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Correlation between Liver Fat Indices and Ultrasonography to Determine Non-alcoholic Fatty Liver Disease among Diabetic Patients in Sri Lanka

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ABSTRACT

Objectives: Non-alcoholic fatty liver disease (NAFLD) and type 2 diabetes mellitus (T2DM) strongly coexist as they share common pathophysiological conditions. Several non-invasive, patient-friendly, and cost-effective liver fat indices have been introduced recently to diagnose NAFLD at an early stage. This study aimed to establish the correlation between ultrasonography and liver fat indices (fatty liver index [FLI] and hepatic steatosis index [HSI]) to determine NAFLD among known T2DM patients.

Material and Methods: A cross-sectional study was conducted using one hundred newly diagnosed type 2 diabetic patients attending the diabetic and endocrinology clinic at the Colombo South Teaching Hospital, Kalubowila, Sri Lanka. An interviewer-administered questionnaire was used to collect socio-demographic data and anthropometric measurements. Ultrasound scans were performed to diagnose and stage fatty liver. Biochemical investigations included aspartate amino transferase, alanine aminotransferase, gamma-glutamyl transferase triglyceride analysis. Scores for the liver fat indices were calculated using collected data and correlations between the variables were statistically analysed using the statistical software, SPSS version 23.0. Descriptive statistics, chi-square tests, Independent *t*-tests and Pearson correlation were used in the data analysis.

Results: The incidence of NAFLD among T2DM was 82%. There was a statistically significant correlation ($P < 0.05$) between NAFLD diagnosed by ultrasonography and HSI. There was also a statistically significant correlation ($P < 0.001$) between NAFLD diagnosed by ultrasonography and FLI, and there was a statistically significant difference between FLI among participants with no fatty liver compared to participants with ≥ grade 2 fatty liver ($P < 0.001$.

Conclusion: The current study showed that both FLI and HSI can be used as markers for the early diagnosis of NAFLD in T2DM patients.

Keywords: Non-alcoholic fatty liver disease, Type 2 diabetes mellitus, Fatty liver index, Hepatic steatosis index, Ultrasonography

INTRODUCTION

Non-alcoholic fatty liver disease (NAFLD) has become the main cause of chronic liver diseases worldwide and in Sri Lanka. Therefore, proper diagnosis and management of the disease are of utmost importance.[1,2] Fibrosis and cirrhosis are known to be the main complications of NAFLD progression, which can also lead to more severe conditions such as hepatocellular carcinoma.[3,4] Diabetes mellitus (DM) is also considered to be one of the most important global health threats, with a rapid increase in incidence over the past few decades.[5-7] Severe complications of DM affect the general population worldwide and its treatment and management are also of utmost importance.[5-7]

Since NAFLD is strongly associated with DM, it is important to quickly diagnose this condition in patients to initiate early treatment and prevent complications.[3] The diagnosis of NAFLD is mostly conducted using abnormal liver function test results; however, fatty liver can be present even with normal levels of liver enzymes.[8] Liver biopsy is considered to be the gold standard to diagnose NAFLD, which is an invasive and costly procedure and can be prone to sampling errors and, on rare occasions, lead to mortality. Thereby, it is unable to conduct liver biopsies on all the suspected patients having NAFLD due to the complicated procedures.

At present, ultrasonography is the most common procedure used in Sri Lanka and can identify and stage NAFLD but can be time consuming and costly.[9] Therefore, it is important to develop more non-invasive and easily accessible methods to determine the presence of fatty liver and validate the liver fat indices already available to suit the needs of the Sri Lankan population to easily predict NAFLD and minimize the disease progression.[10,11]

The liver fat indices used in this study are the fatty liver index (FLI)[12] and the hepatic steatosis index (HSI).[13] FLI which is an algorithm based on body mass index (BMI), waist circumference, triglycerides, and gamma-glutamyl transferase (GGT) levels is experimented with and validated to be an accurate predictor of NAFLD when compared with the results obtained by ultrasonography.[12] HSI is a simple screening tool designed to predict NAFLD using alanine aminotransferase (ALT)/aspartate aminotransferase (AST) ratio, BMI, and DM.[13]

Determining the correlation of the liver ultrasonographic findings of fatty liver with the proposed liver fat indices would allow the introduction of a more economical, cost-effective, and non-invasive means of diagnosing fatty liver in clinical settings and facilitate early initiation of treatment and lifestyle modifications among patients, leading to fewer complications.[10-13]

This study aimed to determine the correlation between the liver ultrasonographic findings of fatty liver and the two liver fat indices (FLI and HSI) among Type 2 DM (T2DM) patients.

