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ORIGINAL RESEARCH

To determine the significance of lipid profile in individuals diagnosed with non-alcoholic fatty liver disease

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ABSTRACT

Aim: To determine the significance of lipid profile in individuals diagnosed with non-alcoholic fatty liver disease. **Material and methods:** Our department conducted a sonographic evaluation of 100 patients, consisting of 40 males and 60 females, to assess the presence of fatty liver. Only patients aged 18 years or older who were identified with nonalcoholic fatty liver by ultrasonography were included in the research, after the patient's informed permission. Subjects were classified as cases if they met the standard criteria for fatty liver, as accepted by the American Gastroenterology Association. **Results:** Ultrasonography revealed that 47% of cases had grade I NAFLD, 43% had grade II NAFLD, and 10% had grade III NAFLD. out of 100 patients, 34 were asymptomatic while the remaining 66 patients were symptomatic. 56% of patients had upper abdominal discomfort, whereas 53% of patients reported weariness.Triglyceride levels in the serum, as well as total cholesterol, LDL, and VLDL levels, were elevated in 67%, 46%, 34%, and 26% of patients, respectively. 63% of patients had low serum HDL values. Significance was attributed to P values less than 0.05. The study found a significant correlation between higher grades of NAFLD and higher levels of blood total cholesterol (P value-0.002), LDL (P value-0.001), and VLDL (P value-0.004), as well as lower levels of HDL (P value-0.001). There was no significant correlation seen between blood triglyceride levels (P value-0.05) and the progression of non-alcoholic fatty liver disease (NAFLD) as determined by sonographic diagnosis. **Conclusion:**The majority of individuals with non-alcoholic fatty liver disease (NAFLD) in India are asymptomatic, without diabetes or hypertension. While liver biopsy is considered the most reliable way for diagnosing NAFLD, Ultrasonography, a non-invasive and straightforward instrument, may be used to diagnose NAFLD at an early stage in asymptomatic individuals.

Keywords: lipid profile, Non-alcoholic fatty liver disease, fatty liver

INTRODUCTION

NAFLD, or non-alcoholic fatty liver disease, refers to the excessive and abnormal accumulation of fat in liver cells in individuals who do not use alcohol. NAFLD has been recognized as a prevalent and recurring cause of liver disease [1]. Nonalcoholic fatty liver disease was first documented about six decades ago, although it was not officially recognized by pathologist Jurgen Ludwig until 1980. He documented the histological results in individuals with steatohepatitis who had either no significant alcohol use or modest alcohol consumption. The author's findings were accurate, as they reported a significant presence of liver inflammation with necrotic regions in the majority of individuals. Non-alcoholic fatty liver disease (NAFLD) refers to the accumulation of lipids in hepatocytes, resulting in either simple steatosis or steatohepatitis. Steatohepatitis occurs when aberrant lipids are deposited in the liver cells, causing fatty alteration. This may also be referred to as steatosis, which is accompanied with fibrotic or cirrhotic changes in the liver, known as steatohepatitis [2].

Fatty liver disease (non-alcoholic) is a prevalent cause of chronic hepatic disease (CLD) in the western population [3]. However, the prevalence of diabetes is now on the rise in the Asia-Pacific region, mostly due to lifestyle changes such as increasing consumption of fatty foods, lack of physical activity, and the growing burden of type 2 diabetes.

