ISSN: 0975-3583,0976-2833 VOL15, ISSUE 09, 2024

Correlation between Non HDL and Cholesterol to HDL Ratios among the Lipid Profiles of Patients in Central India

[1*] Kirti Songade, [2] Dr. Kavitarati Dharwadkar , [3] Dr. K.C. Sreevalsan , [4] Dr. Neha Solanki, [5] Dr Anisha Mathew

[1]Research Assistant, Department of Biochemistry, SAIMS & PGI, Indore
[2]Prof. & Head, Department of biochemistry, SAIMS & PGI, Indore
[3]Assistant Professor, Department of Biochemistry, SAIMS & PGI, Indore
[4]Assistant Professor, Department of Biochemistry, SAIMS & PGI, Indore.
[5]Assistant Professor, Department of Biochemistry SAIMS & PGI, Indore.

Corresponding Author-
Kirti Songade
keertisongades@gmail.com

Abstract

Background: Non-alcoholic fatty liver disease (NAFLD) has become the predominant chronic liver disease globally in recent years, mostly due to the rise in obesity and metabolic syndrome (MS). Non-high-density lipoprotein cholesterol (non-HDL-c) and the ratio of non-HDL-c to HDL-c are emerging as significant indicators for cardiovascular disease risk, especially in patients with metabolic disorders.

Method: This observational and record-based study focuses on lipid profile estimations using routine fasting samples billed during March 2022. All samples processed on the Vitros 5.1 FS for lipid profile between March 1st and March 31st, 2022, were included. The study variables were fasting total cholesterol (TC), fasting HDL, fasting LDL, and fasting triglycerides (TG). Inclusion criteria included all samples assayed, while exclusion criteria excluded hemolyzed samples and non-fasting samples. Blood samples, approximately 3ml, were collected after an overnight fasting period of 8-12 hours. Lipid profile estimations were conducted using the Vitros 5.1 FS, employing dry chemistry methods.

Result: Descriptive statistics showed that the mean total cholesterol (TC) was 196.68 mg/dL, HDL was 43.16 mg/dL, and non-HDL was 153.52 mg/dL. The CHOL/HDL ratio had a mean of 4.77. A strong positive correlation ($r = 0.815$, $p = 0.001$) was observed between non-HDL cholesterol and the CHOL/HDL ratio.

Conclusion: The study concludes that lipid profiles should include both non-HDL cholesterol and the cholesterol to HDL ratio. These parameters, when considered alone and in combination, provide a more accurate marker for predicting cardiovascular risk and are highly associated.

Keywords: Lipid profile, Non-HDL cholesterol, Cholesterol to HDL ratio, Cardiovascular risk, Non-alcoholic fatty liver disease (NAFLD), Vitros 5.1 FS.

INTRODUCTION

A lipid panel is a routine blood test that healthcare providers utilise to monitor and assess susceptibility to cardiovascular disease. The panel consists of three measures of cholesterol levels and one assessment of triglycerides. A lipoprotein panel is a blood test that can assess cholesterol levels. Prior to the test, it is necessary to abstain from consuming any food or beverages, with the exception of water, for a period of 9 to 12 hours.Total cholesterol is a metric that quantifies the whole quantity of cholesterol present in bloodstream. It encompasses both low-density lipoprotein (LDL) cholesterol and high-density lipoprotein (HDL) cholesterol.LDL (low-density lipoprotein) cholesterol is the primary cause of cholesterol accumulation and obstruction in the arteries. HDL (high-density lipoprotein) cholesterol plays a crucial role in eliminating cholesterol from arteries. Non-HDL refers to the value obtained by subtracting HDL cholesterol from total cholesterol. non-HDL cholesterol comprises LDL cholesterol and other forms of cholesterol, such as VLDL (very-low-density lipoprotein). Triglycerides are a type of fat found in blood that can increase chances of developing heart disease, particularly in women.

