Prevalence and risk factors of non-alcoholic fatty liver disease in primary health care centers among subjects examined by abdominal ultrasound in Qatar: A case-control study

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Abstract

Background and study aim: Non-alcoholic fatty liver disease (NAFLD) is a cause of chronic liver disease and an important public health problem. The prevalence of NAFLD in patients with components of metabolic syndrome is high. Ultrasound is a non-invasive, available screening method to detect and follow up NAFLD with treatment options. The aim of this study is to explore NAFLD and its association with metabolic syndrome and other risk factors. It also aimed to identify a cohort of patients with fatty liver to perform a follow-up study.

Patients and methods: This is a retrospective case-control study nested in a cross-sectional design for NAFLD patients, diagnosed by ultrasonography. After assessing the size of cases, we initiated a case control study.

Results: NAFLD is prevalent in the study population (58.5%). The prevalence and risks were high in males (69.7% and 1.35) and in the 50-59 years age group (74.2% and 2.08 respectively). The prevalence and risk increased with increase in weight with the highest values in Grade III obese measuring 85.9% and 3.39, respectively. The difference in prevalence or risk between Qatari and expatriates or smoker and non-smoker patients was non-significant. The prevalence of NAFLD in cases of Metabolic syndrome was 81.7% and the risk was 1.89 and the prevalence and risk increased with increased number of metabolic syndrome components (the prevalence increased from 31.3% in 1 component to 90.2% in 5 components, and the risk increased from 1.71 in 1 component to 4.95 in 5 components).

Conclusion: Ultrasonography is the reference test for the detection of fatty liver at the population level in primary health care centers. NAFLD is a prevalent health problem in Qatar and is associated with metabolic syndrome and its components. A multifactorial intervention approach on the risk factors can restrict the appearance of more severe hepatic complications.

Key words: NAFLD, ultrasound, prevalence, risk factors, Qatar.

Introduction

Non-alcoholic fatty liver disease (NAFLD) is an important public health problem and a cause of chronic liver disease [1]. It is considered the liver disease component of metabolic syndrome (MetS) [2]. It has two clinical entities known as nonalcoholic fatty liver (NAFL) and nonalcoholic steatohepatitis (NASH) [3]. NAFL is a benign, non-progressive clinical entity, while NASH can progress to cirrhosis or even hepatocellular carcinoma [4]. Diagnosis of NAFLD prevalence is based on: (1) nonalcoholic subjects (alcoholic liver disease occurs when daily alcohol consumption exceeds 20 g in women or 30 g in men), with lower levels of these alcohol consumptions, (2) patients with hepatic steatosis diagnosed by histology or imaging modalities, and (3) appropriate exclusion of other liver diseases such as chronic viral hepatitis, steatogenic medications, autoimmune hepatitis, hemochromatosis and Wilson's disease [2,4]. The prevalence of NAFLD is high with components of MetS, type 2 diabetics, and obese patients [5,6]. Most patients with NAFLD are asymptomatic, and diagnosis is predicted by an increased level of transaminases during a health checkup. Sometimes, accidental discovery of hepatomegaly or suggestive changes of fatty liver by other imaging modalities indicates NAFLD. However, the final diagnosis should be confirmed by liver biopsy [7,8]. Obesity has reached epidemic levels and is considered one of the priorities for intervention. Overweight or obese NAFLD patients are more likely to develop steatohepatitis and severe forms of liver disease [7]. Early detection of NAFLD is helpful and important for early intervention, thereby, targeting the associated factors and preventing the evolution of the disease to more severe forms [4]. Qatar occupies a high rank in the prevalence of obesity [9]. The prevalence of NAFLD using ultrasound in Italy was around 25%, and most of these cases had an association with features of MetS [10]. Ultrasound is a widely available, non-invasive screening method to detect NAFLD and help clinicians to select outpatients at highest risk. Thereby, ultrasonography improves diagnostic assessments and follow-up with treatment options [11,12].

The aim of this study is to explore the prevalence rate of NAFLD and its association with MetS and other risk factors. The objectives included (1) Determining the prevalence rate of fatty liver disease among patients undergoing abdominal ultrasound in primary health care settings in Qatar, (2) Study the association of demographic variables (age, gender, and nationality) and MetS with NAFLD, (3) Identify a cohort of patients with NAFLD to perform a follow-up study.

