

ORIGINAL ARTICLE**Correlation between ultrasound grading of fatty liver and body mass index (BMI)**Sarfraz Ahmad¹, Javeria Aslam²

<p>Affiliations</p> <p>1. Assistant Professor Radiology, KMSMC, Sialkot.</p> <p>2. Radiologist, Commissioner Road, Sialkot 0321-4463630</p> <p>Corresponding Author: Dr. Sarfar Ahmad, Assistant Professor Radiology, Govt. Khawaja M. Safdar Medical College, Sialkot. Contact 0321-33442221 Email; sarfrazradio@gmail.com</p> <p>Submission completed: Jan, 2025 Review began: Feb, 2025 Review ended: Feb, 2025 Accepted: Feb, 2025 Published: June, 2026</p> <p>Author contribution: SA: Designed the research Pattern and drafted the manuscript. JA: Data Collection, Approval</p>	<p>ABSTRACT</p> <p>Objective: This study is conducted to assess the association between ultrasound grading (e.g grades 0-3) of liver steatosis (fatty liver) and category of BMI among adult patients.</p> <p>Methodology: A Prospective, observational, and cross-sectional study was conducted at Allama Iqbal Memorial Teaching Hospital/ Govt. DHQ Hospital (Govt. AIMTH) a Tertiary Care Hospital. Total 250 patients aged from 18 to 70 years were included in this study. A questionnaire was prepared and data was collected accordingly for their weight, height, (BMI) and ultrasound grading of fatty liver(grades 0-3).</p> <p>Results: By evaluating the data, it was found that out of 250 participants, 92 (36.8%) were male and 158 (63.2%) were female. Mean age was 43.5 ± 12.4 years, mean BMI was 29.1 ± 4.6 kg/m². Ultrasound findings showed Grade 0 fatty liver in 42 (16.8%), Grade 1 in 84 (33.6%), Grade 2 in 78 (31.2%), and Grade 3 in 46 (18.4%) patients. A strong positive correlation ($r = 0.71$, $p < 0.001$) was found between BMI and fatty liver grade. Patients with Grade 3 fatty liver had significantly higher mean BMI (33.4 ± 3.2 kg/m²) compared to Grade 0 (24.8 ± 2.5 kg/m²). Female patients were found allegedly to be more affected with steatosis than males while majority of patients fell into category of grade 1 fatty liver.</p> <p>Conclusion: This concludes that higher BMI is strongly associated with increased ultrasound grading of fatty liver.</p> <p>Key words: Fatty Liver Disease ,BMI, Ultrasonography, Grade, Steatosis</p> <p>Cite this Article as: Ahmad S., & Aslam J.,; Correlation between ultrasound grading of fatty liver and body mass index (BMI). SIAL J Med. Sci. J June-2026 Volume-4, (Issue-4, Overall Issue-16):18-22</p>
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Introduction

Fatty liver disease is characterized by excess of fatty acid and fat accumulation in hepatocytes, detectable via ultrasound grading (the first line diagnostic modality).

BMI is easy to calculate and widely used in clinical and public health settings. It does not directly measure body fat, but gives a useful estimate. It may be less accurate for athletes, elderly individuals, or people with high muscle mass^{1,2}. The Body Mass Index (BMI) is a widely accepted indicator of body

fat and is closely related to the risk of non-alcoholic fatty liver disease (NAFLD). It is also linked with several features of metabolic abnormalities. NAFLD has grown to epidemic proportion and is currently the most common cause of abnormal liver leading to cryptogenic cirrhosis^{1,2}.

Nonalcoholic fatty liver disease (NAFLD) develops in result of obesity and metabolic syndrome. It comprises a disease pattern which results liver cirrhosis, atherosclerosis,

cardiovascular disease (CVD), and non-alcoholic fatty liver disease NAFLD³. Nonalcoholic fatty liver disease (NAFLD) is becoming the most common cause of chronic liver disease 2 to 30% worldwide when acids are greater than 5% of liver weight⁴.

Liver biopsy has been the gold standard method for diagnosis but it is of invasive nature. So, different imaging studies are used for the diagnosis. Ultrasonography having good accuracy so it detects moderate to severe degree hepatic steatosis, but not for mild steatosis⁵.

