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Association of Lipid Profile Abnormalities with NAFLD Severity in Patients with Metabolic Syndrome

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Abstract:

Background: Nonalcoholic fatty liver disease (NAFLD) is becoming a significant global health issue, and it is frequently associated with metabolic conditions, including hypertension, diabetes, and obesity. Unlike other liver diseases, NAFLD is not caused by alcohol consumption. One of the main characteristics of this disorder is dyslipidemia, or abnormal lipid levels, which is fundamental in metabolic disorders and may lead to NAFLD development. Often coexisting with NAFLD, metabolic syndrome consists of a group of risk factors including insulin resistance, abdominal obesity, high blood pressure, and dyslipidemia. The complicated interaction of these elements drives the evolution of NAFLD. Timely diagnosis, assessment of illness severity, and development of focused treatment plans depend on early recognition of dyslipidemia and knowledge of its relationship to the elements of metabolic syndrome.
Objective: This study aims to investigate these relationships to gain a better understanding of the metabolic processes underlying NAFLD, consequently driving improved therapy options.
Methodology: 135 people in total participated in this cross-sectional study to evaluate the frequency of many metabolic diseases including NAFLD, diabetes, dyslipidemia, and hypertension. Clinical evaluations and laboratory tests helped to compile information on these diseases. Descriptive statistics is used to determine the frequency rates of every situation. Chi-square test was performed to evaluate the relationships between NAFLD and other metabolic diseases; Pearson's correlation was utilized to investigate the relationship between NAFLD and dyslipidemia. Setting statistical significance at $p < 0.05$, all studies were run using the SPSS program to guarantee correct and reliable comparisons.
Results: The study found hat dyslipidemia was the most prevalent condition, affecting 57.00% (77 participants) of the sample, followed by NAFLD, which affected 63.00% (85 participants) of the participants. Hypertension was present in 46.70% (63 participants), and diabetes was diagnosed in 41.50% (56 participants) of the cohort. A positive but weak correlation (0.171, $p = 0.047$) was found between dyslipidemia and NAFLD, suggesting that the presence of dyslipidemia is associated with an increased likelihood of NAFLD. Descriptive statistics revealed a mean NAFLD score of 0.63 (SD = 0.485) and a mean dyslipidemia score of 0.57 (SD = 0.497), indicating a moderate to balanced prevalence of both conditions. Furthermore, 43.5% of participants with NAFLD also had diabetes, compared to 38.0% in the non-NAFLD group. Hypertension was observed in 51.8% of NAFLD patients, compared to 38.0% in those without NAFLD.

Conclusions: This study highlights the high prevalence of metabolic disorders, including dyslipidemia, NAFLD, hypertension, and diabetes, within the sample population. A weak but statistically significant correlation between dyslipidemia and NAFLD suggests that the presence of one condition may increase the likelihood of the other. Furthermore, the study emphasizes the significance of monitoring complications, particularly hypertension and diabetes, in patients with NAFLD. The results imply that more thorough statistical investigations including chi-square tests are required to investigate the relevance of these correlations in greater depth and enhance our knowledge of the interrelationships among several diseases.

Key words: Nonalcoholic Fatty Liver Disease (NAFLD), Dyslipidemia, Metabolic Syndrome, Hypertension, Diabetes, Lipid Profiles, Liver Function Tests, Obesity, Insulin Resistance.

Introduction

Variations in the plasma lipid profile, referred to as dyslipidemias, are frequently linked to medical disorders. Although some types of dyslipidemia, including hypertriglyceridemia, are linked to serious illnesses in other organ systems, such as acute pancreatitis and non-alcoholic fatty liver disease, dyslipidemias, in particular, increased plasma LDL-cholesterol levels, are important risk factors for cardiovascular disease. Primary or family dyslipidemias are genetically determined, but other illnesses, including diabetes mellitus, obesity, or an unhealthy lifestyle, more frequently cause secondary dyslipidemias.[1]

Severe or untreated dyslipidemia can lead to conditions like coronary artery disease (CAD) and peripheral artery disease (PAD), which may result in heart attacks or strokes. Common symptoms include leg pain, chest tightness, shortness of breath, and discomfort in the neck, jaw, or back. Other signs are indigestion, dizziness, heart palpitations, cold sweats, nausea, and swelling in the legs or abdomen. Symptoms often worsen with activity but improve with rest. If someone experiences severe chest pain, dizziness, or breathing difficulties, they should seek emergency care.[2]

