

Original Research Article

Evaluation of fatty liver disease using ultrasound in a semi-urban population in Jos, North Central Nigeria

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ABSTRACT

Background: Fat liver is one of the most common abnormalities of the liver depicted on ultrasound and whose impact has not been fully evaluated in Nigeria. Ultrasound scan is an imaging modality that is cheap and readily available and comes in handy in evaluating this disease. Aim of the current study was to determine the relationship of Fatty liver with age, gender, alcohol consumption and body habitus.

Methods: This is a hospital-based cross-sectional study involving 316 subjects diagnosed with fatty liver on ultrasound scan. A structured questionnaire was administered to each subject to ascertain their age, sex, and alcohol intake. The weight and height of all subjects were also measured and the body mass index (BMI) was calculated.

Results: The study comprises 151 (47.8%) males and 165 (52.2%) females respectively. A good number of the participants 232 (73.4%) were between the age of 30-59 years. The majority of the participants had of 30 kg/m² and above. Majority of the participants 225 (71.2%) do not consume alcohol. The study showed a positive but weak correlation between increasing BMI and fatty liver span. The study revealed that most participants with liver span <15.9 cm (57.1%) or ≥16 cm (75.5%) have BMI ≥30 kg/m².

Conclusions: This study showed fatty liver is common in all ages and gender but commoner in the middle age groups with strong relationship between increasing body weight and fatty liver, but a weak relationship with regards to the span of the liver.

Keywords: Fatty liver, BMI, Ultrasound scan

INTRODUCTION

Fatty liver also known as hepatic steatosis is a spectrum of clinical and pathological disorder that is defined by abnormal deposition of fat (triglyceride) within the cytoplasm of the hepatocytes.¹⁻³ It is the most common liver disease worldwide and ranges from steatosis alone to steatosis with inflammatory change (steatohepatitis).^{2,4} The prevalence of this condition is increasing rapidly with great changes in lifestyle in Nigeria and globally.

Several risk factors have been linked with the development of this disease and alcohol consumption is

probably the most important. In advanced countries, the disease is usually associated with abdominal obesity and metabolic syndrome.⁴⁻⁶

Although liver biopsy with histology is an invasive procedure and comes with life threatening complications, it still remains the gold standard for the diagnosis of fatty liver disease.⁷ Ultrasonography with a sensitivity ranging from 60 to 94% and specificity ranging from 84 to 95% is accepted globally as an initial screening tool for fatty liver because it is safe, readily accessible, well tolerated, and inexpensive.⁷⁻⁹

Various grading of steatosis has been put forward based on the intensity of the echogenicity of the liver using the visual analysis of the operator provided that the gain setting is optimum. When it appears normal in echopatterns it is grade 0 when the echogenicity is just increased with normal visualization of the diaphragm and intrahepatic vessel borders, it is a grade I; when the echogenic liver slightly obscures the echogenic walls of portal vein branches and diaphragmatic outline, it is grade II, and when the echogenic liver obscures the diaphragmatic outline, it is grade III.⁷ These gradings are however subject to inter-observer variation.

The disease is grouped into non-alcoholic fatty liver disease (NAFLD) and alcoholic fatty liver disease (AFLD) depending on the quantity of alcohol consumption. Nonalcoholic fatty liver disease (NAFLD) is steatosis on imaging or histology affecting at least 5% of the liver volume or weight in the absence of significant alcohol consumption (>21 standard drinks in men and >14 standard drinks in women on average per week, or a daily alcohol consumption ≥ 30 g for men and ≥ 20 g for women) and other secondary hepatic fat accumulation disorders.¹⁰⁻¹²

The prevalence of NAFLD has been on the rise owing to the growing epidemics of obesity which accounts for close to half of the population so far studied. It is currently documented as the most common cause of abnormal liver tests and chronic liver disease in developed nations and is projected to become the most common indication for liver transplantation soon.^{4,10,11}

Globally an estimated 1.5 billion people are overweight, among them about 200 million men and 300 million women.¹²⁻¹³ World health organization reports an abrupt increase in global childhood obesity, from 32 million in 1990 to 41 million in 2016. Several studies have shown the relationship of overweight and obesity with the development of fatty liver disease globally.^{13,15} Nevertheless, not all obese or overweight individuals are metabolically unhealthy or neither all normal weight/lean are metabolically healthy. Other conditions that have been documented to increase the risk of fatty liver disease include diabetes mellitus (DM) and hyperinsulinemia.¹⁶ There is a paucity of data concerning the prevalence of fatty liver disease in this part of Nigeria. In current study, we hope to correlate Alcohol consumption, body habitus, age, and gender of the subjects with the development of fatty liver disease in our environment.