Patients and Methods

This is an observational case-control study nested in a cross-sectional design for all subjects with a valid ultrasound of the liver to verify the presence of fatty liver. Nested in the first design is another case-control sub-study. For the comparative study, only subjects that satisfied the requirements of completeness for defining MetS were included. After assessing the size of case groups, we drew an age- and gender-matched control group.

The inclusion criteria for the cross-sectional part of the study were all adult patients aged between 18 and 70 years with an abdominal ultrasound examination performed for any reason in PHCC centers in Qatar. Valid ultrasound scan results available on the official electronic medical record system (RIS PACS system) during the study period from 1st January 2018 to 31st December 2018 were reviewed. The case-control study part included subjects with complete information for lipid profile, blood pressure (or history of hypertension) and BMI. Fasting blood sugar (or a documented diagnosis of diabetes) was needed but was replaced by HbA1c when not available.

The exclusion criteria included documented alcohol intake, presence of chronic liver disease as hepatitis B and C, secondary causes of fatty liver (medications, human immunodeficiency virus, gastrointestinal by-pass surgery) and history of liver surgery.

We analyzed the whole population of study (3,853 subjects after exclusion of 81 subjects from the total number of 3,934 subjects according to the inclusion and exclusion criteria). The criteria of American Gastroenterology Association for Diagnosis of NAFLD and its grade were used in the study. We classified the study population into cases and non-cases. The prevalence rate of NAFLD was calculated at this stage stratified by age, gender, and nationality. After examining the age and gender frequency distribution of cases, we selected the control group from the population with a negative ultrasound diagnosis of NAFLD using a group age and gender matching technique. Subjects were considered as cases if they had fatty liver according to the ultrasound standard criteria of the American Gastroenterology Association. We reviewed all ultrasound images and reports. Fatty liver was diagnosed in the presence of one of the following standards [13]:

NAFL Grade I- Minimal diffuse rise in the fine echoes of the liver that are bright compared to the cortex of the kidney and normal appearance of diaphragm and intra hepatic vessel borders (Image 1).

Abbreviations: ALT, alanine aminotransferase; AST, aspartate aminotransferase; BMI, body mass index; CI, confidence interval; EMR, Electronic Medical Records; FLD, fatty liver disease; HDL, high-density lipoprotein; HS, hepatic steatosis; LDL, low-density lipoprotein; MetS, metabolic syndrome; NAFL, nonalcoholic fatty liver; NAFLD, nonalcoholic fatty liver disease; NASH, nonalcoholic fatty steatohepatitis; NCEP ATP III, National Cholesterol Education Program Adult Treatment Panel III; PHCC, Primary Health Care Corporation; SH, steatohepatitis; T2DM, type 2 diabetes mellitus.

NAFL Grade II- Moderate diffuse rise in the fine echoes with slight diminished visualization of the intrahepatic vessels and diaphragm (Images 2, a, b).
NAFL Grade III- Noticeable increase in fine echoes with poor or no visualization of intrahepatic vessels and diaphragm and poor penetration of posterior segment of the right lobe of the liver (Image 3).

We calculated the one-year prevalence rate of NAFLD by this formula:

Prevalence = Count of subjects with a positive diagnosis of NAFLD during the study period ÷ Count of subjects with a valid ultrasound scan during the study period×100.

We evaluated the following variables requested from HIM department in subjects fulfilling the inclusion criteria as follows:(1) The abdominal ultrasound scan, (2) Socio-demographic variables: Age, gender, and nationality, (3) Personal history of liver disease or liver surgery, (4) The BMI measurement, (5) Presence of Type II diabetes mellitus, dyslipidemia, or arterial hypertension, (6) A history of alcohol intake, (7) Smoking habit, (8) History of drug used during previous six months, (9) Arterial blood pressure measurement, (10) Blood tests included measurement of hemoglobin, urea, creatinine, glucose, HbA1c %, lipid panel (cholesterol, triglycerides, HDL, LDL), liver function tests (ALT, AST, Alkaline Phosphatase, Albumin, Total protein, Total Bilirubin, including hepatitis markers (hepatitis B surface antigen virus and hepatitis C virus antibodies), (11) Diagnosis of MetS: Adapted national cholesterol education program adult treatment panel III (NCEP ATP III) component definitions were used for the study [14]. MetS is present if three or more of the following five criteria are met (or medication was taken to control them). Insulin Resistance (Serum Fasting Glucose≥100 mg/dl or HbA1c≥5.56) or a diagnosis of T2DM); blood pressure >130/>85 mmHg or a diagnosis of hypertension; fasting triglyceride >150 mg/dL (>1.7mmol/L); low, high-density lipoprotein (HDL) cholesterol (<40 mg/dL (<1.04 mmol/L) for males, <50 mg/dL (<1.3 mmol/L) for females; and waist circumference over 102 cm (40 inches) in men and 94 centimeters (37 inches) in women or obesity (BMI >30 [kg/m2]) [15].