A lipid profile, also known as a lipid panel, is a set of blood tests that are utilised to detect abnormalities in lipids, including cholesterol and triglycerides, which have not been confirmed within the body. The outcomes of this examination have the capability to discover specific genetic disorders and ascertain approximate probabilities for cardiovascular illness, specific types of pancreatitis, and other ailments. When it comes to forecasting risk of heart disease, many doctors now consider determining non-HDL cholesterol level to be more valuable than calculating cholesterol ratio. Both options seem to be more effective predictors of risk than overall cholesterol level or even low-density lipoprotein (LDL, or "bad") cholesterol level. Non-HDL cholesterol is calculated by subtracting the value of high-density lipoprotein (HDL) cholesterol, which is

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 09, 2024

considered "good" cholesterol, from the total cholesterol amount. Thus, it encompasses all the undesirable forms of cholesterol.

The ideal threshold for non-HDL cholesterol is below 130 mg/dL, or 3.37 mmol/L. Greater numerical values indicate an elevated susceptibility to heart disease. To determine cholesterol ratio, simply divide total cholesterol value by HDL cholesterol value. If total cholesterol is 200 mg/dL (5.2 mmol/L) and HDL is 50 mg/dL (1.3 mmol/L), then ratio would be 4-to-1. Elevated ratios are associated with an increased susceptibility to heart disease.

The ratio of non-HDL-cholesterol to HDL-cholesterol (non-HDL-c/HDL-c) is a reliable indicator for predicting the likelihood of developing coronary heart disease, metabolic syndrome, and insulin resistance. Individuals diagnosed with non-alcoholic steatohepatitis (NASH) have a heightened susceptibility to developing cardiovascular complications and type 2 diabetes. Nevertheless, the potential prognostic value of the non-HDL-c/HDL-c ratio in NASH has not yet been studied. Non-alcoholic fatty liver disease (NAFLD) has become the predominant chronic liver disease globally in recent years, mostly due to the rise in obesity and metabolic syndrome (MS). [1] The spectrum of this condition extends from fatty liver or hepatic steatosis to steatohepatitis, which involves inflammation of the liver. Approximately 5-20% of individuals with fatty liver disease progress to develop non-alcoholic steatohepatitis (NASH) over the course of their illness. [2] The morbidity and death rates among patients with nonalcoholic steatohepatitis (NASH) are elevated compared to the general population. This is mostly owing to an increased risk of cardiovascular diseases, various types of cancer, and liver-related events, including hepatocellular carcinoma. [3] Non-high-density lipoprotein cholesterol (non-HDL-c) is considered a secondary target of lipid-lowering medication. Non-HDL-c is approximately equal to the combined levels of low-density lipoprotein (LDL), very-low-density lipoprotein (VLDL), intermediate-density lipoprotein (IDL), and lipoprotein (a). [4]The UK Prospective Diabetes Study discovered that the ratio of non-HDL-c to HDL-c, rather than non-HDL-C alone, was an effective indicator for coronary heart disease (CHD) in patients with type 2 diabetes. [5] Moreover, this ratio has been shown as a reliable indicator for predicting the occurrence of coronary heart disease (CHD) in individuals with chronic kidney disease (CKD). [6] The test provides data regarding : Total cholesterol - a quantification of the overall quantity of cholesterol present in bloodstream. It encompasses both low-density lipoprotein (LDL) cholesterol and high-density lipoprotein (HDL) cholesterol. LDL cholesterol, also known as "bad" cholesterol, is the primary cause of cholesterol accumulation and obstruction in the arteries. High-density lipoprotein (HDL) cholesterol - HDL aids in the removal of cholesterol from arteries. Non-HDL refers to the value obtained by subtracting HDL cholesterol from total cholesterol. non-HDL cholesterol include LDL cholesterol as well as other forms of cholesterol, such as VLDL (very-low-density lipoprotein). Triglycerides are a type of fat found in the bloodstream that can increase chances of developing heart disease, particularly in women. Cholesterol levels are quantified in milligrammes per decilitre (mg/dL). The following are the optimal cholesterol levels, determined by age and gender: Triglycerides are distinct from cholesterol, although they are included in a lipoprotein panel, which is the test used to assess cholesterol levels. An optimal triglyceride level is less than 150 mg/dL. Treatment may be necessary if triglyceride levels are within the borderline high range (150-199 mg/dL) or above the high range (200 mg/dL or above).

