



Original Article

Study of Serum Lipid Profile and liver enzyme in ultrasound diagnosed cases of non-alcoholic fatty liver disease

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ABSTRACT

Background: Gross anatomy and embryology are fundamental components of undergraduate medical education. However, conventional teaching methods may not always promote active participation and conceptual understanding. Creative learning activities, such as anatomical model-making, chart preparation, and collaborative learning, may provide an interactive approach to understanding complex anatomical and embryological concepts.

Objective: To evaluate students' perceptions of creative learning activities in improving conceptual understanding, engagement, and learning experiences in gross anatomy and embryology.

Materials and Methods: A cross-sectional, descriptive study was conducted among 88 first-year MBBS students at a medical institute. Data were collected using a structured questionnaire comprising closed-ended and open-ended questions related to prior knowledge, preparation methods, time investment, emotional responses, and perceived educational benefits. Quantitative responses were analyzed descriptively, while open-ended responses were categorized thematically.

Results: Among the 88 participants, 57% reported having basic prior knowledge of the topic, while 28.5% considered themselves well-versed. Textbook reading was the most common preparation method (85%), followed by peer discussion (71%) and online exploration (57%). Most students (71%) completed their activities within one day. Following submission, 57% reported feeling proud of their work, while 28% experienced apprehension. A positive learning experience was reported by 85% of students, 57% considered creative activities an effective way to learn, and 43% reported improved understanding of the subject.

Conclusion: Creative learning activities were positively perceived by first-year MBBS students and appeared to promote engagement, enjoyment, peer collaboration, and perceived conceptual understanding in gross anatomy and embryology. Integrating these activities alongside conventional teaching methods may enrich anatomy education. Further studies using objective pre- and post-intervention assessments and long-term follow-up are required to establish their effectiveness in improving knowledge acquisition and retention.

Keywords: Medical education, gross anatomy, embryology, creative learning, model-making, active learning, student engagement.

INTRODUCTION

The term non-alcoholic steatohepatitis (NASH) was coined by Ludwig et al. in 1980 to describe the histopathological features of steatohepatitis occurring in individuals without significant alcohol consumption.¹ non-alcoholic fatty liver disease (NAFLD) represents a spectrum of hepatic disorders characterized by excessive fat accumulation in the liver, ranging from simple steatosis to steatohepatitis, progressive fibrosis, and cirrhosis. The liver is the largest internal gland of the human body and plays an essential role in lipid metabolism, carbohydrate homeostasis, protein synthesis, detoxification, and bile production. It is located mainly in the right hypochondrium and epigastrium and receives blood from the hepatic artery and portal vein. Its central role in lipid metabolism makes it important in the development of fatty liver disease. Histologically, the liver consists of hepatocytes arranged in plates separated by hepatic sinusoids. The hepatic lobules contain central veins and peripheral portal tracts comprising branches of the portal vein, hepatic artery, and bile duct. Hepatocytes regulate lipid synthesis and metabolism, while Kupffer cells contribute to immune responses and hepatic stellate cells participate in fibrosis. Alterations in these cellular functions may lead to hepatic fat accumulation, inflammation, and progressive liver injury in fatty liver disease.

Histologically, NAFLD has traditionally been classified into non-alcoholic fatty liver (NAFL) and non-alcoholic steatohepatitis (NASH). Simple steatosis is characterized by the accumulation of fat within hepatocytes without significant hepatocellular ballooning or the characteristic inflammatory changes of steatohepatitis. In contrast, NASH is characterized by steatosis, lobular inflammation, and hepatocellular ballooning, with fibrosis present in some cases.^{2,3} Histological grading systems have been developed to assess the severity of steatosis, inflammation, and hepatocellular injury, while fibrosis staging evaluates the extent of connective tissue deposition and architectural distortion.^{2,3} Although these histological features provide important information regarding disease severity and prognosis, liver biopsy is not required for every patient with suspected fatty liver disease.

NAFLD has emerged as a major global public health concern, closely associated with obesity, insulin resistance, type 2 diabetes mellitus, and dyslipidemia. In India, the reported prevalence of fatty liver disease varies considerably across populations and diagnostic methods, with several studies reporting rates ranging approximately from 15% to 30%.⁴⁻⁶ The increasing prevalence of obesity, sedentary lifestyles, unhealthy dietary habits, and metabolic disorders has contributed to the growing burden of this condition. Although simple steatosis may remain relatively stable in many individuals, a proportion of patients develop progressive hepatic inflammation, fibrosis, cirrhosis, hepatic failure, and hepatocellular carcinoma.^{7,8} Consequently, early identification of fatty liver disease and its associated metabolic abnormalities is important for preventing long-term complications.