Statistical analysis was computed using IBM SPSS version 23 computer software. A descriptive frequency distribution was done first. Assessment of the association between NAFLD and each of age group, gender, and nationality was done. Similarly, we used the statistical method to explore the association between NAFLD and each component of MetS.

Results

The frequency distribution of study population by selected socio-demographic variables is mentioned in Table 1. The age groups of the study population were as follows: <30 years (15.2%); 30-39 years (31.8%); 40-49 years (25.3%); 50-59 years (18.8%) and 60-69 years (8.9%). About 62.6% of the study population denoted female and 37.4% were male. About 22.3% of the population were Qatari, and 77.7% were expatriates. Around 84.4% of the subjects were non-smoker, 10.8% were current smoker and 4.7% were ex-smoker. In addition, 20.1% of the study population had an acceptable BMI (<25 kg/m2), 34.7% were overweight (25-29.9 kg/m2) and 45.2% were obese (≥30 kg/m2).

The overall prevalence of NAFLD was 58.5% in the study population. The prevalence and risk (prevalence ratio) of NAFLD by socio-demographic variables is as follows (Table 4): The prevalence in males and females was 69.7% and 51.8%, respectively. The risk in males was 1.35 compared to females. The prevalence and risk increased within the age groups of >30 years compared to the age groups of <30 years. Also, the highest prevalence and risk was observed in the 50-59 years age group, measuring 74.2% and 2.08, respectively. The prevalence and risk increased with increase in weight with the highest values in Grade III obese measuring 85.9% and 3.39, respectively.

The difference in prevalence or risk between Qatari and expatriates or smoker and non-smoker patients was non-significant.

The percentage of cases of positive MetS in our study was 56.4%. The prevalence of NAFLD in cases of MetS was 81.7% and the risk was 1.89. The prevalence and risk of NAFLD increased with the number of components defining MetS (Table 2). The prevalence increased from 31.3% in 1 component to 90.2% in 5 components, and the risk increased from 1.71 in 1 component to 4.95 in 5 components. The prevalence and risk of NAFLD by variables defining MetS were as follows (Table 2): (1) Obesity (BMI≥30 kg/m2 or central obesity (waist circumference over 102 cm (40 inches) in men and 94 cm (37 inches) in women)): The prevalence was 78.3%, and the risk was 1.53. (2) Insulin Resistance (Serum Fasting Glucose≥100 mg/dl or HbA1c≥5.56) or T2DM: The prevalence was 76.8%, and the risk was 1.78. (3) High blood pressure (over 130/85 mmHg) or a diagnosis of hypertension: The prevalence was 72.9%, and the risk was 1.6. (4) Low serum HDL (Fasting high-density lipoprotein (HDL) cholesterol level <1.04 mmol/L (<40 mg/dl) in men or <1.3 mmol/L (<50 mg/dl) in women: The prevalence was 72.7%, and the risk was 1.27. (5) High serum triglycerides (Fasting triglyceride level over 1.7 mmol/L (150 mg/dl): The prevalence was 81.9%, and the risk was 1.42. Table 3 shows that the prevalence of moderate (grade II) and severe (grade III) degrees of NAFLD increased with the increase in the number of components defining MetS. Table 5 shows that the three grades of NAFLD were more prevalent in males compared to females and the prevalence of grade III NAFLD was highest in obese Grade III, measuring 4.0%.

