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# A Study of Ultrasonography Diagnosis of Non-Alcoholic Fatty Liver and Its Correlation with Obesity, Diabetes and Other Risk Factors

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**Abstract:** Objective: Non-Alcoholic Fatty Liver Disease (NAFLD) is a major hepatic problem in a modern –day, which, refer to a group of conditions where there is accumulation of steatosis in the liver of nonalcoholic people. It is a very common disorder which often asymptomatic. And may associated with many risk factors such as diabetes obesity and other factors. Therefore this study was conducted to determine the correlation between NAFLD and above mentioned condition using ultrasonography investigation, because that the relation of non-alcoholic fatty liver disease to these factors are not fully understood. Methods: A total of 250 Sudanese participants screening by abdominal ultrasound were used as the population of this cross-sectional prospective study, 50 out of them diagnosed with NAFLD represented the study sample. The data of the study were obtained in Sudan –Khartoum city in period from July to September 2018. Results data was analyzed to find out the correlation between NAFLD with diabetes, obesity and some other risk factors such as hypertension, elevation of cholesterol level and patient physical activities and participants were included if they didn't have alcohol intake and their age is 20 years old and above. Statistical descriptive analysis using (SPSS) statistical package for the social sciences program was used to determine the frequency distribution of demographic variables in tables and graphs. Results: The total prevalence result of NAFLD among study population sample achieved 20% percentage and in comparing results of the total number of male and female, the gender distribution reflect that the higher percentage of fatty liver presence in male with (56.00%) percentage more than female with (44.00%) of the study sample, corresponded to maximum age range (40-49) years of group aging in the general sample of the study. Regarding to histologic and/or clinical markers of the study samples, incidence of diabetes, were (40%) with NAFLD and in correlate with patient gender, most of the diabetics are female with (22%) detection. Results for correlation of NAFLD and obesity achieved 78% detection of total study samples. Others Ultrasound results, found that there are correlation with NAFLD and many other risk factors including hypertension, elevation of cholesterol level and patient physical activity. Conclusion: Association with Nonalcoholic fatty liver disease (NAFLD) with obesity, diabetes in addition to hypertension, elevation of cholesterol level and type of patient activities as have been detected in the recent study, these findings should be taken into consideration when patient counseling and monitoring.

**Keywords:** NAFLD, Obesity, Diabetes, Risk Factors, Ultrasound

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## 1. Introduction

NAFLD is a chronic liver disease which most commonly found in the developing countries, furthermore, it expected to become an even more serious public health issue because of the increasing prevalence of obesity and aging, where the prevalence of NAFLD is estimated to be 15-35% of the general population in western countries [1].

The disorder includes a spectrum of pathologies that range from simple steatosis to severe steatohepatitis. Moreover liver cirrhosis and advanced fibrosis which may lead to hepatocellular carcinoma. NAFLD in most often frequently is associated with type 2 diabetes mellitus, obesity, dyslipidemia, cardiovascular disease, and other risk factors such as hypertension, abnormal cholesterol level and irregular exercise. [2].

Further the more, NAFLD also has been reported to be independent of the traditional risk factors, however Cardiovascular Diseases and Metastases may increase the risk of mortality. [3, 4]. When the buildup of fat in the liver becomes too amount, this term describes as hepatic steatosis, and will become a health problem. It estimated by more than 5% hepatocytes infiltrated with fat in individuals characterized by liver with no history of alcohol abuse and no other causes for secondary hepatic fat accumulation are present. The accumulation of fat can cause inflammation, cell death, and scarring. When scarring of cells present, this condition known as Liver cirrhosis. In fact, it's known that the liver have the ability to repair itself by rebuilding new cells when the old ones are damaged. Therefore in some mild forms, fatty liver can be a reversible condition that may improve with lifestyle modifications such as diet changes, weight loss, and increased physically activity. [5, 6].

NAFLD affecting and may affect one in five adults. And around one in ten children in the United States. Obesity is thought to be the most common cause of fatty infiltration of the liver, it was estimated that, about two thirds of obese adults and half of obese children may have fatty liver. And also estimated, 2 to 5 percent of Americans adult and up to 20 percent of those who are obese may suffer from the more severe condition. [7].

