Predictive Accuracy of Fatty Liver Index Against Ultrasonography Among Overweight Non-Diabetic Patients Of A Tertiary Care Center In Tamil Nadu, South India.

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KEYWORDS

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ABSTRACT

Introduction: The increasing prevalence of both obesity and type 2 diabetes due to easy access to high calorie foods and sedentary lifestyles resulted in NAFLD to be one of the ,major public health concern in India. Due to the asymptomatic nature of NAFLD, imaging techniques like ultrasonography and CT scan have been used as diagnostic tool though liver biopsy is gold standard test. Inspire of this, non-invasive algorithms like fatty liver index have been used nowadays in clinical as well as community to detect fatty liver. The current study aimed to determine the diagnostic accuracy among overweight non-diabetic patients.

Methods: An observational cross sectional study was conducted in a internal medicine department of tertiary care center situated in South India between 2022 to 2023 .Convenient sampling technique was followed. A structured questionnaire was used to collect data on socio-demographic and relevant clinical details. Fatty liver index was enumerated with waist circumference, Body Mass Index, serum triglycerides and gamma glutaryl transferase. Ultrasonography was performed as diagnostic test.

Results: A total of 107 study subjects were included. Majority of the study subjects were in age category of 40-60 years (66%). Both male and female genders were equal in number. The prevalence of non alcoholic fatty liver disease identified by fatty liver index was 57 % whereas by ultrasonography it was 54.2%. The sensitivity and specificity of fatty liver index validated against ultrasonography were 77.1% and 76.1% respectively. Conclusion: Fatty liver index has been found to be acceptable diagnostic tool which could be used especially when imaging techniques are not available.

INTRODUCTION:

India is the world's second most populous and seventh largest nation. The current global epidemics of obesity and type 2 diabetes mellitus (T2DM) have combined with easy access to high-calorie foods and sedentary lifestyles to make nonalcoholic fatty liver disease (NAFLD) a major public health concern in India and other countries.[1]The most common liver disease affecting the Indian population is non-alcoholic fatty liver disease (NAFLD), which is also the leading cause of liver disease worldwide.[2] About 25% of the global population are affected by NAFLD and its still increasing.[3] When there are no secondary causes, such as alcohol or drugs linked to fatty liver, and macro vascular steatosis affects more than 4% of hepatocytes, it is referred to as nonalcoholic fatty liver disease (NAFLD).NAFLD encompasses a broad spectrum of conditions, including fibrosis, liver cirrhosis, non-alcoholic steatohepatitis (NASH), and hepatic carcinoma. [4] Globally, NAFLD prevalence is estimated to be over 25%, and in the Indian population as a whole, it ranges from 9% to 32%.5 Metabolic syndromes, such as obesity, insulin resistance/diabetes,

dyslipidemia, systemic hypertension, and hyperglycemia, are frequently correlated risk factors for NAFLD.[5] Because of its high prevalence rate, recently in 2021 the Ministry of Health and Family Welfare has included non-alcoholic fatty liver disease in the National Health Program for the prevention and control of various diseases, including diabetes, cancer, cardiovascular diseases, and stroke.[6]

NAFLD is more prevalent in patients with obesity, diabetes, dyslipidemia, or any other metabolic disorder in medical practice, and it's linked to a higher death rate from cardiovascular causes.[7] Due to its asymptomatic nature, imaging techniques like abdominal computed tomography (CT) and ultrasonography (AU) are frequently used to identify it. The practical guidelines currently suggest an initial clinical assessment that includes anthropometric measurements (height and weight to calculate body mass index (BMI)), vital signs, and laboratory tests in the case of obese/overweight, diabetic, and metabolic syndrome (MS) patients. Following these tests, liver biopsy puncture (LBP), blood markers/scores, or imaging methods are used to show the presence of hepatic steatosis (HS). Because LBP is an invasive procedure with a number of potential complications, such as bleeding, pain, discomfort in the abdomen, and in rare cases, death, its practical utility is limited and it is rarely used.[7] In addition, liver biopsy, the definitive diagnostic method, is usually conducted solely on symptomatic individuals or those exhibiting elevated aminotransferase levels. 8 The diagnosis of non-alcoholic fatty liver disease (NAFLD) frequently involves the use of imaging modalities such as liver ultrasonography, magnetic resonance imaging (MRI), and abdominal CT. Because of its ease of use and non-invasiveness, liver ultrasonography is the technique that is most commonly used in medical practice. For the purpose of identifying moderate-to-severe hepatic steatosis, AU can offer good diagnostic accuracy.[9]