NAFLD (Non-alcoholic fatty liver disease) is divided into grade I, II, and III based on histological characteristics. In grade I (simple steatosis), the liver appears brighter on ultrasonography, and the increased echogenicity is seen in the periportal and diaphragmatic regions. In the second grade, there is a

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change in the way sound waves bounce off the liver. This change is caused by inflammation of the small lobes inside the liver, along with the accumulation of fat and swelling of liver cells. Grade III ultrasonic features include increased liver echogenicity, reduced periportal echogenicity, and diaphragm obstruction. These features indicate inflammation of liver lobules with steatosis, ballooning of liver cells, and Mallory hyaline fibrosis [4,5]. It is caused by the accumulation of fat (steatosis) and the subsequent development of fibrotic and/or cirrhotic changes (steatohepatitis). In basic steatosis, there is an accumulation of triglycerides (TG) inside the cells of the liver. In non-alcoholic steatohepatitis, there is also a buildup of lipid in the liver cells, combined with signs of liver cell damage, varying degrees of fibrosis, and inflammation [6]. Non-alcoholic fatty liver disease (NAFLD) is present in roughly 40% of individuals with obesity, as well as in 15% of overweight individuals. There is a higher prevalence of non-alcoholic fatty liver disease (NAFLD) among individuals with type 2 diabetes mellitus (T2DM). Approximately 60% of the total will originate from Asia in an unpredictable manner. NAFLD often presents as an asymptomatic condition without any noticeable indications of liver disease in individuals at the time of diagnosis. NAFLD may be detected with routine ultrasonography or during examinations for other conditions such as Hypertension and DM, with or without obesity [6-8]. Many patients have reported experiencing a sensation of fullness and discomfort in the upper right abdomen, along with fatigue and a general feeling of being unwell. Liver enlargement is a common clinical observation in many individuals [9]. Patients with diabetes mellitus, hypertension, obesity, and male gender are more susceptible to developing it [10]. The prevalence of non-alcoholic fatty liver disease is around 7% - 9% in the global population, whereas it affects a surprisingly higher percentage of the Asian population, ranging from 12% to 24%. 30% of the general population in the United States has NAFLD, while non-alcoholic fatty liver disease severely impacts 90% of those who are obese [11]. Research conducted in Rawalpindi, Pakistan, examined the prevalence of risk factors and found that 66% of patients were obese, 48% had elevated triglyceride levels, 34% had diabetes mellitus, and 28% had elevated cholesterol levels [12]. Research conducted at the Institute of Pharmaceutical Sciences in Telangana, India, examined different grades of non-alcoholic fatty liver disease (NAFLD) using ultrasonography and assessed the fasting lipid profile of patients. The study recruited patients with different age levels to examine the atypical lipid profile in NAFLD. The lipid profile showed a change of 12.72% in those aged 30-39, 33.93% in those aged 40-49, 20.61% in those aged 50-59, and 17.58% in those aged 60-69. In their research, Santoshini A et al. found that age had a substantial influence on the lipid profile of individuals with various stages of non-alcoholic fatty liver disease (NAFLD) [13]. Liver biopsy (LB) is a definitive and invasive diagnostic procedure used to determine the stage of a condition, but it has many drawbacks including pain, high expense, and a significant risk of complications that may cause discomfort and distress. Ultrasonic results, in conjunction with significantly elevated fasting lipid profile, serve as a reliable, cost-effective, easy, and precise diagnostic technique for non-alcoholic fatty liver disease. Ultrasound (USG) is the primary imaging tool used to diagnose and classify fatty liver disease. It is widely used in individuals suspected of having non-alcoholic fatty liver disease, as well as in asymptomatic individuals with elevated hepatic enzymes. This study used a cross-sectional research design to estimate the levels of fasting lipids in different stages of non-alcoholic fatty liver disease (NAFLD) as measured by ultrasound [14]. Only a limited number of research have reported on people with non-alcoholic fatty liver disease from Pakistan, based on ultrasonography findings. This study examined the lipid profile of individuals with different grades of non-alcoholic fatty liver disease (NAFLD) as determined by ultrasound. The current research aimed to evaluate fasting lipids and their correlation with various degrees of non-alcoholic fatty liver disease (NAFLD) using Ultrasonography.

