ($P = 0.007$), LDL ($P = 0.004$), GGT ($P = 0.034$), and HbA1c ($P = 0.047$) were all statistically significant factors given the level of significance when $P \leq 0.05$. Other variables of interest showed no significant relationships with respect to the outcome measures.

Gender ($P = 0.001$), cholesterol ($P = 0.008$), LDL ($P = 0.006$), and HbA1c ($P = 0.049$) values were all statistically significant in a multivariate logistic regression analysis at an unadjusted odds ratio, while they were not statistically significant in the adjusted odds ratio considering the level of significance when $P \leq 0.05$.

Discussion

Fatty liver is a symptom-free disease that leads to several other diseases. There are major factors (such as DM and obesity) that can enhance the progression of this disease. This study is the first paper to describe the relationship between high- and low-risk among sociodemographic and clinical characteristics of fatty liver patients in Saudi Arabia. We have chosen BMI to be the outcome variable, in which we identified participants with BMI ≤25 as low-risk and BMI >25 as high-risk. We also found based on the associated disease table that the majority of females were at high risk for fatty liver 163 (59.5%). Although this finding may not provide further significant differences in comparison to previous studies, nonetheless, we are looking to use this result as a supplemental information separate from the previously published study articles. Furthermore, we learned that only cholesterol has been identified as having a strong correlation with fatty liver risk factors other variables of interest were not found to be significant in the outcome variable.

Our results show that the majority of females were at high risk of fatty liver disease; this group consisted of 163 (59.5%) females and 111 (40.5%) males. In a previous study conducted by Azfal *et al.* (2016),[17] 130 diabetic patients with type-II DM were surveyed and were screened for NAFLD. The study was carried out at Shaikh

Characteristics	Unadjusted		Adjusted£	
	OR (95% CI)	*P*	OR (95% CI)	*P*
Age in Years				
≤50 years old	1.313 (0.848-2.033)	0.223	1.514 (0.160-14.340)	0.718
>50 years old				
Gender				
Male	2.242 (1.420-3.539)	**0.001§**	15.552 (0.516-468.53)	0.114
Female				
FBG (mmol/L)	1.000 (0.996-1.003)	0.784	0.989 (0.966-1.013)	0.372
Cholesterol (mmol/L)	1.448 (1.100-1.907)	**0.008§**	0.887 (0.112-7.050)	0.910
HDL (mmol/L)	1.488 (0.794-2.789)	0.215	0.503 (0.093-2.732)	0.426
LDL (mmol/L)	1.664 (1.160-2.385)	**0.006§**	10.905 (0.537-221.36)	0.120
Triglycerides (mmol/L)	0.967 (0.821-1.138)	0.686	0.853 (0.329-2.211)	0.744
AST (iu/l)	0.999 (0.993-1.004)	0.630	1.271 (0.941-1.719)	0.118
ALT (iu/l)	1.002 (0.998-1.006)	0.321	0.857 (0.707-1.038)	0.115
ALP (iu/l)	1.001 (0.996-1.005)	0.743	0.993 (0.970-1.016)	0.557
GGT (iu/l)	1.005 (1.000-1.009)	0.063	1.019 (0.975-1.065)	0.404
Total Bilirubin (mg/dl)	1.013 (0.982-1.046)	0.403	0.700 (0.479-1.023)	0.065
Direct Bilirubin (mg/dl)	1.024 (0.974-1.077)	0.359	0.942 (0.697-1.274)	0.699
Albumin (g/l)	1.013 (0.973-1.054	0.543	0.862 (0.636-1.167)	0.337
HbA1c	0.841 (0.708-1.000)	**0.049 §**	0.867 (0.443-1.700)	0.679
Platelet (K/cu)	0.998 (0.996-1.001)	0.189	0.997 (0.982-1.013)	0.703

OR - Odds Ratio, CI - Confidence Interval, BMI - Body Mass Index, FBG - Fasting Blood Glucose, HDL - High-Density Lipoprotein, LDL - Low-Density Lipoprotein, AST - Aspartate aminotransferase, ALT - Alanine Aminotransferase, ALP - Alkaline Phosphatase, GGT - Gamma-Glutamyl Transferase, HbA1c - Hemoglobin. §Significant value considering the level of significance when *P*≤0.05. Adjusted odds ratio from a logistics regression model for the attitude of nurses toward anxiety and each sociodemographic characteristic assessed individually. £The adjusted odds ratio shows that the high-risk fatty liver was associated with each variable after adjusting for all the other variables in the model