MATERIAL AND METHODS

Ethical considerations

Ethical approval to conduct the study was obtained on May 22, 2019, from the Ethical Review Committee, Colombo South Teaching Hospital, Kalubowila, with the approved application number: 776.

Written consent was obtained from all the participants. Participants' names were not recorded and participants' data were only accessible to the investigators.

Study design

A cross-sectional analytical study was conducted on a defined population (Type 2 diabetic mellitus patients) for 1 year.

Study setting

Newly diagnosed Type 2 diabetic patients registered at the Diabetic and Endocrinology Clinic of Colombo South Teaching Hospital, Kalubowila, Sri Lanka, from August 1, 2019, to January 31, 2020. All the procedures of the study were carried out according to the principles of the Declaration of Helsinki.[14]

Study population

One hundred newly diagnosed T2DM patients were selected for the study according to the resources available to conduct the study. The diagnosis of T2DM patients was confirmed by the consultant endocrinologist through the fasting blood sugar levels, postprandial blood glucose levels,[15] and the patient's medical history.

Recruitment of the participants was carried out following inclusion and exclusion criteria.

Age between 25 and 65 years, history of no or safe alcohol consumption, and not on medication for T2DM were included as the inclusion criteria. Safe alcohol consumption was determined by the weekly intake of alcoholic beverages according to the AASLD guidelines[16] where it is defined to be <21 standard drinks for men while 14 standard drinks for women per week. Pregnant individuals and patients with chronic liver disorders, endocrine disorders, Type 1 DM, and hepatic viral infections such as hepatitis B and C or autoimmune disorders were excluded from the study.

Sample and data collection

An information sheet was provided to all the participants with details regarding the research. All participants were advised to fast for 12 h before blood sample collection. Anthropometric data and data on family and clinical history were collected using an interviewer-administered questionnaire. The information collected included age, gender, occupation, height, weight, waist circumference, frequency of alcohol consumption, smoking history, and BMI.

A 3 mL of blood was collected into plain tubes to conduct biochemical investigations. The collected samples were centrifuged and serum was separated and stored at −20°C until the tests were conducted.

Ultrasound scans were performed on all participants by the consultant radiologist to diagnose and determine the stage of the fatty liver using the Toshiba APLIO 500 Ultrasound system (Toshiba America Medical Systems, INC, 2441 Michelle Drive, Tustin, USA). The probe was positioned in the sagittal plane along the mid-axillary line for the required observations and measurements. The grading was determined by observing the specific characteristics which is the echogenicity of the liver. The absence of fatty liver was determined in the presence of normal echogenicity and the Grades 1, 2, and 3 were determined along with the differences in the echogenicity and the degree of the visualization of the liver.[17,18]

Two non-invasive liver fat indices, namely, FLI and HSI were used in this study. Both indices use the results of the biochemical investigations and the anthropometric measurements collected during the study. A score for each index was calculated (Equation 1 and Equation 2) to determine the presence or absence of fatty liver.

$$\text{FLI} = (e^{0.953*\text{loge (triglycerides)}+0.139*\text{BMI}+ 0.718*\text{loge (GGT)}+0.053*\text{waist circumference}-15.745})/(1+e^{0. 953*\text{loge (triglycerides)}+0.139*\text{BMI}+0.718*\text{loge(GGT)}+ 0.053*\text{Waist circumference} - 15.7\,45})*100 \quad (1)$$

$$\text{HSI} = 8*(\text{ALT/AST}) + \text{BMI} + 2, \textit{ if T2DM}; + 2, \textit{ if female} \quad (2)$$

Laboratory analysis

All the biochemical investigations were conducted at the laboratory of the Faculty of Allied Health Sciences, KDU, within 1 week of sample collection. All biochemical investigations were conducted using a semi-automated analyzer – BTS-350 (Biosystems, Costa, Brava 30, 08030 Barcelona, Spain) under the supervision of the supervisors and medical laboratory technologists. The biochemical investigations were conducted to determine ALT, AST, GGT, and serum triglyceride levels.