Many studies have demonstrated statistically significant correlation between BMI and ultrasound-detected liver steatosis grade (e.g;r=0.60;P<0.0001)⁶. This study is conducted to assess the association between ultrasound grading (e.g grades 0-3) and BMI among adult patients ;to evaluate the locally relevant data for prevalence of steatosis by BMI category. It may inform regional risk stratification.

Ethics Approval;

Ethics Committee approved this study.

Objectives

This study is conducted to assess the association between ultrasound grading (e.g grades 0-3) of liver steatosis (fatty liver) and category of BMI among adult patients.

Methodology

The study design was prospective descriptive and open labeled survey conducted using specifically design questionnaire. It was conducted in Allama Iqbal Memorial Teaching Hospital/ KSMC, Sialkot. The study included data of 250 patients to reach at a specific conclusion that how BMI affects the grades of fatty liver on ultrasound. Patients of either sex with age limit of above 18 years but below than 70 years who come for abdominal ultrasound for any clinical indication were included.

Patients suffering from chronic liver disease (cirrhosis, viral hepatitis etc) and pregnant women were excluded.

The details of phenomena were noted down. On the completion of study, the questionnaires were analyzed by using Pearson’s correlation coefficient and chi square test to obtain the result⁶.

Results

All of the collected data was transferred to Microsoft Excel and their results were finalized with the help of Pie Charts and graphs.

The various parameters analyzed are as follows:

Gender Distribution:

Gender	Number Of Patients	Percentage
Female	158	63.2%
Male	92	36.8%

Table;1

Total 250 patients 158 were female while 92 patients were male as shown in Fig.1.

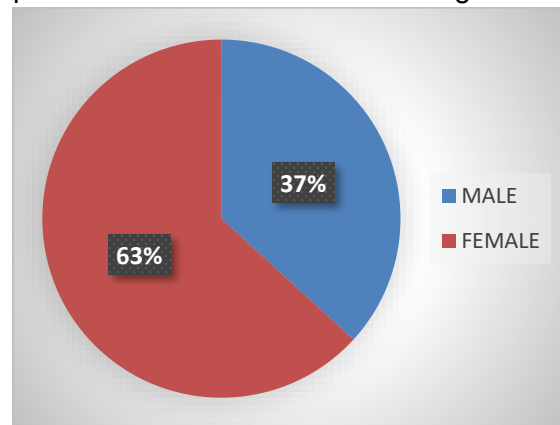


Figure: 1 (Gender Distribution)

Age Distribution:

Out of 250 patients 74 were below 30 years, 84 were between 30 years to 45 years and

CORRELATION BETWEEN ULTRASOUND GRADING OF FATTY LIVER AND BODY MASS INDEX (BMI).

92 were above 45 years of age as shown in Fig. 2.

Age	Number Of Patients	Percentage
<30 years	74	29.6%
30 to 45 years	84	33.6%
>45 years	92	36.8%

Table:2

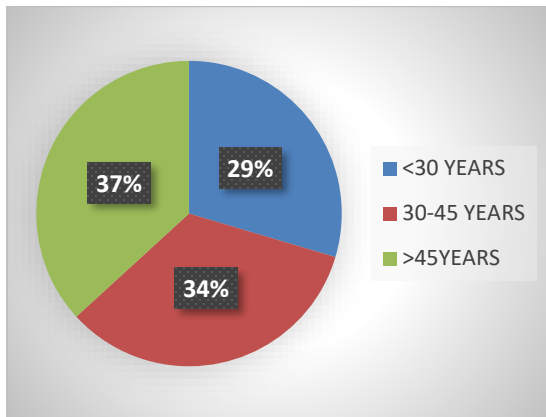


Figure: 2 (Age Distribution)

Was the patient obese?

As obesity has a major role in advanced grade of fatty liver so it was necessary to consider this point in the research.

Out of 250 patients 110 were obese as shown in Fig. 3.