MATERIAL AND METHODS

This observational and record-based study focuses on lipid profile estimations using routine fasting samples billed during March 2022. The sample size comprises all samples processed on the Vitros 5.1 FS for lipid profile between March 1st and March 31st, 2022. The study variables include fasting total cholesterol, fasting HDL, fasting LDL, and fasting triglycerides (TG). Inclusion criteria encompass all samples assayed, while exclusion criteria exclude hemolyzed samples and non-fasting samples. Blood samples, approximately 3ml, were collected after an overnight fasting period of 8-12 hours, adhering to lab protocol. The lipid profile estimations were conducted using the Vitros 5.1 FS, employing dry chemistry methods.

RESULT

Table 1. Descriptive Statistics Table 1 elaborates the descriptive statistics of lipid profile variables for given patients.

S. No.	Variable	Minimum	Maximum	Mean	Std. Deviation
1	TC	96.00	268.00	196.68	33.844
2	HDL	25.00	110.00	43.16	12.002
3	non_HDL	46.00	216.00	153.52	35.203
4	CHOL_HDL_Ratio	1.51	7.31	4.77	1.102

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 09, 2024

Table 1 presents the descriptive statistics for the lipid profile variables of the patients. The Total Cholesterol (TC) levels range from a minimum of 96.00 to a maximum of 268.00, with an average (mean) value of 196.68 and a standard deviation of 33.844. The High-Density Lipoprotein (HDL) levels have a minimum of 25.00 and a maximum of 110.00, with a mean of 43.16 and a standard deviation of 12.002. For non-HDL cholesterol, the values vary from 46.00 to 216.00, with an average of 153.52 and a standard deviation of 35.203. Lastly, the Cholesterol to HDL Ratio (CHOL_HDL_Ratio) ranges from 1.51 to 7.31, with a mean of 4.77 and a standard deviation of 1.102.

Table 2. Elaborates the descriptive statistics of lipid profile variables for given patients.

Variable	**CHOL/HDL Ratio (Correlation coefficient r)**	**P-value**
Non HDl	0.815	0.001

Table 2 details the correlation analysis between the lipid profile variables for the given patients. The correlation coefficient (r) between the CHOL/HDL Ratio and non-HDL cholesterol is 0.815, indicating a strong positive correlation. The p-value for this correlation is 0.001, suggesting that the result is statistically significant.

DISCUSSION

The objective of our current research is to investigate the relationship between the Non HDL to total Cholesterol ratio and the HDL cholesterol levels, which has not been previously studied in India. Non HDL is computed by subtracting HDL from total cholesterol. Unlike LDL-C, non HDL indicates the cholesterol content found in all the lipoproteins that contribute to atherosclerosis.Therefore, the management of dyslipidaemias is believed to be more comprehensive when focussing on the treatment of non-HDL-C, rather than just LDL-C treatment.[7]

The atherogenic or Castelli index, which is the ratio of total cholesterol to high-density lipoprotein (HDL) cholesterol, is used as a predictor of vascular risk. Its predictive value is higher than that of individual measures. An elevation in the overall level of cholesterol, accompanied by a decrease in HDL cholesterol, is associated with many risk factors, such as the components of the metabolic syndrome. This correlation likely entails an independent risk factor as well [8]. Several laboratories provide measurements for both Non HDL cholesterol and the Cholesterol to HDL ratio. We were interested in examining the link between these two derived parameters. Our analysis revealed a strong correlation of r=0.8 (Table 1) between non HDL and Cholesterol to HDL ratio. This suggests that both variables are closely related and can be utilised interchangeably.Our data aligns with a 17-year Swedish study including 6537 women aged 50-59. The study found that both the TC/HDL-C ratio and non-HDL-C levels are reliable indicators of ischaemic heart disease (IHD) in middle-aged women. Their findings demonstrated that TC/HDL-C had a greater predictive capacity compared to non-HDL-C. However, non-HDL-C showed a linear relationship with IHD ($p = 0.58$) and may be more convenient to compute and comprehend in clinical settings for early detection of potential IHD in women.[9]