Most individuals with fatty liver disease remain asymptomatic, and the condition is frequently detected incidentally during abdominal ultrasonography performed for unrelated clinical indications. Some patients may report nonspecific symptoms such as fatigue, malaise, or discomfort in the right upper quadrant of the abdomen. Mild hepatomegaly may be observed on clinical examination, although its absence does not exclude hepatic steatosis.⁹ Because clinical findings alone are insufficient to establish the diagnosis, biochemical investigations and imaging techniques are commonly used in the initial evaluation. Liver biopsy has traditionally been regarded as the reference method for assessing hepatic histology and differentiating simple steatosis from steatohepatitis when histological confirmation is necessary. However, it is an invasive procedure associated with pain, bleeding, and other potential complications. Furthermore, sampling variability may lead to diagnostic errors because steatosis, inflammation, and fibrosis may not be uniformly distributed throughout the liver.¹⁰⁻¹⁴ The procedure also requires specialized expertise and may not be suitable for routine screening in large populations. Therefore, non-invasive diagnostic methods, particularly abdominal ultrasonography, have gained considerable importance in the clinical assessment of suspected fatty liver disease.

Ultrasonography is a widely available, non-invasive, and cost-effective method for detecting hepatic steatosis. Characteristic findings include increased hepatic echogenicity, posterior beam attenuation, and reduced visualization of intrahepatic vessels.¹⁵ However, ultrasound has limited sensitivity for mild steatosis and cannot reliably distinguish simple steatosis from steatohepatitis or assess fibrosis accurately.

The liver plays a major role in lipid metabolism, and impaired insulin signaling can lead to triglyceride accumulation in hepatocytes. This may be associated with increased serum triglycerides, elevated LDL-C, and reduced HDL-C. Dyslipidemia, along with obesity, hypertension, and impaired glucose regulation, is commonly associated with fatty liver disease.¹⁶⁻¹⁹

METHODOLOGY

Our study was of descriptive cross-sectional type and was done at ASMC Hospital in southwestern portion of Uttar Pradesh from 1st March, 2024 to 31st March, 2025. Total 105 participants who fulfilled inclusion criteria were randomly selected. Inclusion criteria were non-alcoholic patients with age of 20 years or more and diagnosed as having fatty liver on ultrasonography in absence of known liver disease only from sampling.

Ultrasonography of liver was done by same Radiologist Consultant. The Fatty liver was diagnosed on ultrasonography

when there is increased echogenicity of liver parenchyma and graded as mild (Grade I), moderate (Grade II) or severe (Grade III). Mild fatty liver is defined as increased echogenicity of liver parenchyma clearly more than that of adjacent renal cortex but echogenic walls of hepatic vessels and diaphragm are normally visualized. Moderate fatty liver is defined as increased parenchymal echogenicity with obscured visualization of echogenic walls of hepatic vessels. Severe fatty liver is defined as increased parenchymal echogenicity with obscured wall of hepatic vessels and diaphragmatic outline.

Laboratory reports of different lipid parameters of all the patients with USG-diagnosed fatty liver were analyzed, which included total cholesterol, triglyceride, low-density lipoprotein (LDL) and high-density lipoprotein (HDL). Then the relationships between USG-diagnosed fatty liver & different lipid parameters were studied.

Entry and tabulation of collected data was done in SPSS 28 version. Calculation of P-value was done and value less than 0.05 was labelled as statistically significant.

RESULT:

Table 1. Distribution of Study Participants According to Gender

Gender	Frequency (n)	Percentage (%)	p-value
Male	55	52.4	0.626
Female	50	47.6	
Total	105	100.0	

The study included 55 males (52.4%) and 50 females (47.6%). Males were slightly more represented than females; however, the difference in gender distribution was not statistically significant ($p = 0.626$).