Image 1: Grade I NAFLD

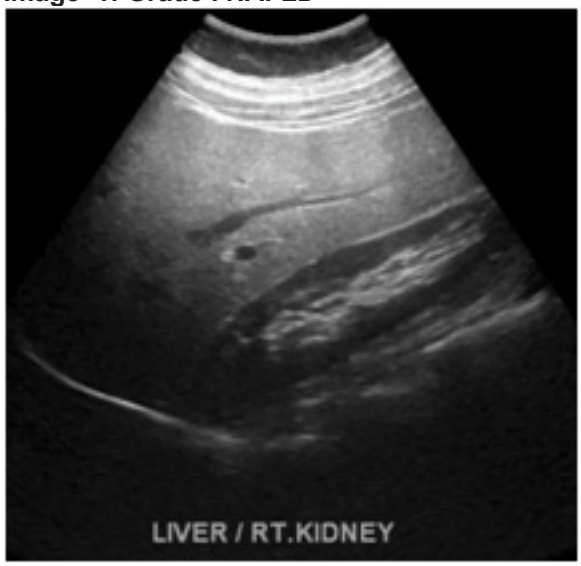

Image 2 (a and b): Grade II NAFLD.

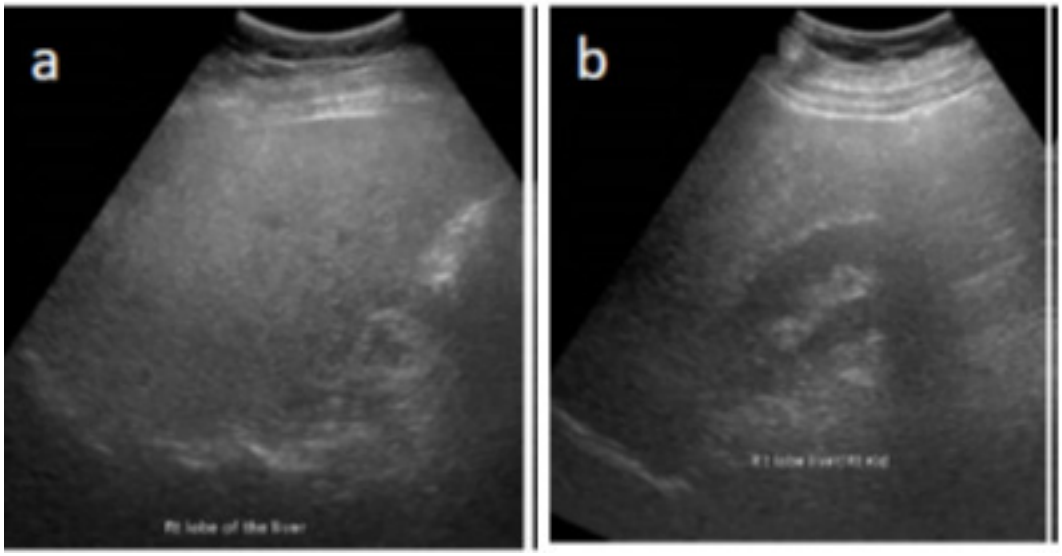

Image 3: Grade III NAFLD

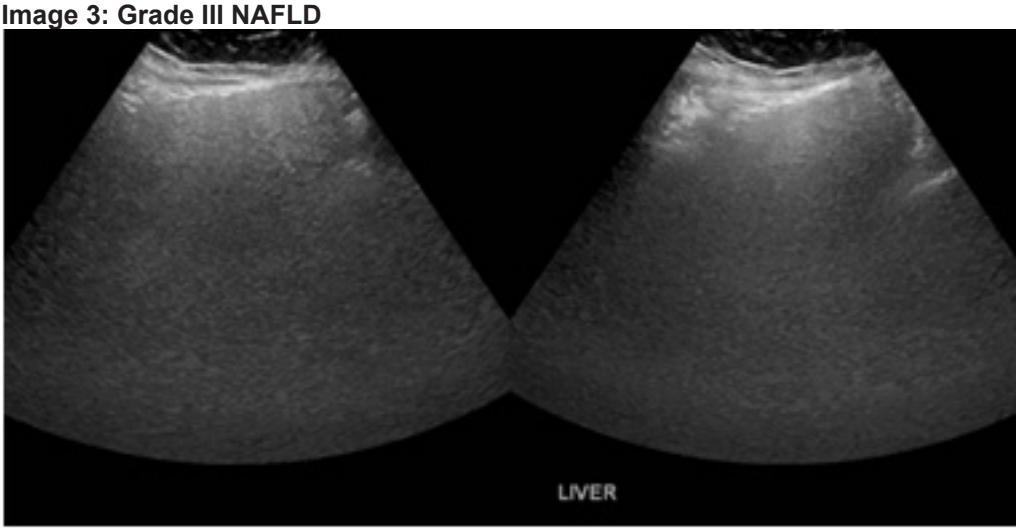

Table 1: Frequency distribution of study sample by selected socio-demographic variables