MATERIAL AND METHODS

Our department conducted a sonographic evaluation of 100 patients, consisting of 40 males and 60 females, to assess the presence of fatty liver. Only patients aged 18 years or older who were identified with nonalcoholic fatty liver by ultrasonography were included in the research, after the patient's informed permission. Prior to commencing this study, the necessary permission was obtained from the institutional ethical committee. Patients having a history of alcohol use over 30 g/d in men and 20 g/d in females were not included in the research. The ultrasound tests were conducted utilizing the ALOKA Prosound SSD-4000SV with a frequency range of 2.5-6 MHz, as well as the TOSHIBA Nemio-30 US Scanners with a frequency range of 3-5 MHz.

Subjects were classified as cases if they met the standard criteria for fatty liver, as accepted by the American Gastroenterology Association. These criteria include an increase in liver brightness on ultrasound, the presence of enhancement and lack of differentiation in the periportal intensity, and the vascular wall showing high brightness in the liver tissue. The level of participation will be standardized using a semi-quantitative scale to measure the extent of liver involvement. Hepatic steatosis was diagnosed based on certain sonographic findings, including increased liver echogenicity, higher liver contrast relative to the kidney, vascular blurring mostly in the portal veins, and attenuation of echogenic level in deep-seated areas.

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Grade I: Minimal diffuse increase in the fine echoes. Liver appears bright compared to the cortex of the kidney. Normal visualization of diaphragm and intahepatic vessel borders.

Grade II: Moderate diffuse increase in the fine echoes. Slightly impaired visualization of the intrahepatic vessels and diaphragm.

Grade III: Marked increase in the fine echoes. Poor or no visualisation of intrahepatic vessels and diaphragm and poor penetration of the posterior, segment of the right lobe of the liver.

Patients who were identified with non-alcoholic fatty liver disease (NAFLD) using ultrasound (USG) were examined for their blood lipid profile. Next, a comparison was made between NAFLD and the serum lipid profile.

Statistical analysis

The findings were documented on a Microsoft Excel 2007 spreadsheet utilizing the Windows XP operating system. The mean values, standard deviation, and charts were computed using Microsoft Excel. The P value was determined using the Analysis of Variance test (ANOVA), and a P value of less than 0.05 was deemed to be statistically significant.

RESULTS

The research comprised a total of 100 instances with NAFLD that were identified by ultrasonography. Table 1 displays the average age of the patients as 50.32 years. The average age for men was 50.12 years, while for females it was 50.32 years. The majority of patients were in their forties and fifties. The male to female ratio was 1:1.5. Ultrasonography revealed that 47% of cases had grade I NAFLD, 43% had grade II NAFLD, and 10% had grade III NAFLD.

Table 1Age of the participants

Age group (years)	Grade I	Grade II	Grade III
Below 25	0	2	0
25-35	8	5	0
35-45	8	16	4
45-55	22	10	4
Above 55	9	10	2
Total	47	43	10
percentage	47%	43%	10%

According to Table 2, out of 100 patients, 34 were asymptomatic while the remaining 66 patients were symptomatic. 56% of patients had upper abdominal discomfort, whereas 53% of patients reported weariness.

Table 2 Signs and symptoms in NAFLD patients

Signs and symptoms	Grade I	Grade II	Grade III	Total	Percentage
Abdominal pain	21	29	6	56	56
Fatigue	23	24	6	53	53
Malaise	7	15	2	24	24
Hepatomegaly	8	4	2	14	14
Asymptomatic	15	16	3	34	34

Table 3 Distribution of patients showing abnormal serum lipid profile in NAFLD.

