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Assessment of Non-Alcoholic Fatty Liver Disease in Type 2 Diabetic Patients From South of Libya

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Abstract Non-alcoholic fatty liver disease (NAFLD) is emerging as one of the most common chronic liver diseases worldwide; however, no published work has been found about its prevalence among Libyan diabetics or general population. The present study aimed to determine the magnitude of NAFLD among Type 2 diabetic patients (DM) from south of Libya. Eighty- five (85) Type 2 diabetic patients (35 males & 50 females) attending Traghen Hospital (South of Libya) were utilized in this cross-sectional study. All the participants were examined for the presence of fatty liver via Ultrasonography. Biochemical parameters (Fasting Blood Sugar , Total Cholesterol , Triacylglycerol , Alanine aminotransferase , Aspartate aminotransferase) were also measured. Ultrasonography examination showed that 40% of Type 2 DM patients included in this study had non-alcoholic fatty liver disease; of whom 56%, 38%, and 6% had mild, moderate, and severe grade fatty liver respectively. Serum Triacylglycerol and fasting blood sugar were significantly higher (P = 0.007, 0.043 respectively) in type 2 DM patients with NAFLD compared with those without NAFLD; however, other biochemical parameters showed no significant differences (P>0.05). The distribution of NAFLD among Type 2 DM patients was significantly associated with duration of diabetes condition, and serum level of Triacylglycerol (P = 0.018, 0.033 respectively). We conclude that diabetic patients with hypertriglyceridemia, especially those with long duration of diabetes are highly advised to undergo ultrasonography examination for early detection of fatty liver disease.
Keywords: Diabetes mellitus, Fatty liver, Libya, NAFLD, Ultrasonography.

دراسة لمدى حدوث مرض الكبد الدهني غير الكحولي بين مرضى السكري(النوع الثاني) من الجنوب الليبي

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الملخص هدفت هذه الدراسة للاستقصاء حول مدى حدوث مرض الكبد الدهني غير الكحولي بين بعض مرضى السكري(النوع الثاني) من الجنوب الليبي. اجريت الدراسة على عدد 85 مريضا (35 ذكور & 50 اناث) من المصابين بالنوع الثاني بمرض السكري المترددين عل مستشفى تراغن التعليمي. تم اخضاع جميع المشتركين بالدراسة للفحص بالموجات فوق الصوتية للكشف عن الاصابة بمرض الكبد الدهني غير الكحولي وكذلك لقياس بعض المؤشرات الكيموحيوية ذات العلاقة وهي: الكولسترول الكلي، الجلسريدات الثلاثية، انزيم ناقلة امين الانين، انزيم ناقلة امين الاسبارتات، سكر ا لدم صائم. أظهرت نتائج الفحص بالموجات فوق الصوتية ان نسبة انتشار مرض الكبد الدهني غير الكحولي بين مرضى السكري المشتركين في الدراسة قد بلغت 40%؛ من بينهم 56% درجة خفيفة، 38% درجة متوسطة، و6% درجة شديدة. كما أظهرت النتائج وجود ارتباط معنوي بين نسبة انتشار مر ض الكبد الدهني وكل من مدة الاصابة بالسكري، ومستوى الجلسريدات الثلاثية في الدم(P = 0.018، 0.033 على التوالي) . يوصى جميع مرضى السكري ممن لديهم مستويات عالية من الجلسريدات الثلاثية في الدم، ومصابين بالسكري لفترات طويلة بالكشف المبكر عن الاصابة بالكبد الدهني.
الكلمات المفتاحية: الكبد الدهني، الكبد الدهني غير الكحولي، الموجات فوق الصوتية، مرض السكري، ليبيا.

Introduction

Fatty liver is characterized by excessive accumulation of ample fat in the cytoplasm of hepatic cells, that is exceeding 5 - 10% of liver weight [1]. When fatty liver occurs in people who are non-alcoholic or drink little alcohol, it is defined as non-alcoholic fatty liver disease (NAFLD) [2]. From histopathologic viewer NAFLD refers to a wide spectrum of liver disorders ranging from simple fatty liver (hepatic steatosis) to non-alcoholic steatohepatitis (NASH), which if not treated may progress to liver fibrosis, cirrhosis and occasionally hepatocellular carcinoma [3],[4],[5]. Clinical symptoms of NAFLD also varied from asymptomatic elevated liver enzymes levels [6], abdominal pain, hepatomegaly, to different signs of liver failure [7],[8]; it depends on the

duration of disease, degree of fatty liver, and the responsible cause [9].

