Original Research Article

STUDY OF THE CLINICAL PROFILE OF NON-ALCOHOLIC FATTY LIVER DISEASE (NAFLD) PATIENTS

Noorussaba Arfeen[1], Shachindra Kumar Astik[2], Uma Shankar Prasad[3], Kaushal Kishore[4]

[1]Senior Resident, Department of General Medicine, Patna Medical College and Hospital, Patna, Bihar, India
[2]Associate Professor, Department of General Medicine, Nalanda Medical College and Hospital, Patna, Bihar, India
[3]Professor, Department of General Medicine, Nalanda Medical College and Hospital, Patna, Bihar, India
[4]Professor, Department of General Medicine, Patna Medical College and Hospital, Patna, Bihar, India

A B S T R A C T

Background: Non-Alcoholic Fatty Liver Disease (NAFLD) is the most prevalent chronic liver disease globally, ranging from simple steatosis to Non-Alcoholic Steatohepatitis (NASH) and cirrhosis. It is closely linked to rising rates of obesity and diabetes. This study aims to evaluate the clinical profile of NAFLD patients attending the outpatient department at Nalanda Medical College & Hospital (NMCH), Patna.

Materials and Methods: A cross-sectional, observational, clinico-demographic study was conducted on 112 patients diagnosed with NAFLD via ultrasonography at NMCH, Patna. Participants were selected based on predefined inclusion and exclusion criteria. Detailed histories and investigative reports were collected and analyzed to assess demographic characteristics, laboratory parameters, liver enzymes, comorbid conditions, lipid profiles, and metabolic indicators.

Results: The age distribution highlighted that NAFLD primarily affects middle-aged and older adults, with the highest prevalence in the 50-59 age group (26.78%). Males comprised 53.57% of the patient population. Hepatomegaly was observed in 24.10% of patients. Laboratory analyses revealed elevated SGPT (ALT) in 21.42% and SGOT (AST) in 16.96% of cases. The ALT/AST ratio of ≥1 was found in 41.96% of patients. Comorbid conditions, primarily diabetes (34.82%) and hypertension (30.35%), were present in 68.75% of patients. Elevated lipid levels were common, with high triglycerides (41.96%) and low HDL levels in both males (56.66%) and females (73.07%). The prevalence of overweight (45.53%) and obesity (30.35%) was notable, with a significant portion exhibiting central adiposity.

Conclusion: NAFLD predominantly affects obese, middle-aged patients with diabetes and hypertension, often presenting with modest liver enzyme elevations and normal bilirubin levels. Comprehensive management strategies are crucial to preventing progression to cirrhosis. Further multicenter studies are required to deepen the understanding of NAFLD's risk factors and clinical profile, facilitating effective intervention strategies.

Keywords: Non-Alcoholic Fatty Liver Disease (NAFLD), Non-Alcoholic Steatohepatitis (NASH), Diabetes, Hypertension, Liver Enzymes, Comorbidities, Obesity, Lipid Profile.

INTRODUCTION

Non-Alcoholic Fatty Liver Disease (NAFLD) represents a significant public health challenge due to its high prevalence and potential to progress to severe liver conditions. First characterized in 1980 by Ludwig *et al*. as hepatic steatosis, NAFLD has since been recognized as the most prevalent chronic liver disease globally, with estimates suggesting that it affects 20% to 46% of the global population. This variability arises from differences in study populations and diagnostic criteria. In the United States alone, approximately 100 million individuals, or 30% of the population, are thought to suffer from this condition. NAFLD is identified by the presence of more than 5% hepatic steatosis, observed without secondary causes like excessive alcohol consumption, medications, or genetic disorders.[1-5]

NAFLD can be categorized histologically into two types: Simple Steatosis (SS), which accounts for 70%-75% of cases and is characterized by excess liver fat without inflammation or cellular damage; and Non-Alcoholic Steatohepatitis (NASH), which makes up 25%-30% of cases and includes inflammation and hepatocyte injury. Although often considered non-progressive and benign, some instances of SS can evolve, leading to NASH, which carries a substantial risk of progressing to more serious liver diseases including fibrosis, cirrhosis, and hepatocellular carcinoma (HCC).[6-9]