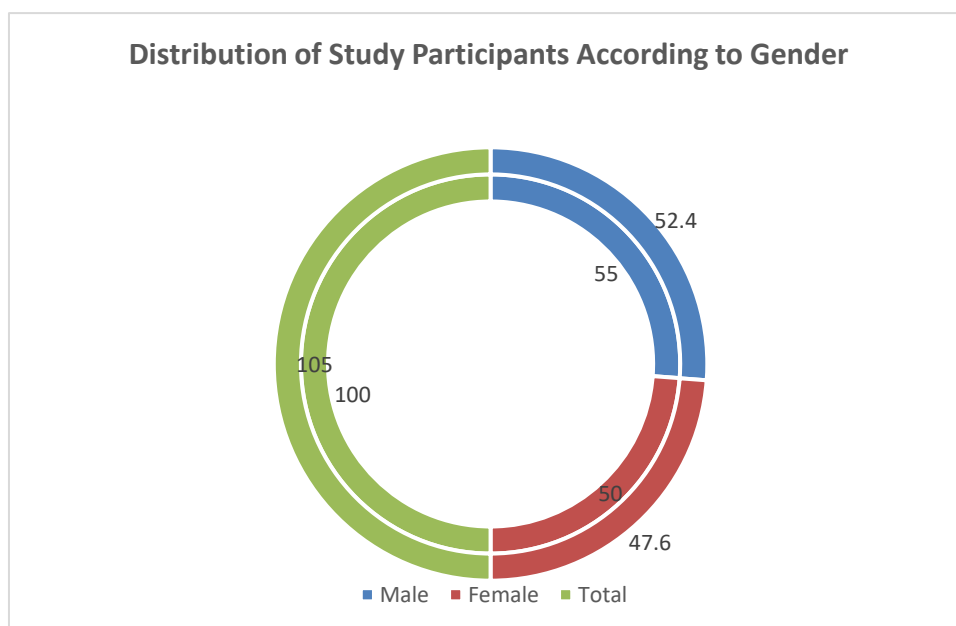


Fig: 1 graphical represents Distribution of Study Participants According to Gender.

Table 2. Distribution of Study Participants According to Age groups.

Age group (years)	Frequency (n)	Percentage (%)	p-value
20–30	12	11.4	<0.001*
31–40	22	21.0	

41–50	34	32.4
51–60	25	23.8
61–70	9	8.6
71–80	3	2.9
Total	105	100.0
Mean ± SD	48.3 ± 10.2 years	

The mean age of the study participants was 48.3 ± 10.2 years. The highest proportion of participants belonged to the 41–50 years age group (32.4%), followed by the 51–60 years group (23.8%). The age distribution showed a statistically significant difference ($p < 0.001$).

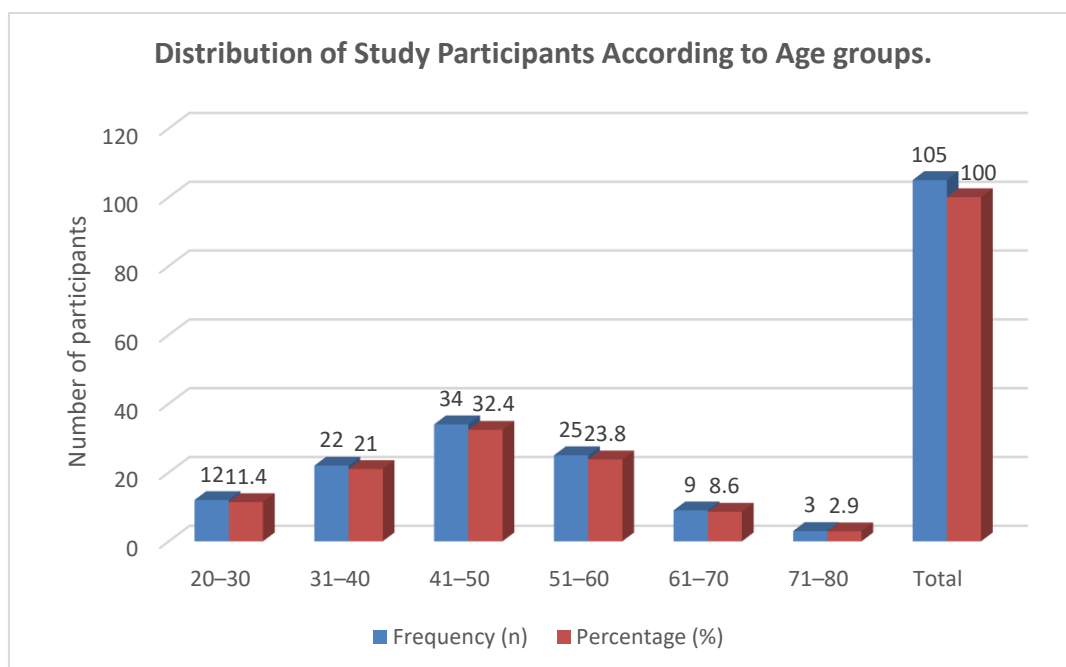


Fig: 2 graphical represents Distribution of Study Participants According to Age groups.