	N	%
Age group (years)		
<30	586	15.2
30-39	1225	31.8
40-49	975	25.3
50-59	724	18.8
60-69	343	8.9
Total	3853	100.0
Gender		
Female	2412	62.6
Male	1441	37.4
Total	3853	100.0
Nationality		
Ex-patriates	2995	77.7
Qatari	858	22.3
Total	3853	100.0
Smoking habit		
Non-smoker	2621	84.4
Current smoker	336	10.8
Ex-smoker	147	4.7
Total	3104	100.0
BMI categories (Kg/m2)		
Acceptable (<25)	776	20.1
Overweight (25-29.9)	1338	34.7
Obese Grade-I (30-34.9)	1017	26.4
Obese Grade-II (35-39.9)	473	12.3
Obese Grade-III (40+)	249	6.5
Total	3853	100.0

Table 2: The risk (prevalence ratio) of NAFLD by variables defining metabolic syndrome.

	Non-Alcoholic fatty liver disease								
	Negative		Positive		Total		Prevalence Ratio		
	N	%	N	%	N	%	estimate	95% CI	P
Count of positive criteria for Metabolic Syndrome									
0	157	81.8	35	18.2	192	100.0	Ref		
1	297	68.8	135	31.3	432	100.0	1.71	(1.23 - 2.38)	0.01
2	269	41.5	379	58.5	648	100.0	3.21	(2.36 - 4.36)	<0.001
3	196	24.0	621	76.0	817	100.0	4.17	(3.08 - 5.64)	<0.001
4	81	13.9	500	86.1	581	100.0	4.72	(3.49 - 6.38)	<0.001
5	24	9.8	221	90.2	245	100.0	4.95	(3.66 - 6.7)	<0.001
Metabolic Syndrome									
Negative	723	56.8	549	43.2	1272	100.0	Ref		
Positive	301	18.3	1342	81.7	1643	100.0	1.89	(1.77 - 2.02)	<0.001
Obesity (BMI>=30 kg/m2 or central obesity)									
Negative	705	48.9	738	51.1	1443	100.0	Ref		
Positive	319	21.7	1153	78.3	1472	100.0	1.53	(1.45 - 1.62)	<0.001
Insulin Resistance (Serum Fasting Glucose>=100 mg/dl or HbA1c>=5.56) or DM									
Negative	589	56.8	448	43.2	1037	100.0	Ref		
Positive	435	23.2	1443	76.8	1878	100.0	1.78	(1.65 - 1.92)	<0.001
High Blood Pressure (Systolic or Diastolic) or hypertensive									
Negative	465	54.5	388	45.5	853	100.0	Ref		
Positive	559	27.1	1503	72.9	2062	100.0	1.6	(1.48 - 1.73)	<0.001
Low serum HDL (<1.04 mmol/L in male and <1.3 mmol/L in female)									
Negative	625	43.0	830	57.0	1455	100.0	Ref		
Positive	399	27.3	1061	72.7	1460	100.0	1.27	(1.2 - 1.34)	<0.001
High serum Triglycerides (>=1.7 mmol/L)									
Negative	869	42.2	1190	57.8	2059	100.0	Ref		
Positive	155	18.1	701	81.9	856	100.0	1.42	(1.35 - 1.49)	<0.001