Data analysis

The sociodemographic data, anthropometric measurements, results of biochemical investigations, results of ultrasonographic findings, and the scores obtained for each index were entered into the statistical software, Statistical Package for the Social Sciences (SPSS) version 23.0 (IBM Corp., Armonk, New York, United States).

The study group of the research was T2DM patients diagnosed with NAFLD and the control group was the T2DM patients without fatty liver.

According to the International Diabetic Federation,[19] the waist circumference of the South Asian population is categorized as follows. The waist circumference of males was approximated to be <90 cm (35.5 inches) while 80 cm (31.5 inches) was for females.

The data collected for the research were summarized using descriptive statistics to get a clear understanding about the study population used before further analysis of the data is carried out. The information regarding the weight, height, BMI, waist circumference, the biochemical investigations (ALT, AST, GGT, and triglyceride) were included in the analysis [Table 1]. Some parameters were classified further to aid the statistical analysis.

Participants with fatty liver were further categorized as Grade 1 fatty liver and ≥2 fatty liver.

The BMI was used according to the Asian BMI categorization[20] to categorize participants as underweight (BMI <18.5), normal weight (18.5–22.9), overweight (23–24.9), pre-obese (25–29.9), or obese (≥30).

FLI participants were categorized according to their diagnostic criteria as follows: FLI ≤30 (no fatty liver), FLI 31–59 (risk for fatty liver), and FLI ≥60 (fatty liver).[12] Similarly, participants were categorized according to the HSI diagnostic criteria as follows: HSI ≤30 (no fatty liver), HSI 31–35 (risk for fatty liver), and HSI ≥36 (fatty liver).[13] The two liver fat indices were used to determine the correlation between the ultrasound scan-based diagnosis of fatty liver to the prediction of the presence or absence of fatty liver following the categorization mentioned for the two indices above.

The Chi-square test was used to analyze all the categorical variables to aid in the analysis. The correlations between different variables; anthropometric measurements and biochemical investigations used in the analysis were conducted against the ultrasound-based diagnosis of fatty liver and the significant variables were further analyzed. This includes further analysis of waist circumference, BMI, ALT, AST, and GGT levels [Table 2].

The correlations between all the continuous variables was done using bivariant correlations (Pearson correlation) and P <0.05 was considered statistically significant.

RESULTS

One hundred (n = 100) newly diagnosed T2DM patients were included in the study. There were 36 (36%) male patients and 64 (64%) female patients [Table 1]. The mean

Table 1: Summary of the data collected and analyzed using descriptive statistics.

Characteristics	Statistics for both categories	No fatty liver	Fatty liver present
Weight (kg)			
Mean±SD	64.84±12.90	58.24±11.85	66.23±12.77
Median	63.3	54.05	64.5
Height (cm)			
Mean±SD	156.60±9.83	156.10±8.61	156.72±10.12
Median	156.5	157.7	156.25
BMI (kg/m^2)			
Mean±SD	26.35±4.10	23.96±4.17	26.88±3.92
Median	25.65	23.5	26.0
Waist (cm)			
Mean±SD	91.58±8.90	85.56±8.85	92.91±9.07
Median	91.0	85.0	92.0
TG (mg/dl)			
Mean±SD	164.54±55.41	156.94±59.05	166.21±54.82
Median	155.5	142.5	156.0
AST (U/L)			
Mean±SD	36.34±17.73	27.28±10.07	38.33±18.46
Median	32.0	27.0	34.0
ALT (U/L)			
Mean±SD	29.24±16.01	21.33±8.23	30.98±16.80
Median	26.0	20.0	29.0
GGT (U/L)			
Mean±SD	42.51±19.30	31.83±10.06	44.85±20.08
Median	36.5	30.0	38.0
HSI			
Mean±SD	39.75±6.05	37.15±5.33	40.32±4.84
Median	39.8	35.75	40.475
FLI			
Mean±SD	53.63±23.0	37.30±22.90	57.22±21.55
Median	52.18	42.24	57.5