NAFLD is usually suspected in overweight or obese person. Those persons found to have mild elevations in their liver tests during a routine blood testing or incidentally detected on radiologic investigations such as abdominal ultrasound, CT or MRI scan which was considered to be more accurate for measuring liver fat, as it is a semi quantitative methods. Ultrasonography, is the most accurate and available method, it has sensitivity of near 100% for NAFLD diagnosis. [8, 9]. The diagnosis of fatty liver in its early stage done when the proportion of liver cells that contain fat is more than 5 percent. This often diagnosed by looking at small samples taken from the liver under the microscope and most often confirmed by imaging studies. The most commonly studies used is ultrasound investigation, which can accurately showing accumulation of fat in the liver in its various stages. [10].

Radiological imaging ultrasound is a type of abased medical diagnostic procedure used to look at internal organs in the body particularly organ in abdomen which including the liver, gallbladder, spleen, pancreas, kidneys and others. Ultrasound also used to examined blood vessels that lead to some of these organs, such as the inferior vena cava and aorta. [11].

Techniques of abdominal ultrasound scan was performed after preparing the patient by overnight fasting about 8-hour. US scanner device used a high-resolution B-mode scanner, with curved on convex array transducers. The transducers which predominantly used for abdominal ultrasound are the frequencies from 2.5 MHz for the obese patients and 0.5 MHz for the slim patients with the mean value around 3.5 to 3.75 MHz of both preceding types. These types of transducers offer a wide near and far zone and can be easily

handling despite the density of the scan lines, which decreases as the distance from the transducer were increasing. [12].

When scanning the upper abdominal organs, including the liver, the transducer has to be carefully manipulated to avoid acoustic shadowing of the lower ribs were the further the transducer can be pressed in under the thoracic wall, the better the scanning conditions. Also it is better to instruct patient to take deep breath, because that it is important to pushes the liver downward, and also better for subcostal access. In addition to that, the visibility is further enhanced if the patient stretches the legs and puts the right arm up over the head with a straight back. This position seems to stretch the skin of the abdomen and gives a larger subcostal access "window" to approach to the middle and right parts of the liver. Supine subcostal position always best and accessible in the most cases to scan the left parts of the liver. [12].

## 2. Methods

### 2.1. Importance of the Study

Non-Alcoholic Fatty liver disease is a common worldwide health problem, which can lead to steatohepatitis and progress further to end-stage liver disease. However, many clinical symptoms of fatty liver are non-specific or silent and the correlation of affected factors are not fully understood.

### 2.2. Aim and Objectives of the Study

The main aim of the current cross-sectional prospective study is to evaluate and determine the correlation between the prevalence of obesity, diabetes disease and others factors such as hypertension, cholesterol level and patient activity with NAFLD using ultrasonography radiologic investigation techniques. Adding to many other specific objectives such as detected the comparison distributions of the disease among population of the study and find out the determination results of demographic variables in tables and figures.

### 2.3. Population Inclusion

Population of the study including total of 250 Sudanese participants underwent abdominal ultrasound, 50 individuals out of them were classified as nonalcoholic fatty liver disease (NAFLD) represented the study sample. Participants were included from both gender male and female if they didn't have alcoholic intake and their age is 20 years old and above.

### 2.4. Aria and Duration of the Study

The current study were conducted in Sudan country, Khartoum city in period from July to September 2018.

### 2.5. Statistical Analysis

The descriptive analysis for obtained data were done by using SPSS programmer to detect the frequency distribution of demographic variables in tables and figures and find out the correlation results determination.

**2.6. Ethical and Confidential**

The data collected in this study, carried out after all ethical consent and requirement for authorship have been met. And the author declare that ethics committee approval has been obtained and declare no conflicts of interest for financial aspect.