Table 3: The grade of NAFLD by variables defining metabolic syndrome

	Non-Alcoholic fatty liver disease grading system (American Gastroenterology Association)											
	No evidence		Grade-I		Grade-II		Grade-III		Total			
	N	%	N	%	N	%	N	%	N	%	Mean rank	P
Count of positive criteria for MS												<0.001
0	157	81.8	34	17.7	0	0.0	1	0.5	192	100.0	743	
1	297	68.8	124	28.7	11	2.5	0	0.0	432	100.0	920	
2	269	41.5	333	51.4	43	6.6	3	0.5	648	100.0	1298	
3	196	24.0	463	56.7	151	18.5	7	0.9	817	100.0	1628	
4	81	13.9	354	60.9	130	22.4	16	2.8	581	100.0	1810	
5	24	9.8	126	51.4	88	35.9	7	2.9	245	100.0	1988	
Metabolic Syndrome												<0.001
Negative	723	56.8	491	38.6	54	4.2	4	0.3	1272	100.0	1086	
Positive	301	18.3	943	57.4	369	22.5	30	1.8	1643	100.0	1746	
Obesity (BMI>=30 kg/m2 or central obesity)												<0.001
Negative	705	48.9	633	43.9	100	6.9	5	0.3	1443	100.0	1209	
Positive	319	21.7	801	54.4	323	21.9	29	2.0	1472	100.0	1702	
Insulin Resistance (Serum Fasting Glucose>=100 mg/dl or HbA1c>=5.56) or DM												<0.001
Negative	589	56.8	389	37.5	54	5.2	5	0.5	1037	100.0	1097	
Positive	435	23.2	1045	55.6	369	19.6	29	1.5	1878	100.0	1657	
High Blood Pressure (Systolic or Diastolic) or hypertensive												<0.001
Negative	465	54.5	323	37.9	62	7.3	3	0.4	853	100.0	1143	
Positive	559	27.1	1111	53.9	361	17.5	31	1.5	2062	100.0	1588	
Low serum HDL (<1.04 mmol/L in male and <1.3 mmol/L in female)												<0.001
Negative	625	43.0	649	44.6	168	11.5	13	0.9	1455	100.0	1331	
Positive	399	27.3	785	53.8	255	17.5	21	1.4	1460	100.0	1584	
High serum Triglycerides (>=1.7 mmol/L)												<0.001
Negative	869	42.2	951	46.2	221	10.7	18	0.9	2059	100.0	1333	
Positive	155	18.1	483	56.4	202	23.6	16	1.9	856	100.0	1760	

Table 4: The risk of NAFLD by sociodemographic variables

	Non-Alcoholic fatty liver disease									
	Negative		Positive			Total		Prevalence Ratio		
	N	%	N	%	95% CI	N	%	estimate	95% CI	P
Age group (years)										
<30	377	64.3	209	35.7	(31.9 to 39.6)	586	100.0	Ref		
30-39	591	48.2	634	51.8	(49 to 54.5)	1225	100.0	1.45	(1.28 - 1.64)	<0.001
40-49	349	35.8	626	64.2	(61.2 to 67.2)	975	100.0	1.8	(1.6 - 2.03)	<0.001
50-59	187	25.8	537	74.2	(70.9 to 77.3)	724	100.0	2.08	(1.85 - 2.34)	<0.001
60-69	94	27.4	249	72.6	(67.7 to 77.1)	343	100.0	2.04	(1.8 - 2.32)	<0.001
Total	1598	41.5	2255	58.5	(57 to 60.1)	3853	100.0			
Gender										
Female	1162	48.2	1250	51.8	(49.8 to 53.8)	2412	100.0	Ref		
Male	436	30.3	1005	69.7	(67.3 to 72.1)	1441	100.0	1.35	(1.28 - 1.42)	<0.001
Nationality										
Ex-patriates	1270	42.4	1725	57.6	(55.8 to 59.4)	2995	100.0	Ref		
Qatari	328	38.2	530	61.8	(58.5 to 65)	858	100.0	1.07	(1.01 - 1.14)	0.19[NS]
Smoking habit										
Non-smoker	1097	41.9	1524	58.1	(56.2 to 60)	2621	100.0	Ref		
Current smoker	120	35.7	216	64.3	(59.1 to 69.3)	336	100.0	1.11	(1.02 - 1.21)	0.2[NS]
Ex-smoker	39	26.5	108	73.5	(65.9 to 80.1)	147	100.0			
BMI categories (Kg/m2)										
Acceptable (<25)	579	74.6	197	25.4	(22.4 to 28.5)	776	100.0	Ref		
Overweight (25-29.9)	607	45.4	731	54.6	(52 to 57.3)	1338	100.0	2.15	(1.89 - 2.45)	<0.001
Obese Grade-I (30-34.9)	296	29.1	721	70.9	(68 to 73.6)	1017	100.0	2.79	(2.46 - 3.17)	<0.001
Obese Grade-II (35-39.9)	81	17.1	392	82.9	(79.3 to 86.1)	473	100.0	3.26	(2.87 - 3.7)	<0.001
Obese Grade-III (40+)	35	14.1	214	85.9	(81.2 to 89.8)	249	100.0	3.39	(2.97 - 3.86)	<0.001