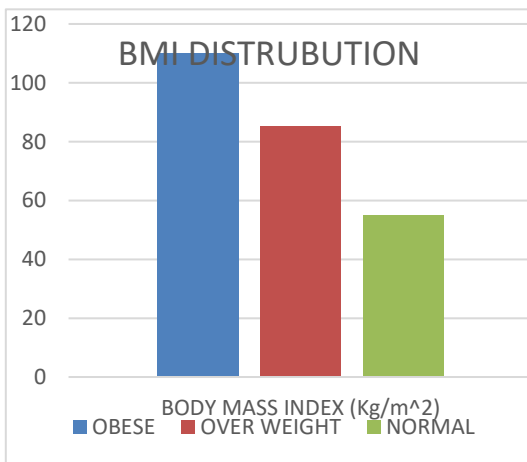


Figure:3 (BMI Distribution)

ULTRASOUND GRADING:

CORRELATION BETWEEN ULTRASOUND GRADING OF FATTY LIVER AND BODY MASS INDEX (BMI).

Out of 250 patients;
 Grade 0: 42 patients(16.8%)
 Grade1: 84 patients(33.6%)
 Grade2 :78 patients(31.2%)
 Grade3 :46 patients(18.4%)

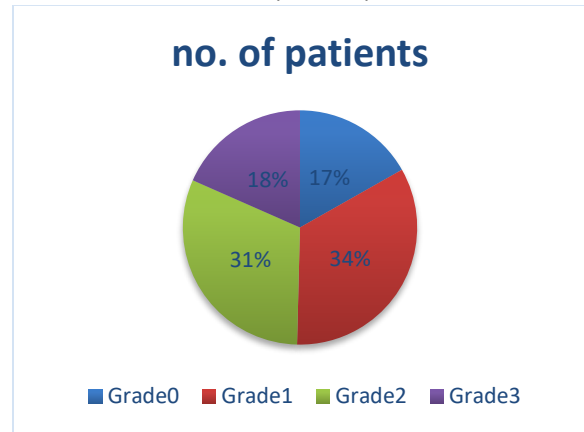


Figure:4 Ultrasound Grading

Higher BMI suggests the advanced grade of fatty liver; so as the chances of progression to liver fibrosis that ultimately leads to liver fibrosis and cirrhosis.

Grade 1 constitutes the point where hepatic echogenicity is slightly increased than normal.

Grade 2 constitutes where echogenic walls of portal vein branches are not visible.

Grade 3 where highly echogenic liver parenchyma obscures the outline of diaphragm.

Discussion

According to the data collected, fatty liver disease was aggravated by high BMI value. Many studies have demonstrated statistically significant correlation between BMI and ultrasound-detected liver steatosis grade (e.g ; r=0.60; P<0.0001)^{7,8,9}.

This study demonstrates a strong positive correlation between BMI and ultrasound grading of fatty liver. The results align with previous literature showing obesity as a major risk factor for NAFLD¹⁰.

Our data show that patients with Grade 3 fatty liver had a mean BMI in the obese

range, supporting the concept that higher body fat leads to increased liver fat deposition.

These findings have the important clinical implications. Since the BMI is simple to measure, it could be used for the early screening to identify individuals at high risk for the fatty liver, even before advanced imaging or liver biopsy is considered.^{4,11,12}

A study conducted in 2021 by Lee, B. also suggests that obesity is major risk factor in increasing steatosis grade; which corresponds with our research work which is in agreement with our study¹³.

Conclusion:

This concludes that higher BMI is strongly associated with increased ultrasound grading of fatty liver.

Limitations

Limitations include reliance on ultrasound (operator dependent) and lack of liver biopsy confirmation.

Recommendation

Routine BMI measurement can help in early detection of patients at risk for advanced fatty liver disease, enabling timely lifestyle and dietary interventions.

BMI can be used as a simple screening tool for fatty liver risk, particularly in overweight and obese populations. Public health interventions targeting weight reduction may help mitigate fatty liver disease progression. However, BMI alone may not capture metabolic risk in lean individuals with Non-Alcoholic Fatty Liver Disease (NAFLD, "lean NAFLD"), and future studies should also consider waist circumference and metabolic parameters.

Disclaimer: None

Conflict of Interest: None

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