The surge in NAFLD incidence is closely linked to rising rates of obesity and diabetes, particularly in the United States where NAFLD is anticipated to become the leading cause of end-stage liver disease and liver transplantation by 2020. Beyond liver-related issues, NAFLD is an independent risk factor for cardiovascular diseases, significantly increasing overall mortality risks.[9-11]

This disease predominantly affects individuals with obesity and type 2 diabetes but can also occur in non-obese individuals, particularly those with conditions like lipodystrophy that affect fat distribution. The current gold standard for diagnosis is liver biopsy, despite its limitations such as sampling error and patient discomfort. Ultrasound serves as a common non-invasive alternative, especially useful for initial assessments due to its accessibility and low cost.[11-13]

Our study focuses on the clinical profiles of NAFLD patients diagnosed via ultrasound at Nalanda Medical College & Hospital, Bihar, analyzing demographic variables and co-morbid conditions to better understand the disease's characteristics within this population. This research underscores the need to address NAFLD not only as a significant liver disease but also as a reflection of broader metabolic dysfunctions, thereby contributing valuable insights into its management and prevention.

Aims and Objectives

The primary aim of this study is to conduct a comprehensive observational evaluation of the clinical profile of patients diagnosed with Non-Alcoholic Fatty Liver Disease (NAFLD) at the outpatient department of Nalanda Medical College and Hospital (NMCH), Patna. The study focuses on assessing demographic variables such as age, sex, and occupation, along with the prevalence of associated comorbid conditions. This endeavor seeks to elucidate the clinical characteristics of NAFLD within the local population and aims to enhance the understanding of its epidemiological aspects to better inform treatment strategies and public health policies.

MATERIALS AND METHODS

Research Design
This investigation is designed as a cross-sectional, observational, clinico-demographic study based in a tertiary urban hospital setting.

Study Setting
The research was conducted in the Department of Medicine at Nalanda Medical College and Hospital, Patna.

Target Population
Patients diagnosed with NAFLD via abdominal ultrasonography (USG) who sought treatment in the outpatient medicine department were included.

Inclusion Criteria
- Patients diagnosed with NAFLD by abdominal ultrasonography.

Exclusion Criteria
- Patients with a history of significant alcohol consumption (>20 grams/day for males, >10 grams/day for females).
- Individuals with hepatitis B or C infections (evidenced by HBsAg, Anti-HCV positive status).
- Recent (within 6 months) history of medication that could influence liver status.
- Patients who declined to provide consent for the study.

METHODOLOGY

A detailed history and appropriate investigative reports from each participant were collected and systematically analyzed.

Data Collection
Data were meticulously collected according to a predetermined proforma, ensuring a structured and consistent approach.

Statistical Analysis
Data analysis involved descriptive statistics to create frequency tables and calculate mean values with standard errors. The Chi-square test was utilized to explore associations between various parameters and NAFLD incidence. Proportion tests, t-tests, and multiple logistic regression analyses were applied to assess risk factors and adjust for confounders. The significance threshold was set at $p<0.05$ with confidence intervals maintained at the 95% level.

Confidentiality
Strict **confidentiality** was maintained regarding patient data to uphold ethical standards and patient privacy.

Ethical Considerations
The study received approval from the institutional ethical committee of NMCH, ensuring adherence to ethical norms and regulations throughout the research process.

RESULTS

The results of the present study provide a detailed analysis of the demographic distribution, laboratory parameters, liver enzymes, comorbid conditions, lipid profiles, and metabolic indicators among patients diagnosed with Non-Alcoholic Fatty Liver Disease (NAFLD). The findings highlight the predominant impact of NAFLD on middle-aged and older adults, the prevalence of metabolic risk factors like diabetes and hypertension, and the diverse biochemical profiles that underscore the importance of comprehensive assessment and early intervention strategies.