Zayed Hospital, Lahore, Pakistan for a period of six months. They found that among 130 diabetic patients, 76 patients were found to have fatty liver; 50 (61.7%) of them were females and 26 (53.0%) were males. This result was in agreement with our study findings. In another study published by Elmakki *et al.* (2015),[18] the prevalence and associated factors of the NAFLD in Saudi patients with T2-DM in the Jazan Region, Saudi Arabia was assessed. It was a cross-sectional study targeting 230 Saudi patients who attended the Diabetic Center at Jazan General Hospital. The main inclusion criteria were adult patients (≥18 years) with type 2-DM, while patients with comorbid liver disease and those who consumed alcohol or took steatogenic drugs were excluded from the study. The study took place at Jazan General Hospital during the period between January and June 2013. We learned that in their study, among those diabetic patients, 44 (46.3%) out of 95 females had fatty liver while 55 (49.1%) out of 112 males had fatty liver. Another variable in their study revealed that patients with BMI categories such as normal with 14 participants (41.2%), overweight with 37 (56.1%), and obese with 26 (49.1%) all tested as positive for fatty liver. Meanwhile, our study showed that 274 (79.2%) patients with BMI > 25 were identified as being high-risk for fatty liver, while 72 (20.8%) patients with BMI ≤25 were identified as having a low risk for fatty liver.

Another finding of our study revealed that only gender and cholesterol were strongly correlated with the fatty liver risk factor. One of the studies published online by Jimenez-Rivera *et al.* (2017)[19] concerned the prevalence and risk factors for NAFL in obese children and young adults. Obese children ranging in age from 8 to 17 years old (BMI >95% for age and sex) were prospectively recruited from September 2009 and December 2012. The study was conducted at the Children's Hospital of Eastern Ontario, a tertiary care academic center, affiliated with the University of Ottawa. Their study showed only triglycerides (*P* = 0.01) was statistically significant with all other variables of interest showing no significant relationship in the outcome variable. We believe that this study is less significant than our study findings as cholesterol demonstrates strong a correlation with fatty liver. In another previous study conducted by Alavi *et al.* (2016),[20] NAFLD was examined in a study entitled "Frequency in Diabetes Mellitus (Type II) Patients and Non-Diabetic Group" conducted at Shalamar Medical And Dental College, Lahore, Pakistan. It was a cross-sectional study performed with non-probability comfort sampling on 400 patients in Shalamar Hospital, Lahore over the period of six months starting in January 2015 and lasting until June 2015. The patients were divided into two categories: (1) diabetic (type II) and (2) non-diabetic. The results from their study revealed that glucose (*P* = 0.03) and TG (*P* = 0.00) were risk factors for non-diabetic patients, and glucose (*P* = 0.00) and TG (*P* = 0.00) in both categories were all statistically significant given the level of significance when *P* ≤ 0.05. Their study findings presented more substantial results compared to our study.

Limitations

The limitation of this study relates to the electronic medical records of the patients. Due to insufficient records for each

fatty liver patient, the study investigators were not successful in obtaining complete laboratory results, which may have led to insignificant results. Nevertheless, this study presents substantial results, especially with respect to gender and other liver enzymes.

Another limitation of our study was that the inclusion criteria were restricted to only those fatty liver patients who were positively diagnosed via US.

Conclusions

This study provides insight into fatty liver risk factors and their correlation with metabolic profiles of lean and obese patients. There was a significant relationship between gender and some of their clinical characteristics with fatty liver. This finding highlights the need to control their element factors, which has been a challenge to healthcare systems. This is also attributable to the remarkable increase worldwide in obesity and DM type II. Along these lines, a collective worldwide effort by all healthcare authorities in this area is critically required. Moreover, the promotion of wellness and healthcare awareness are the core parameters needed to combat the expanding predominance of fatty liver.

Financial support and sponsorship

Conflicts of interest

There are no conflicts of interest.

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