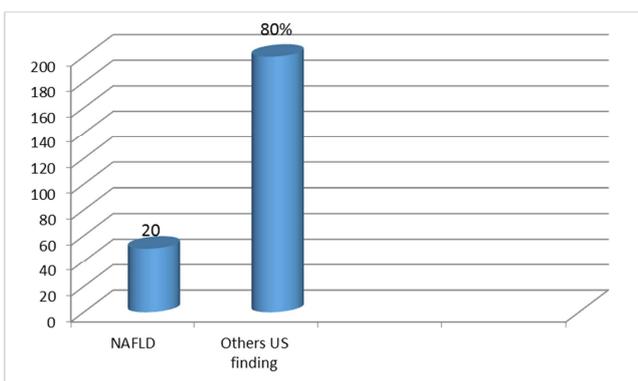
**3. Results**

In this study, a group of 250 patients were scanned by abdominal ultrasound. A total of 50 cases out of them were detected with non-alcoholic fatty liver disease (NAFLD), and the detection rate was 20%. The diagnosis indicated higher distribution reflect in male with (56.00%) percentage more than female with (44.00%), corresponded to maximum range of (40-49) years of group aging in the general sample of the study. The study samples, indicated (40%) diabetes with NAFLD most of them were female with (22%) percentage. 62.0% of the samples were overweight and 16.0% with obesity, by adding together the total percent is 78% detection of total. Other Ultrasound results, indicated correlation with NAFLD and many other risk factors including hypertension, abnormal cholesterol level and type of patient physical activities. The novel finding of ultrasound were summarized in tables and graphs as follows;

Data achieved for NAFLD prevalent were represented in table 1 and figure 1, where there was 50 out of total 250 with percentage of 20% abdominal ultrasound scanning patients, were diagnosed with NAFLD.

**Table 1.** Shows distribution of NAFLD prevalence among the study sample.

US finding	Frequency	Percentage
NAFLD	50	20%
Other US finding	200	80%
Total	250	100%

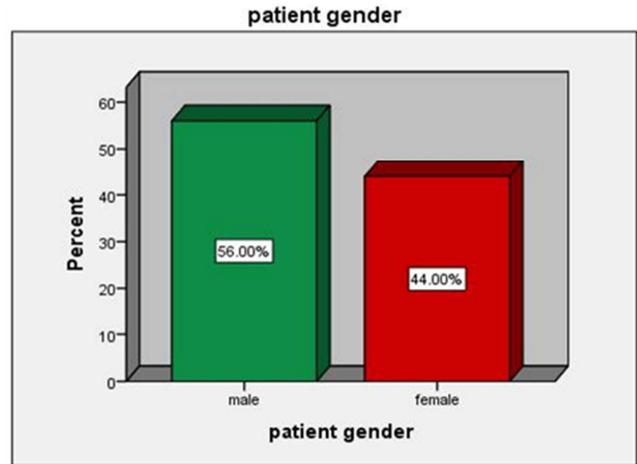


**Figure 1.** Shows distribution of NAFLD prevalence among study sample.

Results regarding distribution of different gender with nonalcoholic fatty liver detected by US examination, represented in (Table 2 and figure 2). The date achieved that prevalent is higher in male gender more than female with mean standard  $44 \pm .501$ .

**Table 2.** Shows gender distribution.

Gender	Frequency	Percentage
Female	22	56.0%
Male	28	44.0%
Total	50	100.0%
Mean and standard deviation	$44 \pm .501$	

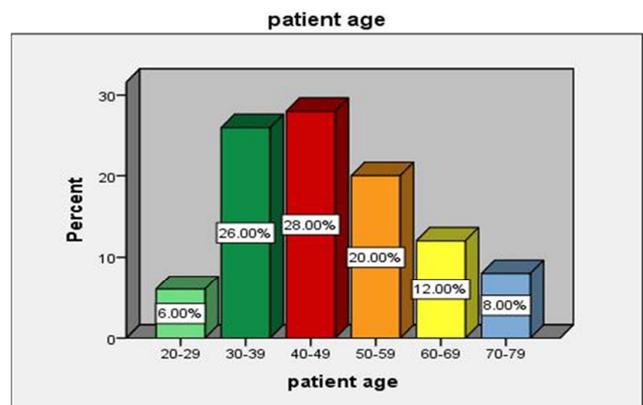


**Figure 2.** Shows patients' gender distribution.

Results achieved of distribution of gender in comparing with group aging represented in tables 3 and figures 3, the data showed that nonalcoholic fatty liver presence in male with percentage of (56.00%) more than female with (44.00%) percent and distribution corresponded to maximum range (40-49) years of group aging of the study.

**Table 3.** Distribution of the patient's age, shows the age group (40-49) years as the big distribution with mean of  $2.3 \pm 1.4$ .