METHODS

This is a hospital-based cross-sectional study involving 316 subjects who were referred for routine/diagnostic abdominal ultrasound scan at Medview medical diagnostic center between January 2020 to December 2020. All the patients were scanned using Samsung Medison SonoAce X8 ultrasound system in B-mode with variable frequency transducer at 2-5MHz or 5-

10MHz. The examination was performed with the patient in the supine position and properly exposed to obtain an optimal view of the abdominal viscera. Patients diagnosed with fatty liver are then recruited into the study after consent was sort and agreed. A structured questionnaire is then administered to each subject and information such as Liver span, age, sex, and alcohol intake was obtained. The weight (kg) and height (m) of all subjects were also measured and the Body Mass Index (BMI=weight (kg)/height (m)²) was calculated and classified based on world health organization (WHO) criteria.

Study definitions

Significant alcohol consumption means alcohol consumption, estimated by questionnaire of >40 gram/week. Fatty liver disease is said to be present if the following sonographic features were present either singly or in combination: the presence of a bright hepatic echo pattern (compared with the kidneys), deep attenuation, and vascular blurring. Liver span is grouped into normal size (≤ 15.9 cm) or enlarged (≥ 16 cm) measured in the midclavicular line.¹⁸

Inclusion criteria

Inclusion criteria for current study were; subjects who are diagnosed with fatty liver on ultrasound and consented and patients of all ages and gender.

Exclusion criteria

Exclusion criterion for current study was subjects who refused to give consent for the study.

Statistical analysis

The data collated was entered into a computer and processed using statistical package for social sciences (SPSS) version 23. Results are presented using frequency tables and percentages as appropriate. A p value of <0.05 was considered statistically significant with a confidence interval of 95%.

RESULTS

The study comprises 15 (47.8%) males and 165 (52.2%) females respectively. The male to female ratio was 0.9:1. A good number of the participants 97 (30.7%) were between the age of 40-49 years. Overall mean age was 47.1 \pm 13.0 years. The majority of the participants had a body mass index (BMI) of 30 kg/m² and above with an overall mean BMI of 29.9 \pm 0.7 kg/m². Only 27 (8.5%) had BMI ranges between 18.5-24.9 kg/m². Liver span was categorized into <15.9 cm and ≥ 16 cm respectively. About half (50.9%) had a liver span below 15.9 cm while 155 (49.1%) had a liver span of ≥ 16 cm. The majority of the participants 225 (71.2%) do not drink alcohol while

91 participants representing 28.8% consume alcohol (Table 1).

Table 1: Simple frequency distribution.

Variables	N	%
Sex		
Male	151	47.8
Female	165	52.2
Age group (years)		
10-19	1	0.3
20-29	24	7.6
30-39	66	20.9
40-49	97	30.7
50-59	69	21.8
60-69	40	12.7
70-79	16	5.1
80-89	3	0.9
Mean±SD (years)	47.1±13.0	
BMI (kg/m²)		
<18.5	3	0.9
18.5-24.9	27	8.5
25.0-29.9	77	24.4
≥30	209	66.1
Liver span		
<15.9	161	50.9
≥16	155	49.1
Alcohol		
Yes	91	28.8
No	225	71.2

Relationship between gender and age with fatty liver

More than half (53.0%) of the male participants had a fatty liver span <15.9 cm while more than half (50.9%) of the females had a fatty liver span of ≥16 cm. This implies that more females had a higher fatty liver span compared to their male counterparts. However, the difference was not statistically significant ($\chi^2=0.477$, $p=0.490$) (Table 2). Similarly, there was no significant association between age and fatty Liver span ($\chi^2=9.895$, $p=0.164$) (Table 2).

Correlate between BMI and fatty liver

The study showed a positive correlation between body mass index (BMI) and fatty liver. This implies that as BMI increases the chances of developing fatty liver increases though at a minimal value ($r=0.144$, $p=0.010$) (Table 3).

Relationship between BMI and liver span

The study revealed that most participants with BMI 30 kg/m² and above 117 (75.5%) had a Liver span of ≥16 cm compared to 57.1% who had a liver span of <15.9. This difference was statistically significant ($\chi^2=17.000$, $p=0.001$) (Table 5). This also agrees with the correlation

coefficient is seen in (Table 3) above, that fatty liver increases with an increase in BMI.

DISCUSSION

Fatty liver which before now was classified under the cryptogenic causes of chronic liver disease is now linked with hepatic metabolic stress damage and is becoming the major cause of liver disease globally.

It is accepted globally that the patho physiology of fatty liver disease is highly linked with behavioral factors and increased glucose intake is considered a major contributor. The combination of a sedentary lifestyle and reduced physical activity independent of dietary control has also been implicated.¹⁹ This current study shows that the presence of fatty liver did not differ much with regards to the gender of the subjects, with the majority seen between the 3rd to 5th decades of life. This is similar to the earlier observation that fatty liver occurs at all ages with no sex predilection, but the incidence increases with increasing body size.²⁰⁻²² This disease appears to affect young adults more than youths/young people as defined by the African youth charter. This finding agrees with the assertion that childhood/adolescent obesity is not yet a major problem in this part of the world when compared with documented studies from the developed nations.¹⁶⁻¹⁷ It also suggests that as people become older with improved economic status, unhealthy lifestyles begin to rear its head.