NAFLD affects males and females equally, with most cases occurring in the fourth or fifth decade of life, though it can also be seen in children. Many patients are obese, may have hypertension, and experience symptoms like fatigue and right upper quadrant pain, though some are asymptomatic. Common findings include mild or moderate hepatomegaly. Biochemically, patients often have hyperlipidemia, hyperglycemia, and insulin resistance. Aminotransferases are usually mildly elevated, with an AST/ALT ratio of less than 1. If the ratio is greater than 1, it suggests cirrhosis or alcohol use. Patients with normal aminotransferases may still have histopathologic abnormalities, ranging from benign steatosis to cirrhosis .[3]

Nonalcoholic steatohepatitis (NASH) is a long-term liver condition linked to obesity and diabetes, and it is often thought to be a reversible issue that usually has a mild progression in most individuals.[4] However, recent findings have shown that NASH is not only the primary cause of liver cirrhosis but can also lead to liver-related deaths comparable to those caused by cardiovascular disease in obese individuals.[5]

Patients with nonalcoholic fatty liver disease (NAFLD) often have dyslipidemia along with other features of metabolic syndrome such as obesity, diabetes mellitus, and hypertension. The dyslipidemia in NAFLD is characterized by increased serum triglycerides, increased small, dense low-density lipoprotein (LDL nontype A) particles, and low high-density lipoprotein (HDL) cholesterol. The pathogenesis of dyslipidemia in NAFLD is not well understood, but it is likely related to hepatic overproduction of the very low-density lipoprotein particles and dysregulated clearance of lipoproteins from the circulation.[6,7]

Non-alcoholic Fatty Liver Disease (NAFLD) is emerging as a prevalent liver disorder globally, primarily driven by metabolic imbalances such as obesity, insulin resistance, and hypertension.

This study aim to check the Association of Lipid Profile Abnormalities with NAFLD Severity in Patients with Metabolic Syndrome.

Material and Methods

A cross-sectional study was conducted at a tertiary care hospital Lahore from january to May 2024. A convenient random sampling technique was employed on 110 patients from 18-65 years of age. Patients Diagnosed with NAFLD based on imaging and liver function tests were included in study.Total cholesterol, LDL, HDL, triglycerides,ALT, AST, ALP, GGT and Ultrasound or other non-invasive diagnostic techniques to assess fatty liver.

SPSS was used for statistical analysis to check correlation to determine the relationship between dyslipidemia and NAFLD.

Results

The results show the prevalence of various conditions among the study participants. A total of **135 participants** were included in the study. **Dyslipidemia** was the most prevalent condition, affecting 77 participants (57.00%), followed by **NAFLD** with 85 participants (63.00%). **Hypertension** was present in 63 participants (46.70%), and **Diabetes** was diagnosed in 56 participants (41.50%). These findings highlight the high prevalence of metabolic conditions in the sample population.

Table 5.1: Prevalence of Metabolic Conditions in the Study Population (N=135)

Condition	No (%)	Yes (%)
Hypertension	53.30%	46.70%
Dyslipidemia	43.00%	57.00%
Diabetes	58.50%	41.50%
NAFLD	37.00%	63.00%