Table 1: Demographic and Hepatomegaly Distribution

Category	Subcategory	Count	Percentage (%)
Age Group	10-19	5	4.46
	20-29	7	6.25
	30-39	8	7.14
	40-49	29	25.89
	50-59	30	26.78
	60-69	23	20.53
	≥70	10	8.92
Gender	Male	60	53.57
	Female	52	46.42
Hepatomegaly	Yes	27	24.10
	No	85	75.89

The demographic and hepatomegaly distribution data reveal that NAFLD predominantly affects middle-aged and older adults, with the 50-59 age group comprising the largest proportion (26.78%, n=30) of the patient sample, closely followed by those aged 40-49 (25.89%, n=29). Combined, these two age groups account for over half of the total cases, underscoring the significant impact of NAFLD among this demographic. The age group 60-69 contributes an additional 20.53% (n=23), while patients aged 70 and above make up 8.92% (n=10). Younger age groups, including those aged 30-39, 20-29, and 10-19, collectively represent a smaller fraction. The mean patient age is 50.32 ± 14.51 years, with a significant predominance in the 50-59 age group ($Z = 6.57$, $p < 0.001$). Males constitute 53.57% (n=60) of the cases, leading to a male-to-female ratio of 1.15:1, though this difference is not statistically significant ($Z = 2.19$, $p > 0.05$). Hepatomegaly is observed in 24.10% (n=27) of patients, emphasizing the need for careful monitoring due to the potential progression to more severe liver conditions. These findings highlight NAFLD's demographic patterns and the critical importance of early detection and intervention.

Table 2: Laboratory Parameters (Albumin, Globulin, PT, INR, Bilirubin, and Alkaline Phosphate)

Parameter	Subcategory	Count	Percentage (%)
Albumin	<3.5 IU/L	36	32.14
	3.5-5 IU/L	71	63.39
	>5 IU/L	5	4.46
Globulin	<2.5 mg/dL	3	2.67
	2.5-4.5 mg/dL	77	68.75
	>4.5 mg/dL	32	28.57
Prothrombin Time (PT)	<9.5 mg/dL	2	1.78
	9.5-13.5 mg/dL	72	64.28
	>13.5 mg/dL	38	33.92
INR	0-1	61	54.46
	>1	51	45.53
Bilirubin	0.2-1.3 mg/dL	101	90.17
	>1.3 mg/dL	11	9.82
Alkaline Phosphate	<44 IU/L	6	5.35
	44-147 IU/L	85	75.89
	>147 IU/L	21	18.75

Table 2 provides a comprehensive overview of the laboratory parameters, including albumin, globulin, prothrombin time (PT), INR, bilirubin, and alkaline phosphatase levels. Low albumin levels (<3.5 IU/L) are present in 32.14% of patients, with a mean value of 3.81 ± 0.82 IU/L. The majority (63.39%) have albumin levels between 3.5 and 5 IU/L, a significantly higher proportion ($Z = 1.32$, $p < 0.01$). Elevated globulin levels (>4.5 mg/dL) are detected in 28.57% of patients, with a mean of 3.66 ± 0.77 mg/dL. Furthermore, 76.78% of patients exhibit an albumin/globulin ratio of less than 1 ($Z = 3.01$, $p < 0.01$).

Prothrombin time is greater than 13.5 mg/dL in 33.92% of patients, and the mean PT stands at 12.88 ± 1.40 mg/dL. INR levels above 1 are observed in 45.53% of cases, while the majority (54.46%) have INR levels between 0-1 ($Z = 2.13$, $p > 0.05$). Elevated bilirubin levels (>1.3 mg/dL) are seen in 9.82% of patients, with a mean bilirubin level of

1.17 ± 1.08 mg/dL. The majority (90.17%) fall within the normal range of 0.2-1.3 mg/dL (Z = 7.96, p < 0.001).

Finally, increased alkaline phosphatase levels (>147 IU/L) are found in 18.75% of patients, with a mean value of 108.07 ± 76.00 IU/L. Most patients (75.89%) have levels between 44 and 147 IU/L (Z = 4.09, p < 0.001), underscoring that liver function abnormalities are prevalent but vary significantly among NAFLD patients.

Table 3: Liver Enzymes (ALT, AST, ALT/AST Ratio)

Parameter	Subcategory	Count	Percentage (%)
ALT (SGPT)	0-35 IU/L	88	78.57
	>35 IU/L	24	21.42
AST (SGOT)	3-40 IU/L	93	83.03
	>40 IU/L	19	16.96
ALT/AST Ratio	<1	75	66.96
	≥1	47	41.96