Table 5: The grade of NAFLD by socio-demographic variables

	Non-Alcoholic fatty liver disease grading system (American Gastroenterology Association)											
	No evidence		Grade-I		Grade-II		Grade-III		Total			
	N	%	N	%	N	%	N	%	N	%	Mean rank	P
Age group (years)												<0.001
<30	377	64.3	173	29.5	32	5.5	4	0.7	586	100.0	1467	
30-39	591	48.2	517	42.2	114	9.3	3	0.2	1225	100.0	1773	
40-49	349	35.8	491	50.4	125	12.8	10	1.0	975	100.0	2031	
50-59	187	25.8	384	53.0	140	19.3	13	1.8	724	100.0	2281	
60-69	94	27.4	188	54.8	55	16.0	6	1.7	343	100.0	2218	
Total	1598	41.5	1753	45.5	466	12.1	36	0.9	3853	100.0		
Gender												<0.001
Female	1162	48.2	1000	41.5	236	9.8	14	0.6	2412	100.0	1784	
Male	436	30.3	753	52.3	230	16.0	22	1.5	1441	100.0	2166	
Nationality												0.006
Ex-patriates	1270	42.4	1358	45.3	337	11.3	30	1.0	2995	100.0	1903	
Qatari	328	38.2	395	46.0	129	15.0	6	0.7	858	100.0	2011	
Smoking habit												<0.001
Non-smoker	1097	41.9	1183	45.1	320	12.2	21	0.8	2621	100.0	1528	
Current smoker	120	35.7	162	48.2	47	14.0	7	2.1	336	100.0	1640	
Ex-smoker	39	26.5	79	53.7	26	17.7	3	2.0	147	100.0	1797	
BMI categories (Kg/m2)												<0.001
Acceptable (<25)	579	74.6	181	23.3	15	1.9	1	0.1	776	100.0	1248	
Overweight (25-29.9)	607	45.4	623	46.6	104	7.8	4	0.3	1338	100.0	1805	
Obese Grade-I (30-34.9)	296	29.1	555	54.6	158	15.5	8	0.8	1017	100.0	2170	
Obese Grade-II (35-39.9)	81	17.1	268	56.7	111	23.5	13	2.7	473	100.0	2486	
Obese Grade-III (40+)	35	14.1	126	50.6	78	31.3	10	4.0	249	100.0	2642	

Discussion

Our study showed that NAFLD is a prevalent disease in the Qatar population. It is associated with MetS and its components. The study provided appropriate data of the study population to create awareness among healthcare professionals about the disease and its risk factors. Guidance on lifestyle modification, diet and drugs from our primary care centers can avoid the progression of NAFLD to chronicity or complications. The second phase of the study will generate a cohort of patients, providing insights regarding the natural history of NAFLD (persistence, reversal, or progression of liver involvement). Ultrasonography is the preferred first-line detection procedure and is widely available for diagnosing steatosis [4]. The overall sensitivity and specificity of ultrasound in detection of moderate to severe fatty liver have been shown to be accurate and comparable to those of histology (gold standard). However, biopsy cannot be performed in the general population [16,17].

A previous meta-analysis of a very large population by Younossi et al. showed that the overall global prevalence of NAFLD diagnosed by imaging is around 25.24%. It showed that the highest prevalence of NAFLD is from the Middle East (31.79%) and South America and Asia (30.45%), whereas the lowest prevalence rate is reported from Africa (13.48%). The higher prevalence of NAFLD in these geographic areas can be explained by a higher prevalence of obesity in addition to genetic factors [18,19].

Our study showed that the prevalence of NAFLD by ultrasonography was around 58.5%. This high prevalence in Qatar can be due to the high number of overweight (34.7%) and obese (45.2%) patients apart from increased positive cases of MetS (56.4%).

Features of MetS are not only highly prevalent in patients with NAFLD, but its components also increase the risk of developing NAFLD. This bidirectional association between NAFLD and components of MetS has been strongly established [19].

Our study showed that the prevalence of NAFLD in positive cases of MetS was around 81.7% with the risk of 1.89. Also, our study showed that the prevalence and risk of NAFLD increased with the number of components defining MetS. The prevalence increased from 31.3% in 1 component to 90.2% in 5 components, and the risk increased from 1.71 in 1 component to 4.95 in 5 components.

Previous studies showed that obesity (excessive BMI and visceral obesity) is the most common and well documented risk factor for NAFLD. The entire spectrum of obesity, ranging from overweight to obese and severely obese, is associated with NAFLD. The majority (>95%) of patients with severe obesity undergoing bariatric surgery will have NAFLD [20].