Globally it has been established that obesity and increasing BMI is an important risk factor for fatty liver disease and a majority of patients in our study have a body mass index of 30 kg/m² and above with a mean BMI of 29.9 kg/m². This confirms the globally acceptable strong relationship of increasing body weight with fatty liver disease. However, there was a positive but weak correlation between body mass index and the span of the fatty liver when measured at the midclavicular line. These findings are similar to those documented by Sara et al in Sudan but differs with that recorded by Haley et al in a study done in the USA where they found a significant linear relationship between increase body weight with increase in organ volume and risk of cancer development.²³⁻²⁴

Current study also found a weak relationship between the subject's history of alcohol consumption with the development of fatty liver disease. This agrees with findings documented by Francesco et al in a population-based study in Northern Italy and Kratzer et al in Germany who separately showed no association between alcohol consumption and fatty live disease but shows a strong association with anthropometry and all the metabolic syndrome component.^{18,25} This is however in disagreement with the findings of Sara et al in Sudan found a strong and positive correlation between alcohol consumption and fatty liver disease/span.

Table 2: Relationship between gender and age with fatty liver (n=316).

Variables	Liver span			χ^2	P value
	<15.9 (N=161)	≥16 (N=155)	Total		
Sex					
Male	80 (53.0)	71 (47.0)	151 (100.0)	0.477	0.490
Female	81 (49.1)	84 (50.9)	165 (100.0)		
Age group (years)					
10-19	0 (0.0)	1 (100.0)	1 (100.0)	9.895	0.164*
20-29	7 (29.2)	17 (70.8)	24 (100.0)		
30-39	32 (48.5)	34 (51.5)	66 (100.0)		
40-49	53 (54.6)	44 (45.4)	97 (100.0)		
50-59	34 (49.3)	35 (50.7)	69 (100.0)		
60-69	26 (65.0)	14 (35.0)	40 (100.0)		
70-79	8 (50.0)	8 (50.0)	16 (100.0)		
80-89	1 (33.3)	2 (66.7)	3 (100.0)		

*Fisher’s exact test

Table 3: Correlate between BMI and fatty liver.

Correlations			
		BMI (kg/m ²)	Liver span
BMI (kg/m ²)	Pearson correlation (r)	1	0.144*
	P value	-	0.010
	N	316	316
Liver span	Pearson correlation (r)	0.144*	1
	P value	0.010	-
	N	316	316

*Correlation is significant at the 0.05 level (2-tailed).

Table 4: Relationship between alcohol consumption and development of fatty liver.

Alcohol	Liver span			χ^2	P value
	<15.9	≥16	Total		
Yes	53 (32.9)	38 (24.5)	91 (28.8)	2.720	0.099
No	108 (67.1)	117 (75.5)	225 (71.2)		
Total	161 (100.0)	155 (100.0)	316 (100.0)		

Table 5: Relationship between BMI and liver span.

BMI (kg/m ²)	Liver span			χ^2	P value
	<15.9	≥16	Total		
<18.5	0 (0.0)	3 (1.9)	3 (0.9)	17.000	0.001
18.5-24.9	18 (11.2)	9 (5.8)	27 (8.5)		
25.0-29.9	51 (31.7)	26 (16.8)	77 (24.4)		
≥30	92 (57.1)	117 (75.5)	209 (66.1)		
Total	161 (100.0)	155 (100.0)	316 (100.0)		

This study also revealed no significant association between gender with the span of the liver. These findings agree with earlier studies and findings that gender did not assert any influence on liver size. It thus concluded on the reliability of age and body mass index in preventing false diagnoses of an enlarged liver. Current study showed a steady increase in the number of fatty liver diseases as the

age increases peaking at the fourth decade with a steady decline subsequently. The decline in the number after the fourth decade could be attributed to the fewer number of participants recruited who fall within the age bracket above 50 years. Our finding cannot conclusively say that the age of the participants has any contributory factor in the development of fatty liver disease. A large survey conducted by Kratzer et al Germany and similar works by

Siddiqui 2014 et al concluded that increasing age has a strong influence on the liver span. They believed that the increase is linked to workload and the corresponding metabolic rise of advancing age.^{18,26,27}

Current work has shown the relationship between increasing weight/BMI with the development of fatty liver disease and the disease commoner among the young adults in our environment.

Limitations

This finding represents data from only a single center in Jos North Central Nigeria. Data from multiple centers and larger population could give a more comprehensive outlook on the relationship of fatty liver with age, gender, alcohol consumption, and body habitus.

CONCLUSION

Current study findings showed that fatty liver disease is common in all ages and gender but commoner in the middle age groups. It was also concluded that there is also a strong relationship between increasing body weight/BMI with the development of fatty liver.

Recommendation

Screening for fatty liver disease using ultrasound scan in a resource-poor setting like stated in current study should be encouraged.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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