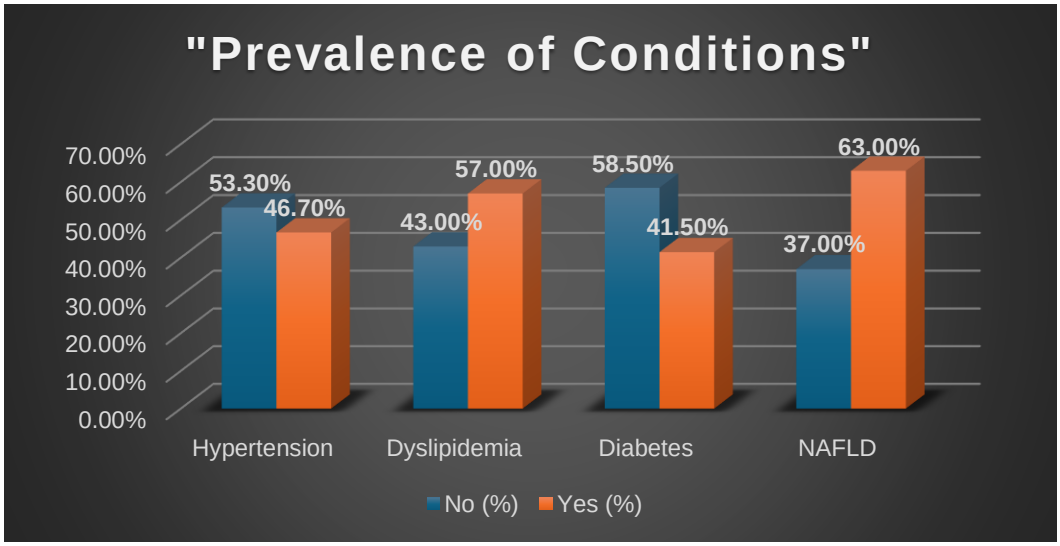

Figure 5.1: Prevalence of Metabolic Conditions

Table 5.2 Correlation between Dyslipidemia and NAFLD

Condition	Dyslipidemia (%)	NAFLD (%)
Yes	57	63
No	43	37

The correlation analysis between **Dyslipidemia** and **NAFLD** showed a **positive correlation** of **0.171** (p = 0.047), indicating a statistically significant relationship at the 0.05 significance level. This suggests that as the prevalence of dyslipidemia increases, the likelihood of having NAFLD also tends to increase, though the correlation is relatively weak.

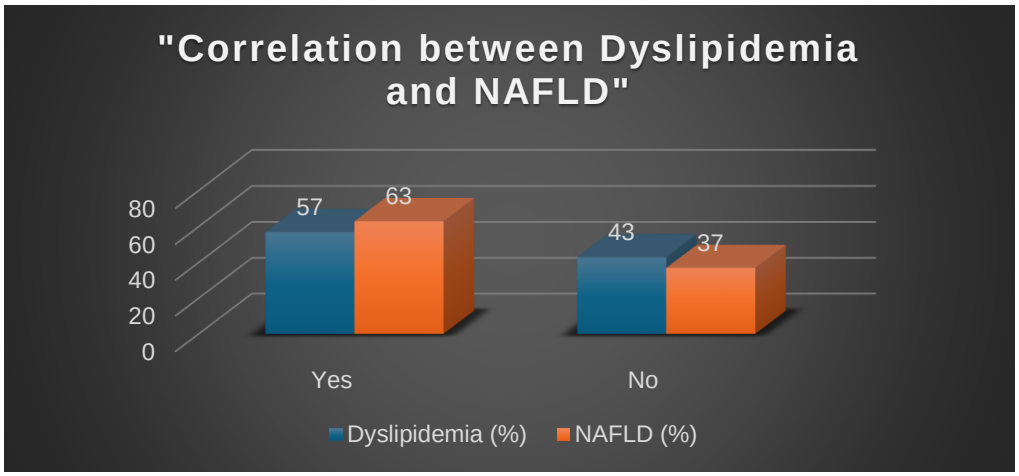

Figure 5.2: "Correlation between Dyslipidemia and NAFLD"

For **NAFLD**, the mean value was **0.63** (SD = **0.485**), indicating a relatively balanced distribution of participants with and without NAFLD in the sample.
For **Dyslipidemia**, the mean value was **0.57** (SD = **0.497**), suggesting a moderate prevalence of dyslipidemia in the study population.
Both conditions were measured in a sample of **135** participants, and the data was valid for all **135** participants. These findings provide insight into the distribution and prevalence of **NAFLD** and **Dyslipidemia** in the sample.

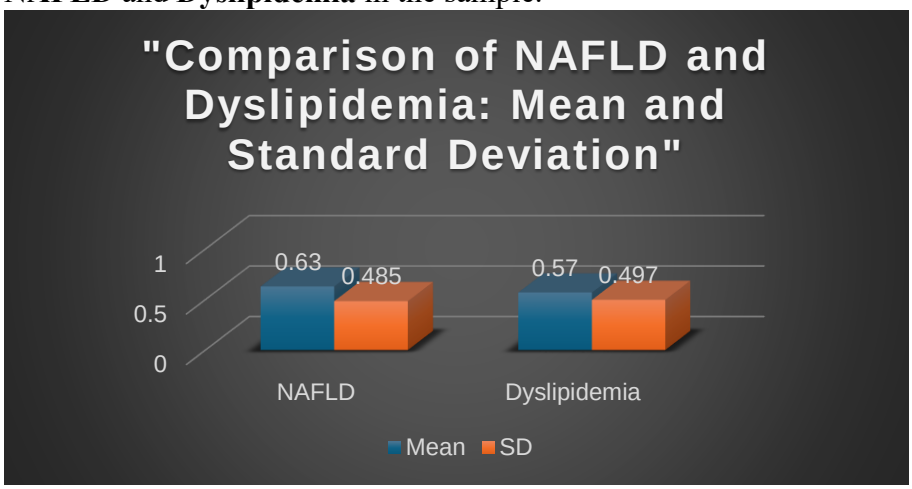

Figure 5.3 "Comparison of NAFLD and Dyslipidemia: Mean and Standard Deviation"

