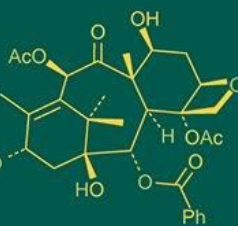
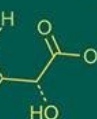


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2017; 1(1): 71-74
www.biochemjournal.com
Received: 06-04-2017
Accepted: 22-04-2017

Agrawal Sumit Suresh
Assistant Professor,
Department of General
Medicine, Malla Reddy
Institute of Medical Sciences,
Jeedimetla, Hyderabad,
Telangana, India

Narmadha Rajasekaran
Assistant Professor,
Department of Biochemistry,
Madha Medical College and
Research Institute, Kovur,
Mangadu, Thandalam,
Chennai, Tamil Nadu, India

Biochemical markers of liver damage in patients with non-alcoholic fatty liver disease

Agrawal Sumit Suresh and Narmadha Rajasekaran

DOI: <https://www.doi.org/10.33545/26174693.2017.v1.i1a.4471>

Abstract

Background and Objective: There is a strong correlation between obesity, insulin resistance, metabolic syndrome, and non-alcoholic fatty liver disease (NAFLD), making it one of the leading causes of chronic liver disease globally. It starts with basic hepatic steatosis and progresses to non-alcoholic steatohepatitis (NASH), which can lead to cirrhosis and hepatocellular cancer. The purpose of this research was to examine biochemical markers of liver damage in NAFLD patients and determine their pattern and importance.

Material and Methods: This cross-sectional study involved 60 adult patients identified with NAFLD using clinical assessment and ultrasonography. The research was carried out in the department of Biochemistry, Madha Medical College and Research Institute, located at Kovur, Mangadu, Thandalam, Chennai, Tamil Nadu, India, from March 2016 to February 2017. Individuals with alcohol use, viral hepatitis, or other chronic hepatic conditions were excluded. Blood samples were obtained to assess blood concentrations of ALT, AST, ALP, GGT, bilirubin, and fasting lipid profile.

Results: There were 63.3% males and 36.7% females among the 60 patients, with an average age of 46.3 ± 10.2 years. Seventy percent of patients had elevated ALT levels and sixty percent had elevated AST values. In 20% of instances, the AST/ALT ratio was less than 1, which could indicate steatohepatitis. Forty-five percent of patients had elevated GGT and thirty percent had elevated ALP. There were notable correlations between higher ALT levels and an increase in BMI ($p < 0.01$) and lipid levels ($p < 0.05$). The observation of a significant correlation between GGT and fasting blood glucose levels ($r = 0.41$, $p < 0.01$) further supports the idea that there is a connection between metabolic disturbance and hepatic damage.

Conclusion: Patients with non-alcoholic fatty liver disease (NAFLD) have metabolic abnormalities and high levels of biochemical markers, especially ALT, AST, and GGT. The significance of routinely monitoring liver function in people at risk for metabolic syndrome cannot be overstated, as it allows for early detection and intervention in the course of NAFLD.

Keywords: NAFLD, Liver enzymes, ALT, AST, GGT, Steatohepatitis, Metabolic syndrome, Liver function tests

Introduction

Excessive fat buildup in hepatocytes without heavy alcohol use characterizes a range of liver diseases known as Non-Alcoholic Fatty Liver Disease (NAFLD). Included in this category are various hepatic abnormalities, such as simple steatosis, non-alcoholic steatohepatitis (NASH), and fibrosis, cirrhosis, and hepatocellular cancer [1, 2]. North American Fatty Liver Disease (NAFLD) affects about 25-30% of the adult population globally, making it the most common chronic liver disease. This is due to the worldwide growth in obesity, type 2 diabetes mellitus, and metabolic syndrome [3-5].

Multiple factors, including insulin resistance, oxidative stress, dyslipidemia, and inflammatory pathways, contribute to the complicated pathophysiology of non-alcoholic fatty liver disease (NAFLD). The lack of symptoms in the early stages of NAFLD makes it difficult to diagnose until serious liver damage has already taken place. Therefore, in order to detect and track the evolution of the disease early on, it is critical to identify trustworthy non-invasive indicators for liver injury [6, 7].

Common biochemical indicators used to evaluate liver function and injury include alanine aminotransferase (ALT), aspartate aminotransferase (AST), gamma-glutamyl transferase (GGT), and alkaline phosphatase (ALP).

Correspondence

Narmadha Rajasekaran
Assistant Professor,
Department of Biochemistry,
Madha Medical College and
Research Institute, Kovur,
Mangadu, Thandalam,
Chennai, Tamil Nadu, India

The AST/ALT ratio can shed light on the severity of the condition, and ALT is thought to be the most sensitive indicator of hepatic inflammation in NAFLD. Hepatobiliary dysfunction and oxidative stress linked to NASH may also be indicated by elevated GGT and ALP values [8-10].