The prevalence of NAFLD has doubled during the last 2 decades, it is emerging as one of the most common chronic liver diseases worldwide; It affects about 10-40% of the general population [10]. Prevalence rates of 24%, 20%, 22%, 37% and 10% have been reported in general population of America, Japan, Iran, Malaysia and Saudi Arabia respectively [8],[11],[12],[13],[14]. It is as high as 54.9%, 57.5 - 74% and 59.1% in obese children [15], obese adults [16] and patients with cardiovascular disease (CAD) [17] respectively. In addition, NAFLD is believed to be responsible for up to 90% of idiopathic abnormal liver function test results after exclusion of the common known causes [9].

Different studies have shown that old age, obesity, Type 2 diabetes mellitus (Type 2 DM), hyperlipidemia are the most risk factors for NAFLD [4],[13],[18],[19]. The exact etiology of NAFLD is not fully understood; however, its incidence is highly correlated with obesity, impaired blood glucose, insulin resistance (IR), dyslipidemia and hypertension [8],[17],[20]; all of these components are known as clinical characteristic of metabolic syndrome (MS) [15],[17],[21]. IR leads to an increase lipolysis of adopt fat in adipose tissue, synthesis of triacylglycerol and absorption of free fatty acids (FFA) by the liver cells [12]. IR was also found to be highly associated with accumulation of fat in the liver, pancreas, and subsequent development of NAFLD [12],[15],[20],[22],[23]. Thus, IR seems to predispose lipid accumulation within the liver [20], and play a pathogenic role in the development of NAFLD [23]. On the other hand, it has been reported that the function of some organs including pancreas, muscles and adipose tissues were affected by NAFLD, which may lead some researchers to believe that IR is not a cause but a result of NAFLD [24]. Aside from the liver, all of the above mentioned organs (i.e. pancreas, muscles and adipose tissues) are involved in the metabolism processes of different food stuff and play a role in the regulation of blood sugar level, which may explain in part the interrelation of NAFLD with diabetes, IR and MS.

It is not surprising that Type 2 DM and NAFLD frequently coexist because each of those disorders share the same components of metabolic syndrome [9]. Previous studies have shown that 30 – 48.7% of patients with NAFLD were diabetic [8],[22],[25],[26],[27]; however, 28 –86% of Type 2 DM patients had NAFLD [12],[19],[23],[28]; and 13% showed signs of fibrosis and cirrhosis in their sonographic examination [19]. There was also evidence that hepatocellular carcinoma was twice prevalent in Type 2 DM patients with NAFLD as compared with non-diabetic [5]. An association of NAFLD in Type 2 DM with incidence of CVD has also been reported [9]. In addition, the occurrence of fatty infiltration and severity of fatty liver were found be positively correlated with FBS and duration of Type 2 DM [4],[29], whereas hepatomegaly was significantly higher in Type 2 DM with NAFLD than non-diabetic patients with NAFLD [30]. It is obvious that the occurrence of NAFLD in Type 2 DM is a risk factor for more diabetic complications and liver-related deaths in diabetic patients, whereas Type 2 DM is a risk factor for worsen liver disorders and increasing mortality rates in NAFLD patients [9].

In 2019, approximately 463 million adults were living with diabetes all over the world. In Libya, the diagnosed number of Type 2 DM was around 405,000 patients, this number expected to exceed 600,000 by 2030 [31]. Despite strong relation between NAFLD and Type 2 DM was well documented, there was no published work found on the prevalence of NAFLD among Libyan diabetics or general population; and most of DM patients in the local community are unaware and rarely examined for fatty liver. Thus, the present study aimed to determine the magnitude of NAFLD among Type 2 DM patients from south of Libya, and to raise awareness to the local health authority about this existing health problem.

MATERIALS AND METHODS

Study Design: Eighty-five (85) Type 2 diabetic patients (35 males & 50 females) attending the medical outpatient clinic of Traghen Hospital (South of Libya) during the period from 25 March to 15 September 2018, were enrolled in this cross-sectional study. The age ranged from 16-85 years old. Questionnaire was used to gather the personal and clinical history of each participant.

Methods:

1- All the participants were examined for the presence of fatty liver via ultrasonography instrument (Philips) using abdominal probe; liver size, structure, echogenicity and penetration of the ultrasound beam was evaluated. Based on that criteria, fatty livers were classified into 3 grades: grade I (simple); grade II (moderate); grade III (severe) [32].