To facilitate the diagnosis of NAFLD, many non-invasive algorithms have been developed in which, FLI is most commonly used by the physicians. Four clinical and biochemical variables are included in the FLI: triglycerides, waist circumference (WC), gamma-glutamyl transferase (GGT), and BMI. [10] Since it is most often used by the treating physicians to diagnose as well as to screen high risk patients, it is imperative to elicit the diagnostic accuracy of FLI. Being NAFLD common among the obese and diabetic people and considering the overweight to be the major risk factor of NAFLD, this study was conducted to determine the sensitivity and specificity of FLI on comparing with the ultrasonography.

METHODS:

This is an observational cross sectional study conducted in the department of General medicine belonging to a tertiary care medical college and hospital situated in South India. The study period was between 2022 to 2023.The study participants were selected using a convenient sampling method. All patients aged between 20 and 70 years reported in general medicine department were recruited into the study. Only those patients who were non-diabetic and overweight (BMI of 25-20 kg/m2) were included in the study. Those patients who were diabetic (type 2 diabetes/ other types of diabetes), with history of alcoholic fatty liver disease), severe infections, chronic liver diseases (AST/ALT levels more than 2 upper limit) and alcohol intake of more than 2 occasions in a week were excluded from the study. According to Biciusca T et al [11] study, considering the sensitivity of Fatty Liver Index as 82.8% with a precision level of 21% and 95% confidence interval level, the sample size was calculated using the open epi website. The required total sample size for the present study was 107. Patients coming to general medicine OPD and IPD were selected according to inclusion and exclusion criteria. An informed Consent was taken from each candidate.

A structured questionnaire was used to record the clinical and demographic details of the patients. History taking and examination were done after providing a informed written consent. The subject was dressed modestly and wore no shoes when their weight was recorded on a digital scale. The participant stood without shoes, and the participant's height was measured with a tape

measure to the nearest millimeter. Unclothed, the subjects' waist and hip circumferences were measured with a tape measure. Between the iliac crest and the costal margin, the WC was thought to have the smallest circumference. Body mass index (BMI) was computed by dividing weight (in kilograms) by height (in meters) squared. AS per WHO BMI classification, only those study subject were overweight i.e BMI of 25-30 kg/m2 were taken into the study. The FLI's formula is as follows, per a previously released report by Bedogni et al[9] : FLI is equal to [e0.953 = H loge (triglycerides) + 0.139 = × loge (BMI) + 0.718 = × loge (γ-glutamyltransferase) + 0.053 = × loge (waist circumference–15.745)]/[1 + e0.953 + H + loge (triglycerides) + 0.139 + × + BMI + 0.718 + × + loge (γ-glutamyltransferase) + 0.053 + × + waist circumference – 15.745] / 100; Waist circumference measurements are given in centimeters, triglyceride levels are expressed as milliliters per liter, and γ-glutamyltransferase levels are expressed as units of unit (U/l). The score is between 0 and 100. If this score is below, there is low risk of fatty liver index and these patients should ruled out. If the score is between 30-60, fatty liver is neither ruled in nor ruled out. If the score is above 60, fatty liver should be ruled in. Hence, in the current study this score of above 60 was considered as positive for fatty liver disease. The study subjects with fatty liver were also identified with Ultrasonography.

Numerical variables Such as age, weight, height, waist circumference, Body Mass Index, Fatty Liver Index., are represented in parameters such as mean, median, mode and standard deviation. Categorical variables such as gender, etc., are represented in frequencies and percentages. Sensitivity, specificity, positive predictive value and negative predicative value of fatty liver index against ultrasonography were performed to identify the diagnostic accuracy. Data was entered in MS-excel sheet and studied using SPSS software version 24.

RESULTS:

In the present study, a total of 107 non-diabetic patients with overweight were included in the study, in which majority were belonging to age category of 50-59 years (33.5%) followed by 40-49 years (33.6%) as shown in Fig-1. The mean age of the study subjects was 48.43+8.71 years. Almost males (49.5%) and females (50.5%) were equal in proportion.

Fatty liver index was assessed using the anthropometric parameters such as height, weight, waist circumference and BMI. The mean values of the above parameters were depicted in the fig-2. In addition, the mean values of biochemical parameters used to calculate fatty liver index such as serum triglycerides levels and gamma glutamyl transferases were illustrated in fig-3.