Table 3 illustrates the distribution of liver enzyme levels among patients, focusing on alanine aminotransferase (ALT), aspartate aminotransferase (AST), and the ALT/AST ratio. Elevated ALT (SGPT) levels (>35 IU/L) are present in 21.42% (n=24) of the patient population, with a mean value of 42.43 ± 35.16 IU/L and a range spanning from 16 to 198 IU/L. For AST (SGOT), elevated levels (>40 IU/L) are observed in 16.96% (n=19) of cases, with a mean of 38.69 ± 19.75 IU/L and a range between 18 and 134 IU/L. A significant majority (83.03%) of patients maintain AST levels between 3 and 40 IU/L (Z = 3.92, p < 0.001). The ALT/AST ratio of ≥1 is found in 41.96% (n=47) of the patients, indicating potential liver function abnormalities. These results underscore the diverse biochemical profiles among NAFLD patients and highlight the importance of liver enzyme levels in evaluating the disease's progression.

Table 4: Comorbid Conditions and Lipid Profile

Parameter	Subcategory	Count	Percentage (%)
Comorbidities	Yes	77	68.75
	No	45	40.17
Type of Comorbidity	Hypertension	34	30.35
	Diabetes Mellitus	39	34.82
	Dyslipidemia	17	15.17
	Hypothyroidism	12	10.71
	CAD	8	7.14
	COPD	6	5.35
	Arthritis	5	4.46
Cholesterol	<150 mg/dL	50	44.64
	150-200 mg/dL	48	42.85
	>200 mg/dL	14	12.50
Triglycerides	≤150 mg/dL	65	58.03
	>150 mg/dL	47	41.96
HDL (Male)	<40 mg/dL	34	56.66
	≥40 mg/dL	26	43.33
HDL (Female)	<50 mg/dL	38	73.07
	≥50 mg/dL	14	26.92
LDL	<150 mg/dL	95	84.82
	≥150 mg/dL	17	15.17
VLDL	<20 mg/dL	5	4.46
	20-40 mg/dL	62	55.35
	>40 mg/dL	45	40.17

Table 4 highlights the distribution of comorbid conditions and lipid profiles among NAFLD patients, revealing that 68.75% (n=77) of patients suffer from at least one comorbidity (Z = 6.25, p < 0.01). The most common conditions include diabetes mellitus (34.82%, n=39), hypertension (30.35%, n=34), dyslipidemia (15.17%, n=17), and hypothyroidism (10.71%, n=12). Other notable comorbidities include coronary artery disease (7.14%, n=8), COPD (5.35%, n=6), and arthritis (4.46%, n=5).

When examining lipid levels, elevated total cholesterol (>200 mg/dL) is found in 12.50% (n=14) of patients, with a mean level of 163.61 ± 32.71 mg/dL. Increased triglyceride levels (>150 mg/dL) are observed in 41.96% (n=47), while the mean triglyceride level is 147.02 ± 24.95 mg/dL. HDL levels are reduced in 56.66% (n=34) of male patients, and in 73.07% (n=38) of female patients. The mean HDL level among males is 41.33 ± 10.38 mg/dL, and for females, 42.38 ± 9.53 mg/dL. Only 26.92% (n=14) of females have HDL levels above 50 mg/dL (p < 0.05). Elevated LDL levels (≥150 mg/dL) are present in 15.17% (n=17) of patients, with a mean level of 120.1 ± 24.55 mg/dL. Lastly, increased VLDL levels (>40 mg/dL) are detected in

40.17% (n=45) of patients, with a mean VLDL level of 36.45 ± 11.84 mg/dL. Collectively, these results highlight the significant association between NAFLD and various metabolic disorders, emphasizing the importance of comprehensive health assessments in managing the condition

Table 5: Metabolic Indicators (FBS, HbA1c, Blood Pressure, BMI, Waist Circumference)

Parameter	Subcategory	Count	Percentage (%)
Fasting Blood Sugar (FBS)	≤100 mg/dL	57	50.89
	>100 mg/dL	55	49.10
HbA1c	<5.7%	57	50.89
	5.7-6.4%	16	14.28
	≥6.5%	39	34.82
Systolic BP (SBP)	<140 mmHg	89	79.46
	≥140 mmHg	23	20.53
Diastolic BP (DBP)	<90 mmHg	92	82.14
	≥90 mmHg	20	17.85
BMI	<18.5 kg/m²	3	2.67
	18.5-24.9 kg/m²	24	21.42
	25-29.9 kg/m²	51	45.53
	≥30 kg/m²	34	30.35
Waist Circumference (Male)	≤102 cm	43	71.66
	>102 cm	17	28.33
Waist Circumference (Female)	≤88 cm	31	59.61
	>88 cm	21	40.38