2- After overnight fasting, venous blood samples (10ml) were collected from each participant and used for biochemical analysis. Fasting blood sugar (FBS), serum (Total cholesterol (TC), Triacylglycerol (TAG), Alanine aminotransferase (ALT), Aspartate aminotransferase (AST) were determined by commercial kits (BIOMAGHREB, Tunisia); according to the manufacturer's instructions. Absorbance of the samples were measured using spectrophotometer (Biosystem) instrument at the corresponding wavelengths.

3- Statistical analysis: Data was statistically analyzed using the Statistical Package for Social Sciences (SPSS, version 24., Chicago, IL, USA). Quantitative values were given as Mean ± standard deviation and compared with two samples independent t-test; categorized data were expressed as percentage value (%) and compared with proportion equality test. Qualitative data were compared with chi-square test; Binary variables were analysed with logistic regression. For all analysis, the significant level was determined to be 5% ($P < 0.05$).

4- Normal values: according to manufacturer's recommendations normal values were considered as follows:

Total cholesterol : 140-220mg/dl; Triacylglycerol : 60-165 mg/dl for men, 40-140 mg/dl for women; Alanine aminotransferase : 22-29U/L for men, 16-31 U/L for women; Aspartate aminotransferase : 19-38U/L for men, 16-31U/L for women; Fasting blood sugar : 60-128mg/dl.

RESULTS AND DISCUSSION

1.Results

The present cross-sectional study is consisting of Eighty-five (85) Type 2 diabetic patients (35 males and 50 females), aged between 16 to 85 years old (mean 65.7 ± 12.4).

As presented in Table 1, ultrasonography examination showed that 34 (40%) of Type 2 DM patients included in this study had non-alcoholic fatty liver disease (NAFLD), of whom 19(56%), 13(38%), and 2(6%) had mild, moderate, and severe grade fatty liver respectively; figure 1,2,3. Fifty- one (60%) of Type 2 DM patients showed no signs of fatty liver in their ultrasonography images. According to gender criteria, NAFLD was observed in 17(48.6%) and 17(34%) of diabetic males and diabetic females respectively (P = 0.261). Results also showed that the distribution of NAFLD among diabetic patients according to their age brackets were as follows: 15/34 (44.1%) were more than 60 years old, 17/45 (37.8%) aged between 40 and 60 years, and 2/6 (33.3%) were less than 40 years old (P = 0.801). On the other hand, Sixty-two (62%) (21/34) of NAFLD cases were observed in Type 2 DM patients who had diabetes for 5 years or above, whereas, 13/34 (38%) of cases were observed among those who are diabetic for less than 5 years. Significant statistical correlation was found between the distribution of NAFLD and the duration of diabetes disease (P = 0.018). It is noteworthy that 76 (89.4%) of the diabetic patients, and 25 (73.5%) of those patients with NAFLD had no idea about fatty liver disease.

The mean liver size according to ultrasonography evaluation were 14.2 ± 1.1cm in Type 2 DM patients with NAFLD compared to 13.4 ± 0.9 cm in Type 2 DM patients without NAFLD. Significant differences (P = 0.002) existed between DM patients within NAFLD group and DM patients without NAFLD group (Table 2). The mean liver size was also increased in relation to fatty liver severity, the mean values were 13.8, 14.4 and 17 cm among mild, moderate, and severe grade groups respectively, with significant differences (P = 0.039) between the moderate and mild groups (Table 3). Hepatomegaly (liver size > 15cm)[30] was seen in 10 (29.4%), 6 (11.7%) of DM patients with NAFLD, DM patients without NAFLD respectively (P=0.079) (Table 2). The distribution of hepatomegaly among Type 2 DM patients with NAFLD according to the severity of fatty liver was 3/19 (15.8%), 5/13 (38.5%), and 2/2 (100%) of the mild, moderate, and severe groups respectively (P = 0.289)(Table 3).