The prevalence of fatty liver among the study subjects identified by the commonly used ultrasonography imaging was 54.2% where as the proportion of fatty liver identified by using the fatty liver index was 57%. The various screening test parameters were illustrated in table 1. The sensitivity i.e the ability of fatty liver index to correctly identify the patients with fatty liver was 77% and the specificity i.e the ability of fatty liver index to correctly identify the patients without fatty liver was 76 %. The positive and negative predictive values of fatty liver index were 81 % and 71.4% (i.e % proportion of subjects shown positive/negative with fatty liver index actually presented with/without fatty liver respectively) (table 2)

Fig 1- Age distribution of the study subjects (N-107)

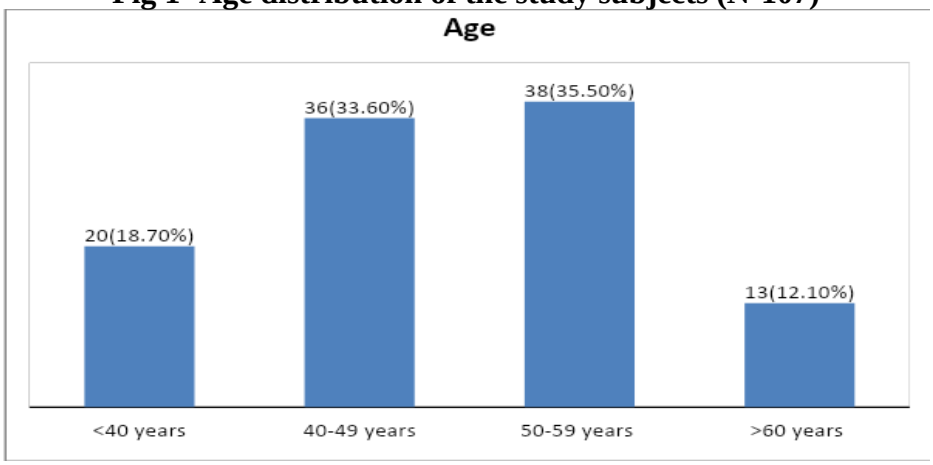

Fig 2- Mean values of anthropometric measurements and biochemical parameters among the study subjects

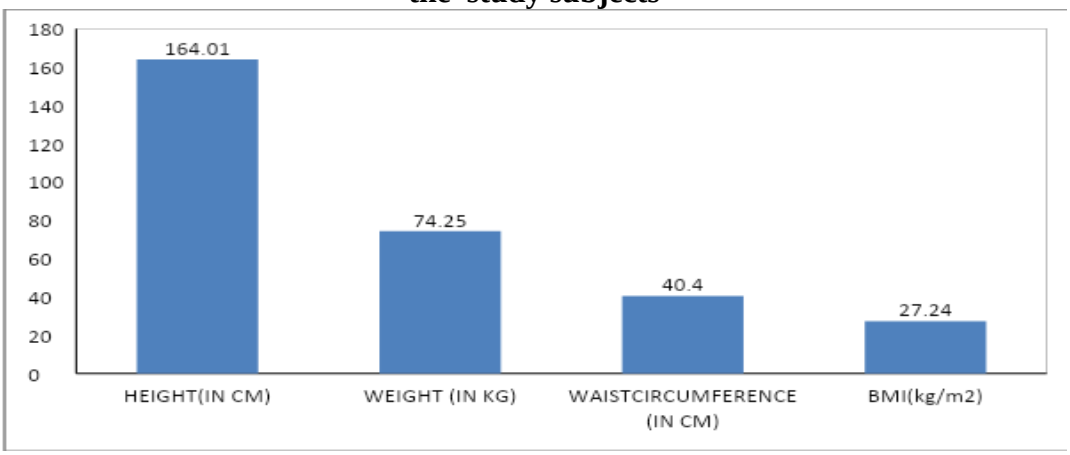

Fig3- Mean values of biochemical parmeters used in fatty liver index (N-107)