The most accurate way to diagnose and stage NAFLD is with a liver biopsy, however this invasive procedure is impractical for everyday use. As a result, biochemical indicators are just as important in clinical practice as imaging techniques such as ultrasonography [11]. The purpose of this research is to examine the relationship between NAFLD biochemical markers and clinical factors including glycemic status, body mass index (BMI), and lipid profile in individuals with a diagnosis of the disease. This might be useful for identifying patients at risk of illness development early on and developing better non-invasive diagnostic methods.

Material and Methods

This cross-sectional observational study was undertaken in the department of Biochemistry, Madha Medical College and Research Institute, located in Kovur, Mangadu, Thandalam, Chennai, Tamil Nadu, India, from March 2016 to February 2017. Sixty adult patients diagnosed with Non-Alcoholic Fatty Liver Disease (NAFLD) were enrolled in the study following the acquisition of informed permission. Patients were chosen based on ultrasonographic indications of hepatic steatosis and clinical assessment. Biochemical analyses were conducted to evaluate liver function and metabolic parameters.

Inclusion Criteria

- Adult patients aged between 18 and 65 years.
- Diagnosed with NAFLD by abdominal ultrasound showing evidence of hepatic steatosis.
- No history of significant alcohol consumption
- Willing to provide informed consent

Exclusion Criteria:

- Patients with known history of viral hepatitis (HBV, HCV), autoimmune hepatitis, or other chronic liver diseases.
- Significant alcohol intake above defined thresholds.
- Patients with a history of hepatotoxic drug use.
- Individuals with diagnosed malignancies, chronic kidney disease
- Pregnant or lactating women.

Data Collection and Biochemical Analysis:

The following information was recorded: patient's demographics, medical history, and anthropometric measurements (height, weight, body mass index). Liver Function Tests (LFTs) including ALT, AST, ALP, GGT, total bilirubin, and direct bilirubin were assessed using blood samples obtained after an overnight fast. Lipide profile: Triglycerides, HDL, LDL, and total cholesterol. Blood glucose levels and hemoglobin A1C levels during fasting. Traditional automated biochemical analyzers were used for every research. Another metric was the AST/ALT ratio.

Statistical Analysis:

Utilizing SPSS software, the data were examined. Mean±Standard Deviation (SD) was used to express

continuous data, whereas percentages were used for categorical variables. Clinical characteristics (such as body mass index and lipid profile) and biochemical markers were examined for correlations using Pearson's correlation coefficient. Statistical significance was determined by a p-value less than 0.05.

Results

The research involved 60 individuals who had been diagnosed with NAFLD, or Non-Alcoholic Fatty Liver Disease. Participant demographics and clinical features showed a middle-aged male preponderance with obesity and metabolic comorbidities including type 2 diabetes mellitus, hypertension, dyslipidemia, and a larger proportion of middle-aged men. High levels of liver enzymes, especially alanine aminotransferase (ALT) and aspartate aminotransferase (AST), were detected in most individuals by biochemical testing. Furthermore, glycemic control and lipid profile abnormalities were prevalent.

Table 1: Demographic and clinical characteristics of study participants

Parameter	Value
Mean Age (years)	46.3±10.2
Gender (Male/Female)	38 (63.3%) / 22 (36.7%)
Mean BMI (kg/m ²)	29.5±4.8
Overweight/Obese patients	47 (78.3%)
History of Type 2 DM	32 (53.3%)
Hypertension	27 (45.0%)
Dyslipidemia	35 (58.3%)

Table 1 provides a concise overview of the clinical characteristics and basic demographics of patients with NAFLD. Over half of the participants had multiple health issues, including diabetes and dyslipidemia, and the majority were men who were overweight or obese.

Table 2: Liver function test results among NAFLD Patients

Biochemical Marker	Mean ± SD	Elevated Cases (%)
ALT (U/L)	59.8±24.3	42 (70%)
AST (U/L)	47.2±20.1	36 (60%)
AST/ALT Ratio	0.78±0.22	<1 in 48 (80%)
ALP (U/L)	112.3±35.6	18 (30%)
GGT (U/L)	89.4±41.7	27 (45%)
Total Bilirubin (mg/dL)	0.8±0.3	5 (8.3%)

The high levels of liver enzymes, especially ALT and AST, which are important markers of hepatocellular injury, are shown in table 2 as being present in patients with NAFLD. Many of the participants had an AST/ALT ratio below 1, which is indicative of steatohepatitis.