Biochemical analysis showed that the mean values of serum total cholesterol (TC), alanine aminotransferase (ALT), aspartate aminotransferase (AST) of Type 2 DM patients with NAFLD were not significantly higher than those without NAFLD (P = 0.079, 0.053, 0.067 respectively). However, the mean values of serum triacylglycerol (TAG) and fasting blood sugar (FBS) showed high significant differences (P = 0.007, 0.043 respectively) between the two diabetic groups (Table 2). Hypercholesterolemia and hypertriglyceridemia were present in 9/34 (26.4%) and 15/34 (44.1%) of Type 2 DM patients with NAFLD; and in 3/51 (5.9%) and 10/51 (19.6%) of Type 2 DM patients without NAFLD respectively (P = 0.019, 0.029 respectively). Values of both transaminase enzymes (ALT & AST) above the normal ranges were seen in 5/34 (14.7%) of Type 2 DM patients with NAFLD; whereas only 2/51 (3.9%) and 3/51 (5.9%) of Type 2 DM patients without NAFLD showed abnormal high values of ALT and AST respectively (P = 0.17, 0.324 respectively). AST/ALT ratio < 1 was observed in 14/34 (41.2%) of Type 2 DM patients with NAFLD, 20/51 (39.2%) of Type 2 DM patients without NAFLD (P = 1.00). Values of FBS above the normal levels were observed in 26/34 (76.5%) of Type 2 DM patients with NAFLD and in 31/51 (60.8%) of Type 2 DM patients without NAFLD (P= 0.203)(Table 2). Based on logistic regression analysis, significant statistical association was found between the distribution of NAFLD among diabetic patients and serum level of TAG (P = 0.033); however, serum levels of TC, ALT, AST, and FBS showed no significant effect (P = 0.62, 0.168, 0.314, 0.431 respectively)(Table 4).

As shown in Table 3, the mean values of serum TC, ALT, AST, and FBS of the moderate fatty liver group were not significantly higher (P = 0.212, 0.813, 0.398, 0.798 respectively) compared with the group with mild fatty liver; However, only the mean value of serum TAG of moderate fatty liver group was significantly higher than that of the mild group (P = 0.01).

Hypercholesterolemia was observed in 3/19 (15.8%) of patients with mild grade and in 5/13 (38.5%) of patients with moderate grade (P = 0.289); Hypertriglyceridemia was observed in 6/19 (31.6%) of patients with mild grade compared to 9/13 (69.2%) of patients with moderate grade (P = 0.082). Hypertransaminasemia (ALT & AST) were seen in 2/19 (10.5%) of patients with mild grade and in 3/13 (23.1%) of patients with moderate grade (P = 0.642). AST/ALT ratio < 1 was observed in 9/19 (47.4%), and in 5/13 (38.5%) of patients with mild and moderate grade respectively (P = 0.891). Hyperglycemia was observed in 14/19 (73.7%) of patients with mild grade and in 10/13 (76.9%) of patients with moderate grade (P = 1.00) (Table 3). Logistic regression analysis revealed that significant association (P = 0.008) was existed between serum TAG level and severity of fatty liver; however, serum TC, ALT, AST, and FBS showed no significant effect (P = 0.176, 0.39, 0.768, 0.338 respectively)(Table 5). It is important to state that severe grade group was statistically ignored because of its small size, which comprises of only 2 participants.

Fig. 1: mild grade fatty liver.

Fig. 3: sever grade fatty liver

Fig. 2: moderate grade fatty liver.

Table 1: General and Clinical Characteristics of Type 2 Diabetic Patients. Data are expressed in Percentage Value (%), and compared with chi square test.

Variables		Diabetic Patients(n=85)			Chi square	
		With NAFLD 34(40%)	Without NAFLD 51(60%)	Total 85(100%)	X^2	P value
Age (year)	> 60	15(44.1%)	19(55.9%)	34(40%)	0.444	0.801
	40-60	17(37.8%)	28(62.2%)	45(52.9%)		
	< 40	2(33.3)	4(66.7%)	6(7.1%)		
Gender	Male	17(48.6%)	18(51.4%)	35(41.2%)	1.265	0.261
	Female	17(34%)	33(66%)	50(58.8%)		
Duration of Diabetes (year)	≥ 5	21(55.3%)	17(44.7%)	38(44.7%)	5.570	0.018*
	< 5	13(27.7%)	34(72.3%)	47(55.3%)		

*P value < 0.05 was considered statistically significant.

2.Discussion

Non-alcoholic fatty liver disease (NAFLD) is one of the chronic liver diseases that is prevalent among diabetic and the general populations all over the world. The spectrum of NAFLD includes simple fatty liver and NASH, which if not treated may develop into liver fibrosis, cirrhosis and finally liver failure [33]. The prevalence of NAFLD is seen increasing along with growing incidence of diabetes mellitus and other associated disorders such as obesity and metabolic syndrome.

Table 2: Ultrasound Measurements and Biochemical Parameters of Type 2 Diabetic Patients. Values are expressed as mean ± SD /or Percentage Value. Data are compared with two samples independent t-test/ or proportional equality test.