Our study showed that the prevalence of NAFLD in cases of obesity (BMI≥30 kg/m2 or central obesity (waist circumference over 102 cm (40 inches) in men and 94 cm (37 inches) in women) was 78.3%, and the risk was 1.53.

Previous studies showed that there is a high prevalence of NAFLD in individuals with type 2 diabetes mellitus (T2DM). Some studies suggested that around one-third to two-thirds of diabetic patients have NAFLD [21]. It is also prudent to remember the importance of bidirectional association between NAFLD and T2DM. T2DM and NAFLD can develop almost simultaneously in patients, which confound the prevalence of NAFLD in patients with T2DM or the prevalence of T2DM in patients with NAFLD [19].

Our study agrees with previous studies and showed that the prevalence of NAFLD in cases of insulin resistance (Serum Fasting Glucose≥100 mg/dl or HbA1c≥5.56) or T2DM was 76.8%, and the risk was 1.78.

Previous studies showed that cases of dyslipidemia (high serum triglyceride (TG) levels and low serum high-density lipoprotein (HDL) levels) are also common in patients with NAFLD. The prevalence of NAFLD in individuals with dyslipidemia attending lipid clinics has been estimated to be 50%. In a cross-sectional study conducted among Taiwanese patients, attending a single clinic showed that the overall prevalence rate of NAFLD was 53.76% [19].

Our study showed that the prevalence of NAFLD in cases of high serum triglycerides (Fasting triglyceride level over 1.7 mmol/L (150 mg/dl)) was 81.9%, and the risk was 1.42. Also, our study showed that the prevalence of NAFLD in cases of low serum HDL (Fasting high-density lipoprotein (HDL) cholesterol level <1.04 mmol/L (<40 mg/dl) in men or <1.3 mmol/L (<50 mg/dl) in women) was 72.7%, and the risk was 1.27. It also showed that the prevalence of NAFLD in cases of patients with high blood pressure (over 130/85 mmHg) was 72.9%, and the risk was 1.6.

Previous studies showed that the prevalence of NAFLD may vary according to age, sex, and ethnicity [19,22]. Studies showed that both the prevalence of NAFLD and stage of liver disease increase with age, but this finding is controversial. Males are considerably a risk factor for NAFLD as the prevalence rate is 2 times higher than that in females [19,22].

Our study showed that the prevalence of NAFLD and grade of NAFLD increase with age. The highest is observed in the 50-59 years age group, followed by 60-69 years age group, measuring 74.2% and 2.08, and 72.6% and 2.04, respectively. It also showed that the prevalence in male and female population was 69.7% and 51.8% and the risk in the male population was 1.35 times higher.

The limitations of our case control study are related to the representativeness of the selected cases with respect to the whole population. Cases which are not suspected, not diagnosed or who do not consult in the primary care may be under-represented, but this possible selection bias will not be systematically introduced. Another limitation of the study is the use of hepatic ultrasonography for the diagnosis of fatty liver. Liver biopsy is the gold standard for diagnosis of NAFLD. However, studies comparing the diagnostic utility of ultrasonography with liver biopsy have shown a sensitivity of greater than 90% and a specificity of greater than 80% for ultrasonography in detecting the presence of NAFLD. The main limitation of ultrasonography is the difficulty in detecting fatty liver when the infiltration is less than 30% of the hepatic content [23]. Another limitation of ultrasonography is the lack of information regarding the histologic changes associated with disease progression, but ultrasonography is currently the test of reference for the detection of fatty liver at the population level [13].

Conclusion

Ultrasonography of the liver is the test of reference for the detection of fatty liver at population level. NAFLD is a prevalent health problem in our primary health care centers in Qatar and has a strong association with MetS and its components. Although the presence of this disease was approached as a minor problem, it must be considered that it may be potentially serious because of its possible evolution to chronicity and hepatic cirrhosis. On the other hand, its detection today in primary health care centers is relatively easy and accessible by ultrasonography. Also, a multifactorial intervention approach on the risk factors leading to its remission can restrict the appearance of more severe hepatic complications.

Competing interests: No conflict of interest

Ethical Considerations: The study was approved by the Primary Health Care Corporation (PHCC) Research Committee and the Research Section in the Department of Clinical Affairs.

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