BMI: Body mass index, TG: Triglyceride, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, GGT: Gamma-glutamyl transferase, HSI: Hepatic steatosis index, FLI: Fatty liver index

age was 48.38 ± 9.47 (range: 26–63 years). 50% of the study participants were aged between 41 and 55 years, 27 (27%) were aged ≥56 years, and the remaining 23 (23%) were aged between 25 and 40 years.

Based on the ultrasound scans, 82 patients (82%) were diagnosed with fatty liver and 18 (18%) had no fatty liver. Participants with fatty liver were further categorized as Grade 1 fatty liver (n = 34; 34%) and Grade 2 fatty liver or above (n = 48; 48%).

Out of the female patients, 84.4% (n = 54/64) were diagnosed with fatty liver based on the radiological investigations. The incidence of fatty liver was similar among the male patients, with 77.8% (n = 28/36) diagnosed with fatty liver.

Table 2: Data analysis using the ultrasonography-based diagnosis of fatty liver.

Measure	Total (%)	No fatty liver (%)	Fatty liver present (%)
AST (U/L)			
Normal (0–40 U/L)	62 (n=62)	88.89 (n=16)	56.1 (n=46)
Abnormal (>40U/L)	38 (n=32)	11.11 (n=02)	43.9 (n=36)
ALT (U/L)			
Normal (0–38 U/L)	81 (n=81)	94.44 (n=17)	78.04 (n=64)
Abnormal (>38 U/L)	19 (n=19)	5.55 (n=01)	23.17 (n=18)
GGT (U/L)			
Normal (11–54 U/L)	21 (n=21)	0 (n=0)	25.61 (n=21)
Abnormal (>54 U/L)	79 (n=79)	100 (n=18)	74.39 (n=61)
HSI			
No fatty liver (<30)	1 (n=01)	5.55 (n=01)	0 (n=0)
Risk of fatty liver (31–35)	23 (n=23)	44.44 (n=08)	18.29 (n=15)
Fatty liver (≥36)	76 (n=76)	50 (n=09)	81.7 (n=67)
FLI			
No fatty liver (<30)	17 (n=17)	44.44 (n=08)	10.97 (n=09)
Risk of fatty liver (31-59)	42 (n=42)	38.89 (n=07)	42.68 (n=35)
Fatty liver (≥60)	41 (n=41)	16.67 (n=03)	46.34 (n=38)

AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, GGT: Gamma-glutamyl transferase, HSI: Hepatic steatosis index, FLI: Fatty liver index

Based on the fatty liver diagnosis, 19.6% (n = 16) of the patients diagnosed with fatty liver were in the age range of 25–40 years while 52.4% (n = 43) of the patients were in the age range of 41–55 years and 28% (n = 23) were in the range of 56 years or above.

Based on the BMI, 83% of the study population were overweight or above irrespective of fatty liver diagnosis; 26 participants were categorized as overweight, 35 as pre-obese, and 22 as obese, while 14 participants had normal weight and three were underweight.

Among the patients with fatty liver, 87.8% (n = 72) were categorized as overweight or above; 11.0% (n = 9) had a normal BMI. 24.4% (n = 20) were categorized as overweight, 40.2% (n = 33) as pre-obese, and 23.2% (n = 19) were categorized as obese. The association between the liver ultrasonographic findings and the BMI classification showed a statistical significance with P = 0.009.

The mean waist circumference among female participants was 91.21 ± 9.13 cm (range: 75–114 cm). Out of the female patients in the study, only 15.6% (n = 10) had a waist circumference <80 cm. Among female patients with fatty liver, 85.2% (n = 46) had a waist circumference >80 cm.

The association between the waist circumference and the ultrasonographic findings showed a statistical significance of $P = 0.002$.