Table 5 outlines the distribution of metabolic indicators such as fasting blood sugar (FBS), HbA1c, blood pressure, BMI, and waist circumference among NAFLD patients. Elevated FBS levels (>100 mg/dL) are observed in 49.10% (n=55) of the patients, while 34.82% (n=39) exhibit HbA1c levels above 6.5%. The mean HbA1c is 6.47 ± 1.60%, ranging from 4.6% to 10.4%. Elevated systolic blood pressure (≥140 mmHg) is present in 20.53% (n=23) of patients, and the mean SBP is 132.58 ± 10.45 mmHg. Similarly, increased diastolic blood pressure (≥90 mmHg) is noted in 17.85% (n=20) of cases, with a mean DBP of 84.25 ± 6.09 mmHg. The majority of patients (45.53%, n=51) have a BMI between 25-29.9 kg/m², indicating overweight status, while 30.35% (n=34) have a BMI of 30 or greater, signifying obesity.

Regarding waist circumference, 28.33% (n=17) of male patients have a waist circumference exceeding 102 cm, with a mean of 96.66 ± 7.96 cm. Among females, 40.38% (n=21) exceed 88 cm, with a mean waist circumference of 88.63 ± 7.70 cm. These metabolic indicators emphasize that a significant portion of the NAFLD patient population exhibits metabolic risk factors like hyperglycemia, hypertension, obesity, and central adiposity, reinforcing the need for comprehensive metabolic management alongside liver health.

DISCUSSION

Our study focused on the observational evaluation of NAFLD in patients attending the outpatient department at NMCH Patna, with particular emphasis on age, sex, occupation, and associated comorbid conditions. This cross-sectional, clinico-demographic study involved 112 patients diagnosed with NAFLD through ultrasonography, aiming to enrich the existing data on NAFLD's clinical profile in an Indian urban hospital setting.

The age distribution of our cohort indicated a predominance of NAFLD in older adults, with the highest prevalence found in the 50-59 year age group (26.78%, n=30), closely followed by those aged 40-49 (25.89%, n=29). The mean age was 50.32 ± 14.51 years, and a significant difference was noted in the prevalence among the 50-59 year group compared to other age groups (Z=6.57, p<0.001), aligning with previous studies such as those by Kalra et al[14], which reported the highest prevalence in the 61-70 year age bracket (61.8%). The gender distribution showed a slight male dominance (53.57%, n=60) with a male to female ratio of 1.15:1, which contrasts with some literature that suggests a female preponderance in NAFLD.[14,15]

In our findings, hepatomegaly was evident in 24.10% of the patients, a figure that falls within the range of clinically identifiable hepatomegaly (25-50%) reported in the literature.[16-24] Liver enzyme analysis showed elevated SGPT (ALT) in 21.42%, SGOT (AST) in 16.96%, and alkaline phosphatase in 18.75% of patients. Notably, 41.96% had an ALT:AST ratio ≥1, a marker potentially indicative of advanced fibrosis.[25] These findings suggest a need for further studies incorporating liver biopsies to accurately correlate enzyme levels with fibrosis stages, supporting evidence from another Indian study by Kalra et al.[14]

A significant portion of our cohort (68.75%, n=77) presented with comorbidities. Diabetes (34.82%, n=39) and hypertension (30.35%, n=34) were the most prevalent, highlighting the interrelation between NAFLD and metabolic syndromes, as also observed in previous studies.[25,26] Lipid profile discrepancies were notable, with increased levels of total cholesterol (12.50%), triglycerides (41.96%), LDL (15.17%), and VLDL (40.17%), along with

decreased HDL levels in 56.66% of males and 73.07% of females. These lipid abnormalities are consistent with findings from other studies, which indicate significant associations between dyslipidemia and NAFLD.[27-29]

The prevalence of overweight and obesity was high, with 45.53% having a BMI of 25-29.9 and 30.35% classified as obese (BMI ≥30). Central obesity was also a common finding, affecting 28.33% of males and 40.38% of females, reinforcing the relationship between adiposity and NAFLD as reported in literature.[30,31] These factors underscore the critical role of weight management in NAFLD prevention and treatment.