Table 3: Lipid Profile and Glycemic Status of NAFLD Patients

Parameter	Mean ± SD	Abnormal Cases (%)
Total Cholesterol (mg/dL)	211.2±39.5	37 (61.7%)
Triglycerides (mg/dL)	186.5±57.2	40 (66.7%)
HDL (mg/dL)	38.7±8.4	45 (75%)
LDL (mg/dL)	132.6±28.9	36 (60%)
Fasting Glucose (mg/dL)	118.3±26.8	30 (50%)
HbA1c (%)	6.9±1.3	28 (46.7%)

Table 3 shows that individuals with NAFLD are more likely to have dyslipidemia and poor glucose metabolism. The

majority of the abnormalities that were found were high triglycerides and low HDL.

Table 4: Correlation between ALT Levels and Metabolic Parameters

Parameter	Correlation Coefficient (r)	P-Value
BMI	0.58	< 0.001 **
Triglycerides	0.45	0.002 **
Fasting Glucose	0.37	0.015 *
HbA1c	0.32	0.027 *

There is a clear relationship between hepatic damage and metabolic dysfunction in NAFLD, as seen by the statistically significant positive correlations of ALT levels with BMI, triglycerides, fasting glucose, and HbA1c.

Table 5: Distribution of elevated liver enzymes by BMI Category

BMI Category	N (%)	Elevated ALT (%)	Elevated AST (%)	Elevated GGT (%)
Normal (18.5-24.9)	5 (8.3%)	1 (20%)	1 (20%)	0 (0%)
Overweight (25-29.9)	22 (36.7%)	14 (63.6%)	12 (54.5%)	8 (36.4%)
Obese (≥ 30)	33 (55.0%)	27 (81.8%)	23 (69.7%)	19 (57.6%)

Supporting the relationship between excess body weight and liver dysfunction in NAFLD, table 5 reveals that elevated ALT, AST, and GGT values were substantially more common in obese patients.

Discussion

The purpose of this research was to examine the relationship between metabolic parameters and biochemical indicators of liver damage in individuals suffering from Non-Alcoholic Fatty Liver Disease (NAFLD). According to the results, many people with NAFLD also had metabolic syndrome symptoms such as obesity, type 2 diabetes, and dyslipidemia, as well as elevated liver enzymes (especially ALT and AST). The metabolic foundations of NAFLD are reinforced by these findings, which are in line with earlier studies [11, 12].

Among our cohort, elevated ALT was the most prevalent anomaly, impacting over 70% of the patients. This is consistent with previous research, for example the work of Clark *et al.* (2003), which found that increased ALT levels were a sensitive indicator of hepatocellular damage in NAFLD. According to Diehl and Day (2006), our patients typically had an AST/ALT ratio below 1, which is indicative of early or moderate NAFLD. A ratio greater than 1, on the other hand, is indicative of advanced fibrosis of the liver or alcoholic liver disease [12, 13].

Elevated transaminases were substantially related with obesity and a higher body mass index (BMI), lending credence to the well-established association between excess fat and liver steatosis studied by Chalasani *et al.*, 2018 [14]. Additionally, we discovered strong positive associations between ALT and lipids, fasting glucose, and HbA1c levels. Consistent with previous research, these results show that insulin resistance and hypertriglyceridemia are key factors in NAFLD-related liver damage reported by Marchesini *et al.*, 2003; and Targher *et al.*, 2005 [15, 16].

Consistent with other research, 45% of our subjects had increased GGT, which may point to oxidative stress and potential cholestatic involvement (Ruhl & Everhart, 2003)

[17]. Mild rise in a limited subgroup of bilirubin values, albeit often within the normal range, may indicate early functional impairment in hepatobiliary excretion. Diabetes and dyslipidemia were associated with an unusually high prevalence of NAFLD. Consistent with previous research, Younossi *et al.* (2016) found that NAFLD is a marker of cardiovascular risk in addition to being a hepatic sign of metabolic syndrome [18].

A significant consequence of these results concerns the function of routine liver function testing in individuals who are known to have metabolic syndrome. Timely lifestyle and pharmacological changes can be made possible with the early diagnosis of liver dysfunction through biochemical indicators. This can help prevent the progression to non-alcoholic steatohepatitis (NASH) or cirrhosis. Nevertheless, there are some limitations to the study [19, 20].

To start with, it couldn't be shown a cause and effect relationship because it was cross-sectional. Additionally, there were ethical and practical considerations that prevented the use of liver biopsies, which are considered the gold standard for NASH diagnosis and fibrosis staging. Results are also not applicable to a broader population due to the small sample size and absence of longitudinal follow-up. In spite of these caveats, the study highlights the significance of combining metabolic and hepatic evaluations and gives useful information on the biochemical profile of individuals with NAFLD in a real-world clinical context [21, 22].