62% of the total participants showed normal AST levels. The percentage of patients with fatty liver showing normal AST level was 56.1% while higher AST level was shown by 43.9%. About 88.9% of the patients with no fatty liver showed normal AST levels. The association between AST levels and ultrasonographic findings of fatty liver was statistically significant at $P = 0.016$ level [Table 2].

The majority of the participants showed normal ALT levels which is 81% of the 100 participants. Patients with fatty liver showed 78% normal ALT levels while only 22% showed higher ALT levels. About 94.4% of the patients without fatty liver showed normal ALT levels. The association between ALT levels and ultrasounds scan was statistically significant at $P = 0.02$ level [Table 2].

About 79% of the participants showed higher GGT levels and patients with fatty liver showed 61% higher levels of GGT. The association between GGT levels and ultrasound scan results for fatty liver was statistically significant at $P = 0.009$ level [Table 2].

There was a statistically significant correlation between the ultrasound scan-based diagnosis of fatty liver and calculation of the HSI scores (correlation coefficient, r = 0.233; $P = 0.015$) ($n = 67$). There was also a statistically significant correlation between the FLI scores and the ultrasound scan-based diagnosis of NAFLD (correlation coefficient, r = 0.317, $P < 0.001$) ($n = 73$). However, our results also showed that 50% of the T2DM patients with no NAFLD were positive for NAFLD based on the HSI scores [Table 3].

Out of the participants diagnosed with fatty liver based on the ultrasonography results, 81.7% were classified into the fatty liver group based on the HSI score classification, while 89% were categorized into the risk group for fatty liver or the fatty liver group based on the FLI scores.

Table 3: Comparison between the ultrasounds scan and two liver fat indices.

Ultrasounds scan	HSI	FLI
r-value	0.233	0.317
P-value	0.015	< 0.001

r: Correlation coefficient

There was a statistically significant difference between FLI among participants with no fatty liver compared to participants with ≥Grade 2 fatty liver at $P = 0.000213$. It revealed that there is a significant difference between the categories of Grade 2 fatty liver or above (mean ± SD=61.75 ± 20.18) and no fatty liver (mean ± SD=37.29 ± 22.90) than the other categories [Table 4].

The area under the receiver operating curve (AUROC) was calculated to determine the sensitivity and specificity of the two liver fat indices which are more suitable for the study population used in this present study [Table 5].

FLI [AUC = 0.738 (95% CI 0.641 to 0.821)] was able to identify patients with and without disease with >50.18 as optimal cut-off having a 62.20% Sensitivity and a Specificity of 83.33%.

HSI [AUC = 0.675 (95% CI 0.574 to 0.765)] was able to identify patients with and without disease with >36 as optimal cut-off having a 81.71% Sensitivity and a Specificity of 55.56%.

The AUROC analysis is depicted for both FLI and HSI in the two diagrams with their relevant sensitivities and specificities [Figures 1 and 2].

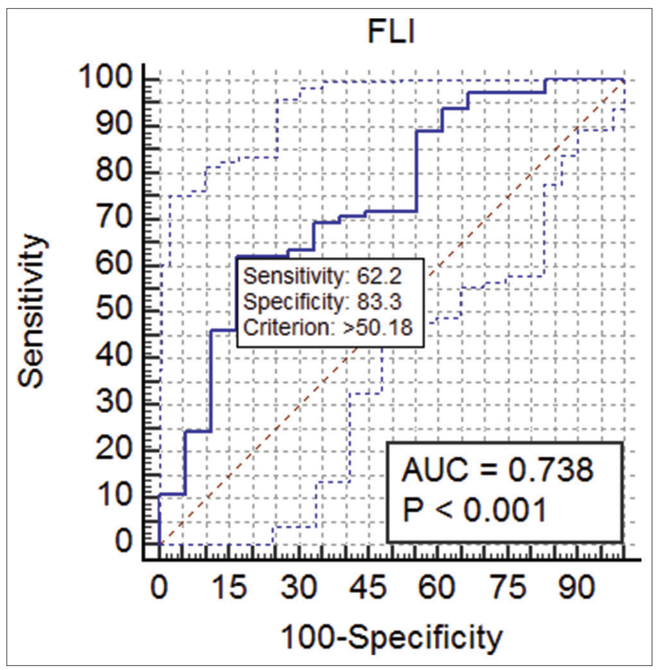

Figure 1: AUROCs for FLI in comparison with ultrasounds scan for the diagnosis of fatty liver.