Table 2. Serum Lipid Profile Among Ultrasound-Diagnosed NAFLD Patients (N = 105)

Lipid parameter	Mean value	Increased/Decreased n (%)	Normal n (%)	p-value
Total cholesterol (mg/dL)	233.5	71 (67.6)	34 (32.4)	<0.001*
Triglycerides (mg/dL)	215.5	69 (65.7)	36 (34.3)	<0.001*
LDL cholesterol (mg/dL)	148.7	71 (67.6)	34 (32.4)	<0.001*
HDL cholesterol (mg/dL)	32.5	64 (60.9)	41 (39.1)	<0.001*

Dyslipidemia was found in more than two thirds of our study population. Total cholesterol, triglyceride and LDL were increased in 67.6%, 65.7% and 67.6% respectively. HDL was decreased in 60.9% cases. Mean value of total cholesterol,

triglyceride, LDL and HDL were 233.5 gm/dl, 215.5 gm/dl, 148.7 gm/dl and 32.5 gm/dl respectively. When lipid profiles were compared with fatty liver, significant positive correlation was seen between NAFLD with increased serum cholesterol, increased triglyceride, increased LDL & decreased serum HDL. P value was <0.001 in all the cases. Different grades of NAFLD and individual lipid components show no significant correlation.

Table 3. Hepatic Serum Parameters in Ultrasound-Diagnosed NAFLD and Control Groups

Hepatic Parameter	Control Group (n=55)	NAFLD Group (n=50)	p-value
	Mean $\pm$ SD	Mean $\pm$ SD	
AST (U/L)	28.5 $\pm$ 14.0	31.6 $\pm$ 15.7	0.209
ALT (U/L)	15.0 $\pm$ 8.2	23.2 $\pm$ 21.9	0.001*
AST/ALT ratio	2.11 $\pm$ 0.94	1.76 $\pm$ 0.79	0.019

Hepatic serum parameters of ultrasound diagnosed NAFLD and control groups: -Mean AST and γ -GT serum levels were slightly higher in the ultrasound-diagnosed NAFLD group as compared to patients without sono-morphological NAFLD signs but these differences did not reach statistical significance (Table 3). In contrast, serum ALT levels were significantly higher (23.2 $\pm$ 21.9 U/l vs. 15.0 $\pm$ 8.2 U/l; p=0.001), and the AST/ALT ratio was significantly lower (1.76 $\pm$ 0.79 vs. 2.11 $\pm$ 0.94, p=0.019) in the NAFLD group.

Discussion: The present cross-sectional study demonstrated that most participants with ultrasound-diagnosed NAFLD were in the fifth and sixth decades, with a mean age of 48.3 years. Grade I fatty liver was predominant (84.8%), followed by Grade II (13.3%) and Grade III (1.9%). ALT was significantly higher and the AST/ALT ratio significantly lower in NAFLD patients compared with controls. Dyslipidemia was common, with increased total cholesterol, triglycerides, and LDL and decreased HDL observed in a majority of participants. These lipid abnormalities showed a significant association with NAFLD (p < 0.001); however, no significant association was observed between individual lipid parameters and different grades of fatty liver, possibly due to the small number of patients with severe NAFLD. Overall, the findings support a strong association between NAFLD and dyslipidemia and highlight the importance of early lipid evaluation and management in patients with fatty liver.

CONCLUSION

The study demonstrated that dyslipidemia was common among patients with ultrasound-diagnosed NAFLD. Increased total cholesterol, triglycerides, and LDL, along with decreased HDL, were significantly associated with NAFLD. However, lipid abnormalities were not significantly related to the severity grades of fatty liver. Early identification and management of dyslipidemia in patients with NAFLD may help reduce the risk of hepatic and cardiovascular complications.

Conflict of Interest

The authors declare that there is no conflict of interest related to this study.

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