Conclusion

This study shows that Non-Alcoholic Fatty Liver Disease patients had significant changes in biochemical markers like ALT, AST, and GGT. These higher enzyme levels substantially correlate with metabolic syndrome traits like obesity, insulin resistance, and dyslipidemia, emphasizing the link between metabolic health and hepatic function. Our findings suggest that routine liver enzyme monitoring in at-risk patients like those with type 2 diabetes, hypertension, or central obesity can help detect and treat NAFLD before it progresses to NASH or cirrhosis. Early biochemical testing is critical since early NAFLD is asymptomatic and reversible with lifestyle and pharmaceutical therapies. This study further emphasizes the necessity for interdisciplinary care that includes hepatology, endocrinology, and nutrition to address the complicated metabolic and hepatic elements of the condition. Further longitudinal and interventional studies with bigger populations and liver biopsy correlation are needed to confirm these biochemical markers as disease progression indicators.

Funding support: Nil

Conflict of interest:

None

References

- Angulo P. Nonalcoholic fatty liver disease. *N Engl J Med.* 2002;346(16):1221-1231.
- Bedogni G, Bellentani S, Miglioli L, *et al.* The Fatty Liver Index: A simple and accurate predictor of hepatic steatosis in the general population. *BMC Gastroenterol.* 2006;6:33.

3. Adams LA, Lymp JF, St Sauver J, *et al.* The natural history of NAFLD: A population-based cohort study. *Gastroenterology*. 2005;129(1):113-121.
4. Browning JD, Szczepaniak LS, Dobbins R, *et al.* Prevalence of hepatic steatosis in an urban population in the United States: Impact of ethnicity. *Hepatology*. 2004;40(6):1387-1395.
5. Sanyal AJ. AGA technical review on NAFLD. *Gastroenterology*. 2002;123(5):1705-1725.
6. Bugianesi E, Leone N, Vanni E, *et al.* Expanding the natural history of NAFLD: From cryptogenic cirrhosis to hepatocellular carcinoma. *Gastroenterology*. 2002;123(1):134-140.
7. Loria P, Lonardo A, Carulli N, *et al.* Review: NAFLD and liver enzymes: An update. *Dig Liver Dis*. 2005;37(4):260-268.
8. Targher G, Day CP, Bonora E. Risk of cardiovascular disease in patients with NAFLD. *N Engl J Med*. 2010;363(14):1341-1350.
9. Tilg H, Moschen AR. Evolution of inflammation in NAFLD: The multiple parallel hits hypothesis. *Hepatology*. 2010;52(5):1836-1846.
10. Musso G, Gambino R, Cassader M, Pagano G. Meta-analysis: Natural history of NAFLD and diagnostic accuracy of non-invasive tests for liver disease severity. *Ann Med*. 2011;43(8):617-649.
11. Tetri NBA. Nonalcoholic steatohepatitis: Summary of an AASLD Single Topic Conference. *Hepatology*. 2003;37(5):1202-1219.
12. Clark JM, Brancati FL, Diehl AM. The prevalence and etiology of elevated aminotransferase levels in the United States. *Am J Gastroenterol*. 2003;98(5):960-967.
13. Diehl AM, Day C. Cause, pathogenesis, and treatment of nonalcoholic steatohepatitis. *N Engl J Med*. 2006;355(19):2061-2071.
14. Chalasani N, Younossi Z, Lavine JE, *et al.* The diagnosis and management of NAFLD: Practice guidance from the AASLD. *Hepatology*. 2018;67(1):328-357.
15. Marchesini G, Bugianesi E, Forlani G, *et al.* Nonalcoholic fatty liver, steatohepatitis, and the metabolic syndrome. *Hepatology*. 2003;37(4):917-923.
16. Targher G, Bertolini L, Padovani R, *et al.* Relationships between liver histology and carotid intima-media thickness in subjects with NAFLD. *Arterioscler Thromb Vasc Biol*. 2006;26(5):1165-1171.
17. Ruhl CE, Everhart JE. Elevated serum alanine aminotransferase and gamma-glutamyltransferase and mortality in the United States population. *Gastroenterology*. 2003;125(5):1190-1197.
18. Younossi ZM, Koenig AB, Abdelatif D, *et al.* Global epidemiology of NAFLD-meta-analytic assessment of prevalence, incidence, and outcomes. *Hepatology*. 2016;64(1):73-84.
19. Bellentani S, Scaglioni F, Marino M, Bedogni G. Epidemiology of NAFLD. *Dig Dis*. 2010;28(1):155-161.
20. Targher G, Bertolini L, Scala L, *et al.* Non-alcoholic hepatic steatosis and its relation to increased plasma biomarkers of inflammation and endothelial dysfunction in non-diabetic men. Role of visceral adipose tissue. *Diabet Med*. 2005;22(10):1354-1358.
21. Yki-Järvinen H. NAFLD as a cause and a consequence of metabolic syndrome. *Lancet Diabetes Endocrinol*. 2014;2(11):901-910.
22. Machado MV, Pinto CH. Non-invasive diagnosis of NAFLD. A critical appraisal. *J Hepatol*. 2013;58(5):1007-1019.