Table 4: Comparison of the grade of fatty liver with FLI.

			Mean difference	95% CI	Significance
Ultrasounds scan	Grade 2 fatty liver or above	No fatty liver	24.45049	10.4126–38.4884	0.000213

Table 5: AUROC analysis of FLI and HSI.

	FLI	HSI
Youden index J	0.4553	0.3726
Associated criterion	>50.18	>36
Sensitivity	62.20	81.71
Specificity	83.33	55.56
Area under the ROC curve (AUC)	0.738	0.675
95% confidence interval	0.641–0.821	0.574–0.765
Significance level *P* (Area=0.5)	0.0004	0.0316

HSI: Hepatic steatosis index, FLI: Fatty liver index

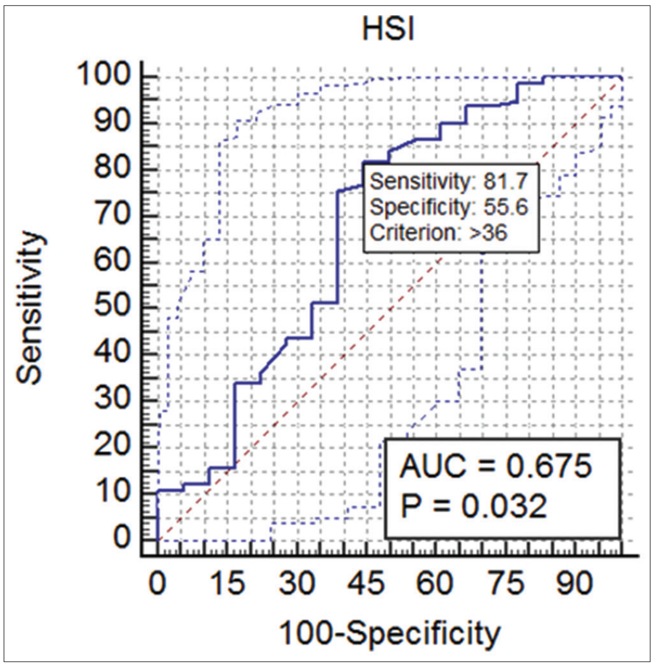

Figure 2: AUROCs for HSI in comparison with ultrasounds scan for the diagnosis of fatty liver.

DISCUSSION

In this study, the incidence of NAFLD among T2DM patients was high (82%) as determined by the ultrasound-based diagnosis of fatty liver. NAFLD was previously considered to be confined to individuals in developed Western countries with reported prevalence rates of up to 50%.[19] Surprisingly, recent reports have shown that NAFLD is no longer confined to highly developed Western countries, but is an increasing health threat in Asian countries, including Sri Lanka.[21] The prevalence of NAFLD was reported to be 33% among the general Sri Lankan population by a previous study[22] and 63% among T2DM patients in Sri Lanka in a study similar to the present study.[23]

The FLI scores obtained in our study showed a highly significant correlation ($P < 0.001$) with the ultrasound scan-based diagnosis of fatty liver. The previous studies have reported similarly significant correlations, indicating that FLI is a better screening tool to be used instead of an ultrasound scan for the early detection of fatty liver.[24-26] The percentage of the diabetic population with fatty liver as based on the ultrasound scan showed normal value in FLI (≤30) was 11% ($n = 9$) while the rest of the population ($n = 73$) gave intermediate (42.7%) and positive (46.3%) results in FLI for NAFLD.

There was also a significant correlation between HSI scores and ultrasound scan-based diagnosis of fatty liver. About 81.7% ($n = 67$) of the T2DM patients with fatty liver were also positive for fatty liver according to the HSI scoring system. This corroborates the findings of previous similar studies.[27] However, our results also showed that 50% ($n = 9$) of the T2DM patients with no fatty liver were positive for fatty liver based on the HSI scores.