Patient age	Frequency	Percent%
20-29	3	6
30-39	13	26
40-49	14	28
50-59	10	20
60-69	6	12
70-79	4	8
Total	50	100
Mean and standard deviation	$2.3 \pm 1.4$	



**Figure 3.** Distribution of the patient's age.

Results concerning prevalent of overweight to obesity, represented in table 4 and figures 4 showing distribution of the patient's obesity in comparison with the patient gender, most of the male and female patients are overweight with 62.0% percent and (16.0%) obesity correlation achieved. By adding together NAFLD hence associate in 39 cases which represent 78% of total.

Table 4. Patient's obesity distributions.

Obesity	Frequency	Percent
Normal weight	11	22
Overweight	31	62
Obese	8	16
Total	50	100
Mean and standard	94 ±.620	

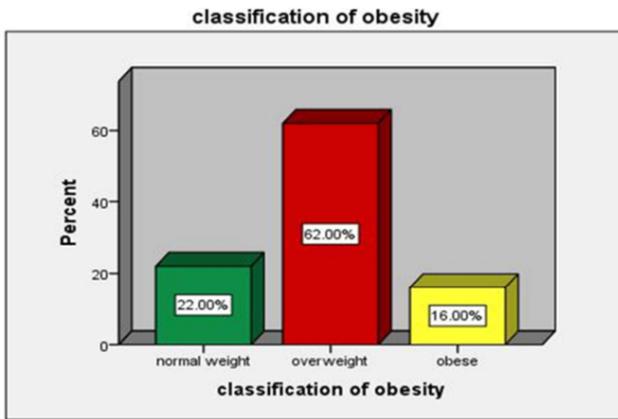


Figure 4. Shows classification of patient's obesity distributions.

Results obtained for diabetes prevalent associate with NAFLD, represented in table 5 and figures 5, 6 which achieved that diabetes were found in population samples with percent of (40%), and in correlate with patient gender, most of the diabetics are female with (22%) detection.

Table 5. Shows the distribution of the present of diabetes.

Diabetes	Frequency	Percentage
Present	20	40.0%
Not present	30	60.0%
Total	50	100.0%

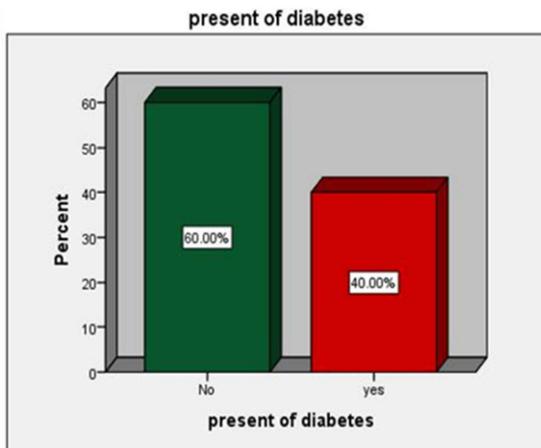


Figure 5. Distribution of diabetes present.

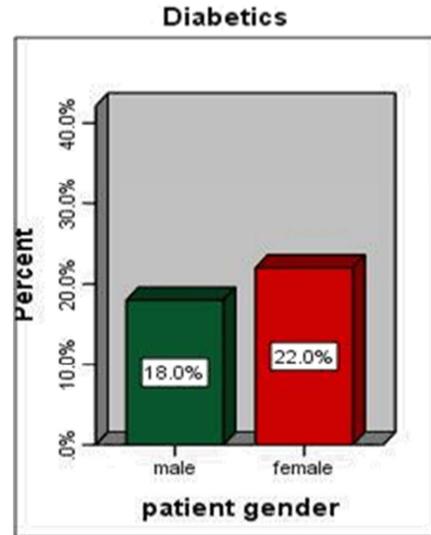


Figure 6. The distribution of diabetes present in comparison with patient gender.

Results associate with correlation NAFLD and other risk factors besides obesity and diabetes were represented in table 6 and figure 7, these factors including present of hypertension, with percent of 22.0%, elevation of cholesterol level found with percentage of 24.0% and irregular exercise activities were obtained with the higher percent of 54.0%.

Table 6. The distribution of Other risk factors.