A separate study established a correlation between Non HDL and Total Cholesterol levels and intimal Thickness, and determined that all lipid indicators exhibited a substantial correlation with IMT. The association between non-HDL cholesterol and the variable in question was found to be higher ($r = 0.24$, $p < 0.0001$). Similarly, the correlation between the total/HDL cholesterol ratio and the variable was also higher ($r = 0.23$, $p < 0.0001$). The total/HDL cholesterol ratio was found to be the most accurate predictor of having an IMT over the 75th percentile in both men and women. The odds ratio was 1.21, with 95% confidence intervals of 1.09-1.35, and a p-value of less than 0.01.Both the Non HDL and Cholesterol to HDL ratio were equally effective in predicting the risk. Nevertheless, they proposed that the ratio of Total/HDL cholesterol was the most effective indicator of subclinical atherosclerosis.[10]

CONCLUSION

Our conclusion is that the lipid profile should include both the estimated parameters of Non HDL and Cholesterol to HDL ratio. These parameters, when considered alone and in combination, provide a more accurate marker for predicting risk and are highly associated.

REFERENCES

1. Pappachan JM, et al. Non-alcoholic fatty liver disease: a clinical update. J ClinTranslHepatol. 2017;5(4):384–93.
2. Bugianesi E, et al. Clinical update on non-alcoholic fatty liver disease and steatohepatitis. Ann Hepatol. 2008; 7(2):157–60.
3. Sanyal AJ, et al. Challenges and opportunities in drug and biomarker development for nonalcoholicsteatohepatitis: findings and recommendations from an American Association for the Study of Liver Diseases-U.S. Food and Drug Administration joint workshop. Hepatology. 2015;61(4):1392–405.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 09, 2024

4. Expert Panel on Detection, E. and A. Treatment of High Blood Cholesterol in. Executive summary of the third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (adult treatment panel III). JAMA. 2001;285(19):22486–97.6
5. Lu W, et al. Non-HDL cholesterol as a predictor of cardiovascular disease in type 2 diabetes: the strong heart study. Diabetes Care. 2003;26(1):16–23.
6. Lamprea-Montealegre JA, et al. Chronic kidney disease, lipids and apolipoproteins, and coronary heart disease: the ARIC study. Atherosclerosis. 2014;234(1):42–6.
7. Goldbourt U, Yaari S, Medalie JH. Isolated low HDL cholesterol as a risk factor for coronary heart disease mortality: a 21-year follow-up of 8000 men. ArteriosclerThrombVasc Biol. 1997;17:107–113. pmid:9012644
8. Kastelein JJ, van der Steeg WA, Holme I, Gaffney M, Cater NB, Barter P, et al. Lipids, apolipoproteins, and their ratios in relation to cardiovascular events withstatin treatment. Circulation 2008;117(23):3002–9.
9. Blaha MJ, Blumenthal RS, Brinton EA, Jacobson TA, National Lipid Association taskforce on non-HDL cholesterol. The importance of non-HDL cholesterol reporting in lipid management [monograph on the Internet]. J ClinLipidol 2008;2(4):267–73. Availableat:http://www.lipidjournal.com/article/S1933-2874(08)00274-2/abstract [cited 2011 Feb 1].
10. Ascaso J, González Santos P, Hernández Mijares A, et al. Management of dyslipidemia in the metabolic syndrome. Recommendations of the SpanishHDL Forum. Am J Cardiovasc Drugs. 2007;7:39–58.