Our study corroborates the complex interplay between age, gender, metabolic disorders, and liver health in NAFLD patients. It underscores the importance of comprehensive management strategies that address not only liver health but also associated metabolic conditions to curb the rising trend of NAFLD, particularly in settings similar to NMCH Patna. Future studies should aim to explore the longitudinal outcomes of these patients and the impact of various intervention strategies on disease progression.

CONCLUSION

Our study on the clinical profile of Non-Alcoholic Fatty Liver Disease (NAFLD) at a tertiary care hospital in eastern India reveals that the condition predominantly affects obese, middle-aged patients with diabetes, hypertension, and sedentary lifestyles. Despite significant metabolic risks, bilirubin levels largely remain normal, and liver enzyme elevations are modest, primarily involving AST and ALT. Hepatomegaly is not consistently observed, highlighting the need for precise diagnostic methods. These findings underscore the necessity for early detection and comprehensive management to prevent the progression to cirrhosis. To thoroughly understand NAFLD's risk factors and clinical profile across different populations, a large prospective multicenter study is imperative, offering valuable insights for effective prevention and treatment strategies.

REFERENCES

1. Williams CD, Stengel J, Asike MI, Torres DM, Shaw J, Contreras M, *et al*. Prevalence of nonalcoholic fatty liver disease and nonalcoholic steatohepatitis among a largely middle-aged population utilizing ultrasound and liver biopsy: a prospective study. Gastroenterology. 2011;140(1):124-31.
2. Rinella ME. Nonalcoholic fatty liver disease: a systematic review. JAMA. 2015;313(22):2263-73.
3. Idowu MO, Chhatrala R, Siddiqui MB, Driscoll C, Stravitz RT, Sanyal AJ, *et al*. De novo hepatic steatosis drives atherogenic risk in liver transplantation recipients. Liver Transpl. 2015;21(11):1395-402.
4. Hannah WN Jr, Harrison SA. Nonalcoholic fatty liver disease and elastography: incremental advances but work still to be done. Hepatology. 2016;63(5):1762-4.
5. McPherson S, Hardy T, Henderson E, Burt AD, Day CP, Anstee QM. Evidence of NAFLD progression from steatosis to fibrosing steatohepatitis using paired biopsies: implications for prognosis and clinical management. J Hepatol. 2015;62(5):1148-55.
6. White DL, Kanwal F, El-Serag HB. Association between nonalcoholic fatty liver disease and risk for hepatocellular cancer, based on systematic review. Clin Gastroenterol Hepatol. 2012;10(12):1342-59.
7. Athyros VG, Tziomalos K, Katsiki N, Doumas M, Karagiannis A, Mikhailidis DP. Cardiovascular risk across the histological spectrum and the clinical manifestations of non-alcoholic fatty liver disease: an update. World J Gastroenterol. 2015;21(22):6820-34.
8. Sumida Y, Nakajima A, Itoh Y. Limitations of liver biopsy and noninvasive diagnostic tests for the diagnosis of nonalcoholic fatty liver disease/nonalcoholic steatohepatitis. World J Gastroenterol. 2014;20(2):475-85.
9. Chen CL, Cheng YF, Yu CY, Ou HY, Tsang LL, Huang TL, *et al*. Living donor liver transplantation: the Asian perspective. Transplantation. 2014;97 Suppl 8:S3.
10. Singh D, Das CJ, Baruah MP. Imaging of non-alcoholic fatty liver disease: a road less travelled. Indian J Endocrinol Metab. 2013;17(6):990-5.
11. Obika M, Noguchi H. Diagnosis and evaluation of nonalcoholic fatty liver disease. Exp Diabetes Res. 2012;2012:145754.
12. Lee SS, Park SH. Radiologic evaluation of nonalcoholic fatty liver disease. World J Gastroenterol. 2014;20(23):7392-402.
13. Chan WK, Bahar N, Razlan H, Vijayananthan A, Sithaneshwar P, Goh KL. Non-alcoholic fatty liver disease in a young multiracial Asian population: a worrying ethnic predilection in Malay and Indian males. Hepatol Int. 2014;8(1):121-7.
14. Kalra S, Vithalani M, Gulati G, Kulkarni CM, Kadam Y, Pallivathukkal J, *et al*. Study of prevalence of nonalcoholic fatty liver disease (NAFLD) in type 2 diabetes patients in India (SPRINT). J Assoc Physicians India. 2013;61(7):448-53.
15. Ludwig J, Viggiano T, McGill D, Ott B. Nonalcoholic steatohepatitis. Mayo Clinic experiences with a hitherto unnamed disease. Mayo Clin Proc. 1980;55(7):434-8.
16. Amarapurkar D, Amarapurkar A. Nonalcoholic Steatohepatitis: Clinicopathological Profiles. J Assoc Physicians India. 2000;48:311-3.
17. Agarwal SR, Malhotra V, Sakhuja P, Sarin S. Clinical, biochemical, and histological profile of nonalcoholic steatohepatitis. Indian J Gastroenterol. 2001;20(5):183-6.
18. Amarapurkar D, Das HS. Chronic liver disease in diabetes mellitus. Trop Gastroenterol. 2002;23(1):3-5.
19. Amarapurkar D, Patel N. Prevalence of clinical spectrum and natural history of nonalcoholic steatohepatitis with normal alanine aminotransferase values. Trop Gastroenterol. 2004;25(3):130-4.
20. Madan K, Batra Y, Gupta SD, Chander B, Rajan KD, Tewatia MS, *et al*. Nonalcoholic fatty liver disease may not be a severe disease at presentation among Asian Indians. World J Gastroenterol. 2006;12(21):3400-5.
21. Duseja A, Das A, Das R, Dhiman RK, Chawla Y, Bhansali A, *et al*. The clinicopathological profile of Indian patients with nonalcoholic fatty liver disease (NAFLD) is different from that in the West. Dig Dis Sci. 2007;52(9):2368-74.
22. Singh DK, Sakhuja P, Malhotra V, Gondal V, Sarin SK. Independent predictors of steatohepatitis and fibrosis in Asian Indian patients with non-alcoholic steatohepatitis. Dig Dis Sci. 2008;53(7):1967-76.
23. Duseja A, Nanda M, Das A, Das R, Bhansali A, Chawla Y. Prevalence of obesity, diabetes mellitus, and hyperlipidemia in patients with cryptogenic liver cirrhosis. Trop Gastroenterol. 2004;25(1):15-7.
24. Amarapurkar DN, Patel ND, Kamani P. Impact of diabetes mellitus on outcome of HCC. Ann Hepatol. 2008;7(2):148-51.
25. Souza MR, Diniz Mde F, Medeiros-Filho JE, Araújo MS. Metabolic syndrome and risk factors for non-alcoholic fatty liver disease. Arq Gastroenterol. 2012;49(1):89-96.