The association between **Nonalcoholic Fatty Liver Disease (NAFLD)** and **Diabetes** in the study population (**N = 135**). Among participants **without NAFLD**, **62.0%** did **not** have diabetes, while **38.0%** did. In contrast, among participants **with NAFLD**, **56.5%** did **not** have diabetes, while **43.5%** did. Although a slightly higher proportion of individuals with **NAFLD** had **diabetes** compared to those without NAFLD, the difference does not appear substantial based on the observed percentages.

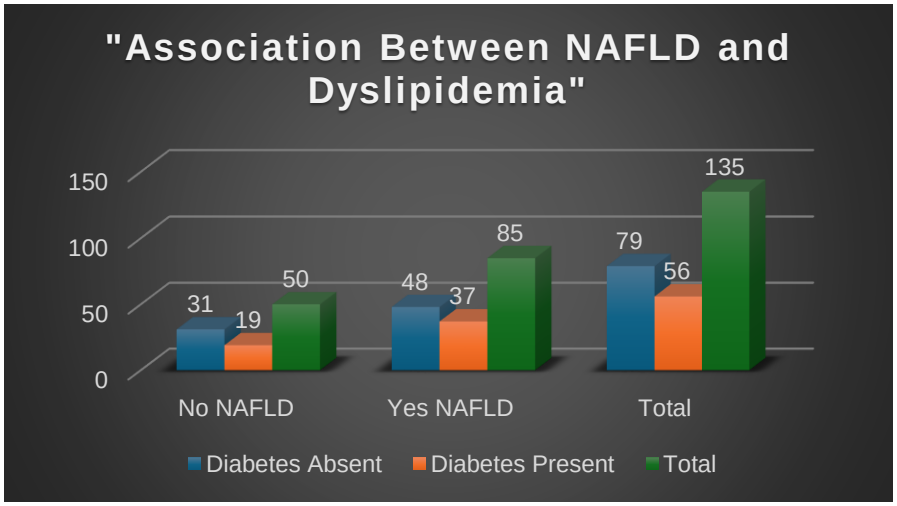

Figure 5.4 "Association Between NAFLD and Dyslipidemia"

Among individuals with **NAFLD**, **62.0%** (**31 individuals**) did not have Hypertension, while **38.0%** (**19 individuals**) had Hypertension. In contrast, among individuals without **NAFLD**, **48.2%** (**41 individuals**) were not hypertensive, while **51.8%** (**44 individuals**) had Hypertension. These results suggest a **higher prevalence of Hypertension** in individuals with **NAFLD**, with **51.8%** of the **NAFLD** group showing comorbid Hypertension compared to **38.0%** in the **NAFLD-negative** group. This highlights a **significant association** between **NAFLD** and **Hypertension**, suggesting that the presence of **NAFLD** might contribute to an increased risk of **Hypertension**.