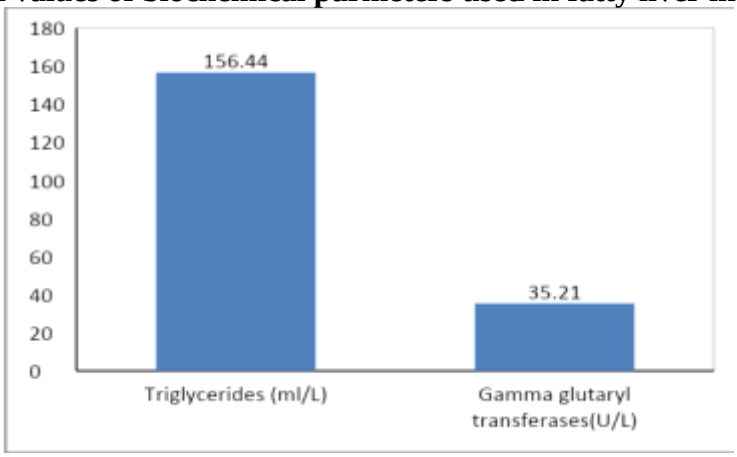

Table 1- Proportion of fatty liver identified using fatty liver index and ultrasonography among the study subjects (N-107)

S.No	FATTY LIVER	Frequency	Percent
1	By Fatty liver Index	58	54.2%
2.	By USG	61	57%

Table 2- Sensitivity, specificity of the fatty liver index among the study subjects

Fatty liver index	USG +ve	USG-ve	Total	
Yes	47 (TP)	11(FP)	58	PPV(TP/TP+FP) =81%
No	14 (FN)	35(TN)	49	NPV(TN/TN+FN)=71.4%
Total	61	46	107	
Sensitivity & Specificity	Sensitivity(TP/TP+FN)= 77.1%	Specificity(TN/TN+FP)= 76.1%		

TP-True Positive, TP= True negative, FP- False Positive, FN- False negative, PPV-positive predictive value, NPV- negative predictive value

DISCUSSION :

The present study was conducted to find out the diagnostic accuracy of fatty liver index in identifying fatty liver among the overweight non-diabetic study subjects. The mean age of the recruited subjects in the current study was identified as 48.43+8.71 years. A similar study conducted among the pre-diabetes patients in Spain by Busquets-Cortés C et al[12] also nearly equal finding of mean age which is 44.81±9.91 years. Males and females were in equal proportion in our study. This finding is consistent with the study conducted by Li Y, et al[13] in China. In the present study, the mean values of height and weight of the study subjects were found to be 164.01 cm and 74.25 kg respectively. These findings are comparable to a similar observational study conducted by Huang JF et al.[14] Also, the mean waist circumference was found to be 40.4 cm and the mean triglycerides levels among the study subjects in the present study was 156.44 mg/dl. Similar findings of almost equal mean values of BMI and serum triglycerides are reported in a study conducted by Tan Ex et al.[15]

The prevalence of fatty liver index was found to be 57% which was estimated using ultrasonography whereas by FLI it was 54.2 %. A contrasting finding of prevalence of NAFLD as 27.2% identified by Ultra sonography and 30.1 % elicited by fatty liver index FLI was observed in a systematic review conducted in Europe.[16] These differences in findings could be due to the difference in the study area and also the difference in the inclusion as well as the exclusion criteria set by the authors in reference article.A guidance paper issued by Indian association for the study of liver showed the prevalence of fatty liver to be around 40% which is still lesser than the prevalence reported in our study which could be due to the selection criteria followed in our study.[17]

The sensitivity and specificity of fatty liver index was found to be 77.1 % and 76.1 % respectively. Though a varying sensitivity and specificity was reported in other countries, In India as per National health and Nutritional examination data published in 2017-18 showed that almost similar sensitivity of our present study which is 80.8% but the specificity is little lower of about 70.5% .[18] The above findings are almost consistent with the current study findings.

In the present study, fatty liver index has a good sensitivity and specificity in the identification of non-acholoclic fatty liver disease among the overweight individuals. Fatty liver index was first put forward by Bedogni et al[19] in Italy following which several research was done proving the discriminative ability to identify ultrasonographic hepato steatosis and outperforming other non-invasive methods such as body mass index, waist circumference , triglycerides and so on. In addition to this, fatty liver index have been found to be useful in predicting other metabolic and cardiovascular disease and all cause mortality.[20,21] Hence, considering all the out study findings and the above mentioned benefits, fatty liver index could be used only as both diagnostic and screening tool especially when ultrasound and other imaging methods are not available

CONCLUSION:

In the current study, there was high prevalence of Non-alcoholic fatty liver disease reported when compared to the global and regional trends. The diagnostic accuracy of fatty liver index validated against ultrasonography was found to be with acceptable limits. Given that each component is consistently assessed in clinical settings, measuring FLI is easy and can be used effectively.

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