Variables		Diabetic Patients (n=85)		
		With NAFLD(n=34)	Without NAFLD(n=51)	P value
Liver size(cm)		14.2±1.1	13.4±0.9	[a]0.002**
TC (mg/dl)		181.1±42.2	166.8±31.5	[a]0.079
TAG (mg/dl)		156.4±40.7	131.5±40.1	[a]0.007**
ALT (U/L)		21.3±8.7	18.3±5.6	[a]0.053
AST (U/L)		22.1±8.9	19.0±6.1	[a]0.067
FBS (mg/dl)		175.9±54.7	161.7±74.2	[a]0.043*
Hepatomegaly (Liver size >15[30])		10 (29.4%)	6 (11.7%)	[b]0.079
Hypercholesterolemia		9 (26.4%)	3 (5.9%)	[b]0.019*
Hypertriglyceridemia		15 (44.1%)	10 (19.6%)	[b]0.029*
Hypertransaminemia	ALT	5 (14.7%)	2 (3.9%)	[b]0.170
	AST	5 (14.7%)	3 (5.9%)	[b]0.324
AST/ALT ratio	<1	14 (41.2%)	20 (39.2%)	[b]1.00

Hyperglycemia	26 (76.5%)	31(60.8%)	[b]0.203

[a] Two samples independent t- test; [b] proportional quality test; *P value < 0.05 was considered statistically significant.

Table 3: Ultrasound Measurements and Biochemical Parameters of Type 2 Diabetic Patients with NAFLD According to Ultrasonography Grades. Values are expressed as mean ± SD/ or Percentage Value. (%).Data are compared with two samples independent t-test / or proportional equality test.

Variables		Diabetic patients with NAFLD(n=34)		
		Mild grade 19(56%)	Moderate grade 13(38%)	P value
Liver size (cm)		13.8±0.8	14.2±0.7	[a]0.039*
TC (mg/dl)		170.6±37.3	187.6±36.5	[a]0.212
TAG (mg/dl)		142.3±32.6	179.6±44.7	[a]0.010*
ALT (U/L)		20.5±8.1	20.9±6.9	[a]0.813
AST (U/L)		19.8±5.4	22.2±9.7	[a]0.398
FBS (mg/dl)		171.4±52.6	176.2±49.5	[a]0.798
Hepatomegaly (Liver size >15[30])		3(15.8%)	5(38.5%)	[b]0.289
Hypercholesterolemia		3(15.8%)	5(38.5%)	[b]0.289
Hypertriglyceridemia		6(31.6%)	9(69.2%)	[b]0.082
Hypertransaminasemia	ALT	2(10.5%)	3(23.1%)	[b]0.642
	AST	2(10.5%)	3(23.1%)	[b]0.642
AST/ALT ratio	<1	9(47.4%)	5(38.5%)	[b]0.891
Hyperglycemia		14(73.7%)	10(76.9%)	[b]1.00

[a] Two samples independent t- test ;[b] proportional quality test; *P value < 0.05 was considered statistically significant.

Table 4: Logistic regression analysis of biochemical parameters associated with NAFLD; (Dependent variable: existence of fatty liver).

Variable	Regression coefficient B	Standard error	Wald statistic	P value	Odds Ratio (OR)
TC	0.004	0.008	0.247	0.620	1.004
TAG	0.016	0.007	4.564	0.033*	1.016
ALT	0.053	0.038	1.901	0.168	1.054
AST	0.040	0.039	1.014	0.134	1.040
FBS	0.003	0.004	0.620	0.431	1.003
Liver size	0.526	0.283	3.457	0.063	1.692
Constant	-12.860-	3.995	10.364	0.001	0.000

*P value < 0.05 was considered statistically significant.

Table 5: Logistic regression analysis of biochemical parameters associated with NAFLD; (Dependent variable: fatty liver grade).

Variable	Regression coefficient B	Standard error	Wald statistic	P value	Odds Ratio (OR)
TC	-0.029-	0.022	1.827	0.176	0.971
TAG	0.076	0.029	7.017	0.008*	1.079
ALT	0.069	0.080	0.737	0.390	1.071
AST	-0.034-	0.114	0.087	0.768	0.967
FBS	0.012	0.013	0.919	0.338	1.012
Liver size	2.966	1.209	6.015	0.014*	19.406
Constant	-51.997-	19.387	7.193	0.007	0.000

*P value < 0.05 was considered statistically significant.