26. Zakeri A, Karamat-Panah S. Prevalence of nonalcoholic fatty liver disease and its risk factors in patients referred to Ardabil city hospital during 2015-2016. Int J Community Med Public Health. 2018;5(3):917-21.

27. Santhoshakumari TMJ, Radhika G, Kanagavalli P. A study of anthropometric and lipid profile parameters in nonalcoholic fatty liver disease patients attending a tertiary care hospital at Puducherry. IOSR J Dent Med Sci (IOSR-JDMS). 2017;16(2):33-7.

28. Cuenza LR, Razon TLJ, Dayrit JC. Correlation between severity of ultrasonographic nonalcoholic fatty liver disease and cardiometabolic risk among Filipino wellness patients. J Cardiovasc Thorac Res. 2017;9(2):85-9.

29. Novakovic T, Mekic M, Smilic L, Smilic T, Inic-Kostic B, Jovicevic L, *et al*. Anthropometric and biochemical characteristics of patients with nonalcoholic fatty liver diagnosed by non-invasive diagnostic methods. Med Arch. 2014;68(1):22-6.

30. Kaltenbach TE, Graeter T, Oeztuerk S, Holzner D, Kratzer W, Wabitsch M, *et al*. Thyroid dysfunction and hepatic steatosis in overweight children and adolescents. Pediatr Obes. 2017;12(1):67-74.

31. Boyraz M, Hatipoglu N, Sari E, Akçay A, Taskin N, Ulucan K, *et al*. Non-alcoholic fatty liver disease in obese children and the relationship between metabolic syndrome criteria. Obes Res Clin Pract. 2014;8(3):e356-63.