Based on the results obtained through the AUROC analysis, it showed that there were sensitivity and specificity of 62.2% and 83.3%, respectively, for FLI. HSI showed a sensitivity and specificity of 81.7% and 55.6%, respectively. A study conducted on a Korean population has shown that the sensitivity and specificity for FLI were 73.4% and 76.1%, respectively,[18] and relative to the present study, another study has shown that there was a strong correlation between the liver ultrasonographic findings and FLI with a significance at $P < 0.001$ an AUROC value of 0.813 which correlates with the present study.[24]

The present study showed the AUROC of 0.738 (95% CI 0.641–0.821) for FLI and the AUROC of 0.675 (95% CI 0.574–0.765) for HSI. Approximately similar results were obtained in several other studies for FLI and a slightly higher AUROC value for HSI.[9,28]

The biochemical investigations used in the study are very appropriate to evaluate and compare the effect of using the indices instead of liver ultrasonography to determine NAFLD as an early detection tool in hospital settings. As it is impractical to conduct ultrasound scans on all suspected patients with fatty liver, the use of liver fat indices with routine investigations may be fruitful. The statistical significance between the liver ultrasonographic findings to determine fatty liver and the biochemical investigations in concern; ALT, AST, and GGT provide proof for the use of liver fat indices and the significant correlations of the investigations are presented clearly in the studies that developed the markers and other similar studies.[12,13]

Suspected patients are forwarded for abdominal ultrasonography mostly after obtaining the liver function test results. The majority of the patients having fatty liver are having normal AST and ALT levels and show that the levels of aminotransferases cannot exactly predict the presence or absence of fatty liver and this is supported by other studies conducted globally.[8,27] A previous study was conducted to determine the risk of NAFLD with normal aminotransferase levels showed that the results of the parameters cannot be used as a valid marker to predict fatty liver condition and forward the patients at risk for ultrasonography.[8]

Limitations

Biochemical investigations were conducted using a semi-automated analyzer BTS-350 for which a manual procedure was involved as this was the available equipment in the laboratory. We recommend performing the assays using an automated analyzer to more accurately measure the biochemical parameters. The study results may also have been affected by variations in patient fasting conditions or nutritional status, which we could not monitor. Another parameter that may have affected the results is the data collected about the alcohol consumption of the participants as it was self-reported by the participants themselves.

The sample size was also small due to the limitations faced in performing ultrasound scans in the hospital setup. Further studies with larger sample sizes are needed to determine much more suitable cutoff values for the two indices (HSI and FLI) for Sri Lankan diabetic population.

The gold standard method for the diagnosis of NAFLD is liver biopsy. We were not able to use the liver histological samples as the diagnosis criteria since it is an invasive procedure and not available for a large sample size. The present study used liver ultrasonography technique to determine the presence or absence of fatty liver and to grade fatty liver as it is the most common technique used in the available clinical setup. We also referred to the literature available and accepted the performance of liver ultrasonography as many of the previously conducted studies have used the same technique to determine fatty liver.

CONCLUSION

In this study, there was a statistically significant correlation between FLI and ultrasonographic findings to determine patients without fatty liver and patients with ≥Grade 2 fatty liver. AUROC analysis of both liver fat indices showed a considerable sensitivity and specificity to predict NAFLD in the study population used. Our results show that FLI can be used as a non-invasive, patient-friendly, and cost-effective marker to detect NAFLD in T2DM patients.

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Authors' contributions

KKDSD, MR, and CMJU were responsible for conceptualism, methodology, investigations, data analysis, and writing the original draft and editing. RS and GDS involved in the conceptualism methodology and analysis of data. WAC was responsible for investigations, data analysis, and providing the necessary resources to carry out the research. WA, Uditha, and JMKB were responsible for the conceptualism, methodology, data analysis and supervision of the overall study and reviewing the writing process, and providing the necessary resources.

Disclaimer

The views and opinions expressed are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

Declaration of patient consent

Patient's consent not required as patient's identity is not disclosed or compromised.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest

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