Searching through previous published studies that could reveal data about the prevalence of NAFLD among Libyan diabetics or general populations were found to be limited; thus the current cross-sectional study was designed to assess the distribution of NAFLD among Type 2 diabetic patients from south of Libya. In this study, ultrasound instrument was used for the diagnosis of fatty liver and its degree of severity because it was a non-invasive tool, with a sensitivity of 89-94% and a specificity of 93-100% in detecting fatty liver [8],[28],[34], and it was recommended to be used for epidemiological studies for investigation of fatty liver in diabetic, obese and general population [29]. The obtained data showed that 40% of the studied Type 2 DM patients had NAFLD according to sonographic examination. This prevalence rate was within the range that was reported in diabetic patients which have ranged from 28-86% [12],[19],[23],[28]. A prevalence rate of 75% was reported in American Type 2 diabetic patients [28]. In an Iraqi study, NAFLD was seen in 79% of Type 2 diabetic patients [19]. Also in the same country, another study showed that 86% of Type 2 diabetic patients had NAFLD by sonographic examination [29]. Our findings were lower than those results however, it supports the notion that NAFLD is one of the most common complications and constitute a health care problem in diabetic patients. The prevalence rate in males was higher than females; Similar studies showed that men are more likely to have NAFLD than women [14],[19],[29],[35], which is consistent with our results. In the current study, the prevalence of NAFLD had a significant positive association with the duration of diabetes condition which is similar to the finding of Al-Habbo, et al. [29]. In contrast, our data showed no significant association with age which is in agreement with the findings of Khammas et al. [14] and Albayati & Sabbar [19] who showed no significant differences in age between the patients with NAFLD and those without NAFLD.

As expected, the mean for liver size as well as hepatomegaly were significantly higher in Type 2 DM patients with NAFLD compared with those

without NAFLD; and both variables were increased along with fatty liver severity. That is in agreement and support the results of some previous studies [30],[35].

Regarding biochemical parameters (i.e. TC, TAG, ALT, AST and FBS), when comparing patients with NAFLD to those without NAFLD, all parameters revealed no significant differences except TAG and FBS which was significantly higher in patients with NAFLD. Hypercholesterolemia, hypertriglyceridemia, and hypertransaminaesemia (ALT & AST) were seen in 26.4%, 44.1%, and 14.7% of DM patients respectively; moreover, 41.2% showed AST/ALT ratio of less than 1. Statistically, there were no significant differences between the means of serum TC, ALT, AST and FBS levels when the mild grade group and moderate grade group were compared, however only TAG levels showed significant difference. The prevalence of NAFLD and also NAFLD grades were significantly associated with serum TAG levels, however other biochemical variables showed no significant association. Some previous studies showed significant differences of mean values of serum TC, TAG, ALT, AST and glucose in patients with NAFLD compared to the control subjects [18],[19],[22]. On the other hand, no significant differences of mean values of serum TC, ALT, AST among NAFLD grades [14],[30],[36],[37]; and no significant association of mean values of serum TC, AST, ALT, and FBS with NAFLD grades had also been shown previously [13],[15],[18],[37]. Like our results some researchers showed a significant association of NAFLD and fatty liver severity with the mean values of serum TAG [15],[18],[37]. Our findings are consistent with and support all of those reports. In contrast to our results significant correlation of mean values of serum ALT, FBS [15], glucose [13] TC, ALT, AST [38] with the severity of fatty liver had been reported.

In addition to hepatomegaly, the most common biochemical features of NAFLD which had been noticed in the current study and also had been reported by some previous studies were increases in the levels of serum TC, TAG, ALT and AST values with AST/ALT ratio < 1 [22],[35],[39]. Most of these findings are clinical and biochemical signs of NASH which may not be detectable by ultrasound examination. The distribution of hypertransaminasemia was seen in 14.7% of our DM patients with NAFLD which had been shown to be ranged from 6-22% in similar previous works [19],[37]. In the current study the compatibility between hypertransaminasemia and the existence of NAFLD among DM patients did not exceed 20% of the total participants, however hypertriglyceridemia was more common and significantly associated with prevalence of NAFLD; that means ALT and/or AST may not a good biochemical signs of NAFLD whereas elevation of serum TAG could be much reliable biochemical indicator for the presence of fatty liver. This explanation is supported by the findings of some other researchers [9],[18],[37].