Other risk factors	Frequency	Percent%
Hypertension	11	22.00%
Cholesterol	12	24.00%
Exercise	27	54.00%
Total	50	100.00%

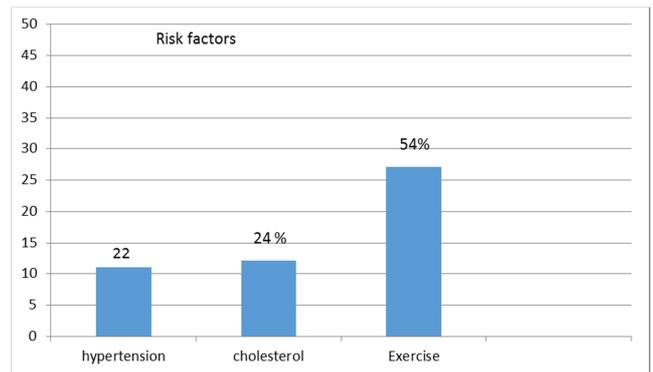


Figure 7. Shows the comparison of distribution of others risk factors.

### 4. Discussion

Asymptomatic non-alcoholic Fatty Liver Disease (NAFLD) is a silent disease that leading to a major morbidity and mortality in nonalcoholic population around the world. And concerning the assessment of the prevalence among population of the study, the novel finding summarized in that the prevalent of NAFLD is 50 out of total 250 with percentage of 20% detection using abdominal

ultrasound scanning, the data were represented in (table 1 and figure 1). This result near matching with the survey searched of Global Epidemiology from 1989 to 2015 for terms involving epidemiology and progression of NAFLD, which reported that the prevalence of NAFLD is 25.24% with highest prevalence in the Middle East and South America and lowest in Africa [13]. The difference in results achieved in current study may be due to few population samples numbers.

Results regarding distribution of different gender with nonalcoholic fatty liver detected by US examination, represented in (table 2 and figure 2). The date achieved that prevalent is higher in male gender more than female with mean standard  $44 \pm .501$ . Discussion associate with the results distribution of gender in comparing with group aging represented in tables 3 and figures 3 and 4, the study data reflect that nonalcoholic fatty liver presence in male with percentage of (56.00%) more than female (44.00%) and distribution corresponded to maximum range (40-49) years of group aging in the general sample of the study. These result agree with previous studies [14, 15], which reported that the risk of steatosis for males was 4 times higher than for females. Obtained results from histologic and/or clinical markers of the study samples for distribution of overweight and obesity shown in Table 4 and figures 5 and 6, the results achieved that 22.0% is normal weight while 62.0% overweight and 16.0% result achieved for obesity, total result was 78% of total samples associate with NAFLD. However this result agree respectively with many previous researches [15, 16, 17] which reported that obesity is the most important risk factor for NAFLD with prevalence of 4.6 times greater in the obese population, and up to 74% of obese individuals have NAFLD. Incidence of diabetes in the obtained data shown in table 5 and figures 7, 8 which achieved that diabetes were found in population samples with percent of (40%), associate with NAFLD and in correlate with patient gender, most of the diabetics are female (22%). However this results agree respectively with previous literature [17, 18, 19] which estimated that the main pathophysiological problem in nonalcoholic fatty liver patients is insulin resistance induces in type 2 diabetes mellitus. Thus, the correlation is clear between NAFLD and metabolic diabetes disease as mentioned previously.

The most risk factors that were associate with NAFLD represented in table 6 and figure 9. Beside obesity and diabetes, these factors including present of hypertension, with percent of 22.0%, elevation of cholesterol level found with percentage of 24.0% and irregular physical exercise activities were obtained with the higher percent of 54.0%. The obtained results achieved that, there is correlation with NAFLD and these risk factors, these results matching and agreed with studies found in literature. [15, 16, 19] which indicated that the prevalence of cholesterol in association with NAFLD was significantly higher than with non-association group and for assessment of physical exercises activates, previous studies agree partially with the current study in that, moderate to vigorous exercise is benefit for

decreasing the risk of developing fatty liver disease. Exercise or physical activity amount to benefit fatty liver disease in non-alcoholic fatty liver disease is not known. Thus, further studies and researches are recommended in this way.

## 5. Conclusion

Ultrasound finding in current study proved that non-alcoholic fatty liver disease have associated with diabetes and obesity in addition to many others risk factors including hypertension, elevation of cholesterol level and irregular physical exercise activities These data should be taken into consideration in patient counseling and monitoring. Recommendations is very important to reducing weight a balanced diet along with regular exercise to maintain normal healthy life and further studies are recommended in this way. Based upon the high prevalence of obesity, the prevalence of NAFLD will continue to be high, unless awareness is inculcated among the population.

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