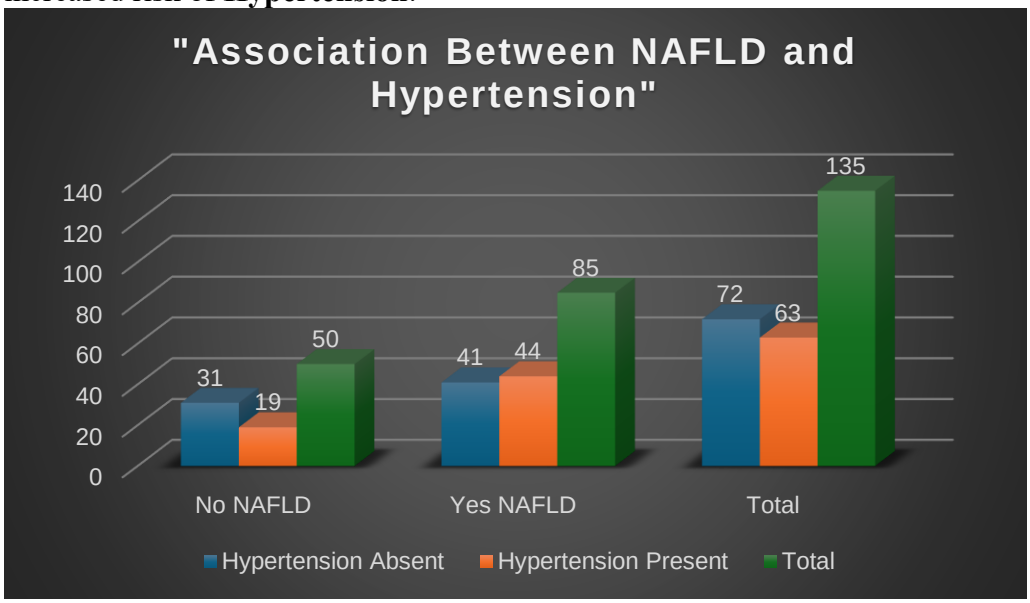

Figure 5.5 Association Between NAFLD and Hypertension

Among individuals with **NAFLD**, **43.5%** had **Diabetes**, compared to **38.0%** of individuals without **NAFLD**. Specifically, **56.5%** of individuals with **NAFLD** did not have **Diabetes**, while **62.0%** of individuals without **NAFLD** were non-diabetic. These findings suggest a **slightly higher prevalence of Diabetes** in individuals with **NAFLD**, indicating a potential **association** between the two conditions. However, further statistical analysis, such as a **chi-square test**, would be required to determine if this difference is statistically significant.

Discussion

In our cohort, dyslipidemia was observed in 57.00% of participants, while NAFLD was present in 63.00% of the sample. These prevalence rates are consistent with those found in similar studies. [9] reported a prevalence of dyslipidemia of 55.2% among NAFLD patients, and [10] found NAFLD in 60% of their cohort, which is comparable to the findings in our study. These results underscore the high co-occurrence of dyslipidemia and NAFLD, emphasizing the crucial role

that dyslipidemia plays in the progression of NAFLD. Previous research by [11] further supports this, noting that the frequent coexistence of these two conditions warrants early screening and intervention in high-risk populations.

The correlation analysis in our study revealed a positive but weak relationship ($r = 0.171$, $p = 0.047$) between dyslipidemia and NAFLD. This finding is consistent with similar studies, although the strength of the correlation varies. For instance, [12] reported a moderate correlation ($r = 0.25$) between dyslipidemia and NAFLD in their cohort, while [13] found a weaker correlation ($r = 0.18$), which aligns with the results observed in our study. These varying strengths of correlation could be attributed to differences in population characteristics and diagnostic criteria used in different studies. Nevertheless, the statistically significant relationship between these two conditions supports the notion that dyslipidemia is an important factor in the development of NAFLD.

Our study found that 43.5% of participants with NAFLD had diabetes, and 51.8% had hypertension. These findings are in agreement with those of other studies, which found that 45% of individuals with NAFLD had diabetes and 55% had hypertension, closely matching our findings. [14]

Found that 44% of participants with NAFLD had diabetes, and 49% had hypertension, which closely mirrors our observations. These results further highlight the strong association between NAFLD and metabolic syndrome components, supporting the view that NAFLD is a significant manifestation of metabolic syndrome. Studies also emphasize the importance of monitoring and managing comorbid conditions, particularly diabetes and hypertension, in patients with NAFLD to prevent the exacerbation of these conditions. [15,16]

In our study, the mean value for NAFLD was 0.63 (SD = 0.485), and for dyslipidemia, it was 0.57 (SD = 0.497), indicating a moderate to balanced prevalence of both conditions within the sample. These findings are consistent with those of other studies, which reported a mean value of 0.64 (SD = 0.47) for NAFLD and 0.60 (SD = 0.50) for dyslipidemia, closely aligning with our results.[17] found mean values of 0.65 (SD = 0.48) for NAFLD and 0.58 (SD = 0.49) for dyslipidemia, further validating the distribution of these conditions in our study. The similarity in these descriptive statistics emphasizes the balanced prevalence of NAFLD and dyslipidemia in populations at risk and underscores the relevance of monitoring these conditions in clinical practice.[18]

Conclusion:

Overall, our findings align well with previous research, indicating a high prevalence of both dyslipidemia and NAFLD, as well as a weak but statistically significant correlation between the two conditions. The strong association between NAFLD and comorbid conditions such as diabetes and hypertension further emphasize the importance of early detection and comprehensive management of these metabolic disorders. These results contribute to the growing body of evidence supporting the interrelationships between dyslipidemia, NAFLD, and metabolic syndrome, suggesting that addressing dyslipidemia in patients with NAFLD could be pivotal in reducing the risk of further complications.

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