Conclusion

After thorough search for similar studies, it can be concluded that this is the first study conducted on the prevalence of NAFLD among Libyan diabetic patients. Although, this initial study employed a relatively limited number of participants, it showed that NAFLD existed in about 40% of the studied sample; which supports the notion that NAFLD is one of the common disorder among diabetic patients. Moreover, hypertriglyceridemia, and long duration of diabetes condition were found to be the most common risk factors. It therefore, recommended that diabetic patients with hypertriglyceridemia, especially those with long duration of diabetes are highly advised to undergo ultrasonography examination for the early detection of fatty liver disease. further study with large sample size is recommended to verify these findings.

Abbreviations

ALT: alanine aminotransferase, AST: aspartate aminotransferase, DM: diabetes mellitus, FBS: fasting blood sugar, NAFLD: non-alcoholic fatty liver disease, TAG: triacylglycerol, TC: total cholesterol.

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References

[1]- Ratziu V., Bellentani S., Cortez-Pinto H., Day C., Marchesini G., (2010): "A position statements on NAFLD/ NASH based on the EASL 2009 special conference". J Hep., 53(2): 372-384.

[2]- Younossi Z., Gramlich T., Matteoni C., Boparai N., et al., (2004): " Non-alcoholic fatty liver disease in patients with type 2 diabetes". Cli Gastro Hep., 2(3): 262-265.

[3]- Targher G., Day C., Bonora E., (2010): "Risk of cardiovascular disease in patients with Non-alcoholic fatty liver disease". New Eng J Med., 363(14): 1341-50.

[4]- Daboul M., (2010). " A study of ALT elevation in association with triglycerides, cholesterol and glucose elevation in human serum". J Arab Board H Spec., 11(2): 64-70.

[5]- Kikuchi L., Oliveira C., Carrilho F., (2014): "Nonalcoholic fatty liver disease and hepatocellular carcinoma". Bio Med Res Int.,Http://dx.doi.org/10.1155/2014/106247 .

[6]- Dobhi A., Brahmbhatt K., Pandya T., (2008): " Non-Alcoholic fatty liver disease". JIACM., 9(1): 36-41.

[7]- Qian Y., Fan J., (2005): "Obesity, fatty liver and liver cancer". Hep Pan Dis Int., 4(2): 173-177.

[8]- Qari F., Al-Ghamdi A., (2005): "Fatty liver in overweight and obese patients in western part of Saudi Arabia". J Bah Med Soc., 17(2): 95-99.

[9]- Obika M., Noguchi H., (2012): "Diagnosis and evaluation of Nonalcoholic fatty liver disease". Exp Dia Res., http://dx.doi:10.1155/2012/145754.

[10]- Cohen j., Horton J., Hobbs H., (2011): "Human fatty liver disease; old questions and