Ultrasound Grades	Grade I=47		Grade II=43		Grade III=10		Total			Total Percentage (%)
Serum lipid profile (mg/dL)	N	A	N	A	N	A	N	A	N	A
Triglyceride (N<150 mg/dL)	25	22	8	35	0	10	33	67	33	67
Total cholesterol (N<200 mg/dL)	31	16	20	23	3	7	54	46	54	46
HDL (>40 mg/dl in female &>50 mg/dL in male)	17	30	20	23	0	10	37	63	37	63
LDL (N<130 mg/dL)	37	10	25	18	4	6	66	34	66	34
VLDL (N-12-30 mg/dL)	35	12	33	10	6	4	74	26	74	26

Triglyceride levels in the serum, as well as total cholesterol, LDL, and VLDL levels, were elevated in 67%, 46%, 34%, and 26% of patients, respectively. 63% of patients had low serum HDL values. Table 4 presents a statistical study utilizing the study of Variance Test (ANOVA) to compare lipid changes in various grades of Non-Alcoholic Fatty Liver Disease (NAFLD). Significance was attributed to P values less than 0.05. The study found a significant correlation between higher grades of NAFLD and higher levels of blood total cholesterol (P value-0.002), LDL (P value-0.001), and VLDL (P value-0.004), as well as lower levels of HDL (P value-0.001). There was no significant correlation seen between blood triglyceride levels (P value-0.05) and the progression of non-

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alcoholic fatty liver disease (NAFLD) as determined by sonographic diagnosis.

Table 4 Comparison between NAFLD and Serum Lipid Profile

Ultrasound Grades	Grade I		Grade II		Grade III		
Serum Lipid Profile (mg/dl)	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	*P* value
Triglyceride	163.54	8.76	219.99	9.57	278.91	8.26	0.05
Total Cholesterol	187.26	8.46	213.59	7.48	254.56	9.26	0.002
HDL	46.36	5.86	42.99	5.56	32.87	2.76	0.001
LDL	105.34	8.99	125.59	9.54	157.12	6.57	0.001
VLDL	26.78	5.94	28.12	2.76	36.06	3.75	0.004

DISCUSSION

Non-alcoholic fatty liver disease (NAFLD) has become the predominant liver disease in Western countries. The occurrence of nonalcoholic fatty liver disease is growing in the Asia-Pacific area due to the expanding affluence of society and the changing traditional lifestyles, which include higher fat consumption, less physical activity, and a higher incidence of type 2 diabetes. Non-alcoholic fatty liver disease (NAFLD) affects about 20% of individuals who are obese and 5% of those who are overweight. The prevalence of non-alcoholic fatty liver disease (NAFLD) increased by a factor of 2.6 when it was associated with type 2 diabetes[15]. Non-alcoholic fatty liver disease (NAFLD) is prevalent among certain ethnic groups such as Filipinos, Indians, and indigenous populations of Australia and Malaysia. Therefore, NAFLD is not exclusive to Western countries. Non-alcoholic fatty liver disease (NAFLD) may result in advanced liver disease, such as cryptogenic cirrhosis, and has been suggested as a potential cause of hepatocellular carcinoma[16].

NAFLD has conventionally been characterized as a condition that mostly affects female patients who are obese, diabetic, and hypertensive. India has conducted a limited number of ultrasound-based investigations on individuals with non-alcoholic fatty liver disease (NAFLD). In India, non-alcoholic fatty liver disease (NAFLD) mostly affects males, with the majority of these patients being non-obese, non-diabetic, and non-hypertensive. The demographic profile in question exhibits variations from the one documented in Western regions.

The diagnostic criteria for NASH, based on clinical and histological factors, have been established. However, our understanding of NASH as a clinicopathological condition is still developing. The purpose of this research was to use ultrasonography to diagnose fatty liver in non-alcoholic patients who visited the radiodiagnosis department and were either asymptomatic or had symptoms such as stomach discomfort, tiredness, and malaise.

The average age of the patients in our research was 50.32 years. The average age for men was 50.12 years, while for females it was 50.32 years. The majority of patients were in their forties and fifties. The mean age recorded in Indian research was 42.90 years with a standard deviation of 10.54, according to Roli Agarwal et al[17], and 55.4 years, according to Amarapurkar et al[18]. The majority of Western research have shown that the average age of non-alcoholic fatty liver disease (NAFLD) falls within the range of 41 to 45 years. NAFLD is mostly seen in individuals in their fourth and fifth decade of life, which is about 5-10 years older than the stated prevalence in other nations.