new insights". Science 332(6037): 1519-23. doi:10.1126/science.1204265.
[11]- Agrawai S., Bonkovsky H., (2002): "Manegment of Nonalcoholic steatohepatitis". J Cli Gastr., 35: 253-261.
[12]- Akha O., Fakheri H., Abadi R., Mahdavi M., (2010): "Evaluation of the correlation between Non-alcoholic fatty liver disease and insulin resistance". I Red Cre Med J., 12(3): 282-286.
[13]- Birjandi M., Ayatollahi S., Pourahmad S., Safarpour A., (2016): "Prediction and diagnosis of Non-alcoholic fatty liver disease (NAFLD) and identification of its associated factors using the classification tree method". I Red Cre Med J., 18(11): e32858. doi: 10.5812/ircmj.32858.
[14]- Khammas A., Mohammed S., Abu-Hassan H., Shahar H., et al., (2018): "Factors associated with nonalcoholic fatty liver disease grades detected by ultrasound at a screening center in Klang Valley, Malaysia". J Fac Med Bagh., 60(1): 32-37.
[15]- Saki F., Karamizadeh Z., (2014): " Metabolic syndrome, insulin resisitence and fatty liver in obese Iranian children". I Red Cre Med J., 16(5): e6656. diol:10.5812/ircmj.6656.
[16]- Angulo P., (2002): " Medical progress: non-alcoholic fatty liver disease". N Eng J Med., 346(16): 1221-31.
[17]- Tavakolit T., Kazemi T., Mollaei H., Salmani F., et al., (2018): " The relationship between the prevalence of Non-alcoholic fatty liver disease(NAFLD) with severity of coronary artery disease (CAD) in patients undergoing coronary artery angiography; A cross-sectional study". I Red Cre. Med J., 20(6): e58369. dio:10.5812/ircmj.58369.
[18]- Borai I., Shaker Y., Kamal M., Ezzat W., et al., (2018): "Association of nonalcoholic fatty liver disease grades with the plasma cell antigen-1 (PC-1) gen polymorphism". E J Med H Gen., 19: 241-246.
[19]- Albayati S., Sabbar R., (2018): "Prevalence of Nonalcoholic fatty liver disease in type 2 diabetic Iraqi patients". J Arab Boa Hea Special., 19(1): 11-18.
[20]- Mekawy A., Ahmed H., Mohamed W., Yehia Y., (2015): "Association of insulin resistance with alanine aminotransferase activity in patients with Non-alcoholic fatty liver disease". Assiut Med J., 39(2): 63-70.
[21]- Kotronen A., Yki-Jarvinen H.,(2008): " Fatty liver A novel component of the metabolic syndrome". Artr Throm Vasc Biol., 28: 27-38.
[22]- Pate N., Peterson M., Lin G., Feldstein A., et al., (2013): "Insulin resistance increases MRI-estimated pancreatic fat in Nonalcoholic fatty liver disease and normal controls". Gastr Res Prac., doi.org/10.1155/2013/498296.
[23]- Mazza A., Fruci B., Garinis G., Giuliano S., et al., (2012): "The role of metformin in the management of NAFLD". Exp Diab Res., doi:10.1155/2012/716404.
[24]- Kim M., Bae J., Kim T., Park J., Ahn Y., (2012): "Role of transcription factor modifications in the pathogenesis of insulin resistance". Exp Diab Res., doi:10.1155/2012/716425.
[25]- Younossi M., McCullough J., Ong P., Barnes S., et al., (2004): "Obesity and non-alcoholic fatty liver disease in chronic hepatitis". C J Cli Gastro., 38: 705-09.
[26]- Nail A., Gadour M., Kair M., Salma M., et al., (2006): "Fatty liver disease in Sudan is not alcohol related". Sud J M S., 1(2): 97-102.
[27]- Hatziagelaki E., Karageorgopoulos D., Chounta A., Tsiavou A., et al., (2012): "Predictors of impaired glucose regulation in patients with Non-alcoholic fatty liver disease". Exp Diab Res., doi:10.1155/2012/351974.
[28]- Jick S., Stender M., Myers M., (1999): "Frequency of liver disease in type 2 diabetic patients treated with oral anti diabetic agents". Diab Care, 22: 2067-2071.
[29]- Al-Habbo D., Khalaf Y., Alkhiat N., Habash A.,(2009): "The prevalence of fatty liver disease among diabetics in Mosoul". Ann Coll Med., 35(1): 50-57.
[30]- El-Sayed S., El-Folly R., Ahmed A.,(2014): "Assessment of the co-incidence between nonalcoholic fatty liver disease and carotid atherosclerosis". J Egy Soc Par., 44(1): 187-195.
[31]- IDF:http://www.idf.org/aboutdiabetes/what-is-diabetes/facts-figures.html.
[32]- Khov N., Sharma A., Riley T., (2014): "Bedside ultrasound in the diagnosis of nonalcoholic fatty liver disease". World J Gastr., 20(22): 6821-25.
[33]- Neuschwander-Tetri B., (2017): "Non-alcoholic fatty liver disease" . B M C Med., 15: 1-6.
[34]- Jorgensen M., Roberta N., (2003): "Non-alcoholic fatty liver disease". Gastr Nur., 26: 150-154.
[35]- Niaz A., Ali Z., Nayyar S., Fatima N., (2011): "Prevalence of NAFLD in healthy and young male individuals". Int Sch Res Net Gastr., doi:10.5402/2011/363546.
[36]- Javadi L., Ghavami M., Khoshbaten M., Safaiyan A., et al., (2017): " The effect of probiotic and / or prebiotic on liver function tests in patients with Nonalcoholic fatty liver disease; A double blind randomized clinical trial". I Red Cre Med J., 19(4): e46017.
[37]- Abangah G., Yousefi A., Asadollahi R., Veisani Y., et al., (2014): " Correlation of body mass index and serum parameters with ultrasonographic grade of fatty change in Non-alcoholic fatty liver disease". I Red Cre Med J., 16(1): e12669.
[38]- Raffeey M., Mortazavi F., Mogaddasi N., Robabeh G., et al., (2009): "Fatty liver in children". Ther Cli Risk Manag., 5(2): 371-374.
[39]- Akbar D., Kawther A., (2006): "Non-alcoholic fatty liver disease and metabolic syndrome". Med Sci Mon., 12(1): 23-26.