The majority of individuals with non-alcoholic fatty liver disease (NAFLD) do not exhibit any symptoms. The illness is often detected either as an unintended finding during standard laboratory testing or while the patient is being evaluated for disorders such as hypertension, diabetes, or obesity. Within our research group, 34 individuals, accounting for 34% of the total, had no symptoms. Studies conducted in India have shown that 30.8 to 38% of patients do not exhibit any symptoms, which is consistent with our findings. According to Western research, the percentage of asymptomatic individuals ranges from 47.7% to 64%, which is greater than the percentage seen in our study.

Out of the individuals included in our research, 66 (66%) had symptoms indicative of liver disease. The predominant symptoms were right upper abdomen ache or discomfort (56%), fatigue (53%), and malaise (24%). Amarapurkar et al[18] found that 69.23% of symptomatic individuals had right hypochondrial discomfort as their first complaint. In Agarwal et al'sstudy[19], 64% of the patients had symptoms, with right upper quadrant discomfort, weariness, and malaise being the primary complaints.

Elevated levels of blood triglycerides, total cholesterol, LDL, and VLDL were seen in 67%, 46%, 34%, and 26% of the patients, respectively. Roli Agrawal and colleagues[17] found that 63.7% of patients had hypertriglyceridemia, 50% to 80% had hypercholesterolemia, 25% had high LDL, and 56.5% had raised VLDL.

Our research found that 63% of patients had low HDL. Roli Agrawal and colleagues[17] found that 45.16% of patients had low levels of HDL. Our investigation found a statistically significant relationship between increasing grades of NAFLD and serum total cholesterol, serum HDL, serum LDL, and VLDL ($P<0.05$). The serum triglyceride levels do not exhibit any statistically significant correlation

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with the severity of non-alcoholic fatty liver disease (NAFLD) grading (P=0.05).

The underlying mechanisms of NAFLD have remained poorly known since the first characterization of the illness. The present thought is mostly speculative since the precise mechanism or processes are still being determined.

Possible reasons for the observed differences may include variations in body-fat distribution or antioxidant systems, maybe influenced by genetic predisposition. The accumulation of lipids, mostly triglycerides, inside hepatocytes is necessary for the progression of nonalcoholic fatty liver disease. The exact mechanisms behind the buildup of lipids due to metabolic abnormalities are not fully understood. However, these abnormalities may include modifications in the processes of absorption, synthesis, degradation, or secretion in hepatic lipid metabolism as a consequence of insulin resistance. Insulin resistance is the most consistent and reliable factor in the development of nonalcoholic fatty liver disease[20].

The gold standard for diagnosing NAFLD is liver biopsy. However, because to its intrusive nature, complexity, level of discomfort, and potential for sample errors, it is not practical to employ this method in all situations when there are no symptoms present. Ultrasonography has a potential function in diagnosing NAFLD, as shown by the dramatically higher lipid profile values seen in our research.

Ultrasonography is a useful tool for promptly identifying NAFLD. Sonographically identified individuals with non-alcoholic fatty liver disease (NAFLD) had a statistically significant correlation with their blood lipid profile, with the exception of serum triglyceride levels. Ultrasound is a cost-effective method for identifying changes related to NAFLD. It reduces the need for unneeded, costly, complex, and time-consuming investigations in both patients with NAFLD and asymptomatic instances.

CONCLUSION

The majority of individuals with non-alcoholic fatty liver disease (NAFLD) in India are asymptomatic, without diabetes or hypertension. While liver biopsy is considered the most reliable way for diagnosing NAFLD, Ultrasonography, a non-invasive and straightforward instrument, may be used to diagnose NAFLD at an early stage in asymptomatic individuals.

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