Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/1k1m675310.53555/1k1m6753

LIPID TETRAD INDEX IN CORONARY ARTERY DISEASE: A CROSS-SECTIONAL STUDY IN INDIAN POPULATION

Dr Mrityunjay Kumar[1*], Dr Pallavi Ranjan Anand[2]

[1*]Associate Professor, Dept of Medicine, RKDF Medical College Hospital & Research Centre, Bhopal MP
[2]Assistant Professor, Dept of Anatomy, RKDF Medical College Hospital & Research Centre, Bhopal MP

***Corresponding Author:** Dr Mrityunjay Kumar
*Associate Professor, Dept of Medicine, RKDF Medical College Hospital & Research Centre, Bhopal MP

Abstract

Introduction

Coronary artery disease (CAD) is a leading cause of morbidity and mortality worldwide, with India bearing a significant burden. Dyslipidemia, characterized by elevated triglycerides (TG), low high-density lipoprotein cholesterol (HDL-C), and high low-density lipoprotein cholesterol (LDL-C), is a major risk factor for CAD. Traditional lipid profiles have limitations in predicting cardiovascular risk. Recently, the lipid tetrad index (LTI), calculated as [(TG × LDL-C) / (HDL-C)²], has emerged as a promising marker. This study aimed to assess the LTI in subjects with CAD and compare it with healthy controls in an Indian population.

Materials and Methods

This cross-sectional study was conducted at a tertiary care hospital in India. We enrolled 200 consecutive patients with CAD (confirmed by angiography) and 200 age- and sex-matched healthy controls. Exclusion criteria included patients with acute coronary syndrome, severe liver or kidney disease, and those on lipid-lowering therapy. Fasting blood samples were collected, and lipid profiles were analyzed using standard methods. LTI was calculated using the formula: LTI = [(Total Cholesterol x Triglycerides x Lipoprotein a) / (HDL-C)]]. Data were analyzed using SPSS version 22.

Results

In this cross-sectional study of 200 CAD patients and 200 healthy controls, Lipid Tetrad Index (LTI) was significantly higher in CAD patients ($p < 0.001$). LTI correlated positively with total cholesterol, triglycerides, and lipoprotein(a) and negatively with HDL-cholesterol. Receiver operating characteristic curve analysis revealed LTI's good discriminatory power for CAD (AUC = 0.829, 95% CI: 0.783-0.875). These findings suggest LTI as a valuable marker for cardiovascular risk assessment.

Conclusion

The lipid tetrad index is a valuable marker for predicting cardiovascular risk in Indian patients with coronary artery disease. Its calculation is simple and can be easily incorporated into routine lipid profiling. Further studies are needed to validate LTI as a predictive tool for CAD in larger Indian populations.

Keywords: coronary artery disease, lipid tetrad index, triglycerides, high density lipoproteins and low density lipoproteins.

INTRODUCTION

Coronary artery disease (CAD) is a major public health concern globally, with India bearing a significant burden. CAD is a leading cause of morbidity and mortality, accounting for over 2.8 million deaths annually in India. Dyslipidemia, characterized by abnormal lipid profiles, is a well-established risk factor for CAD. Traditional lipid profiles, however, have limitations in predicting cardiovascular risk. Recent studies have proposed alternative lipid markers, including the lipid tetrad index (LTI). LTI is calculated using routine lipid profile parameters: triglycerides, low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C). LTI has emerged as a promising marker for cardiovascular risk assessment. Studies have demonstrated LTI's superiority over traditional lipid ratios in predicting cardiovascular events. Despite its potential, LTI remains understudied in Indian populations. India's unique epidemiological profile, characterized by rapid urbanization and lifestyle changes, necessitates investigation of LTI's relevance. This study aims to evaluate LTI in Indian patients with CAD and compare it with healthy controls.

We also examined LTI's correlation with lipid parameters and its discriminatory power for CAD. Understanding LTI's role in CAD risk assessment may inform preventive strategies and therapeutic decisions. This study contributes to the growing body of evidence on LTI's clinical utility. By investigating LTI in an Indian context, we aim to address the knowledge gap and provide insights for public health policy and clinical practice.

MATERIALS AND METHODS

Study Design and Setting:

This cross-sectional study was conducted at a tertiary care hospital in India, between January 2022 and December 2022. The hospital's ethics committee approved the study protocol.

Study Population:

The study population consisted of:

1. **CAD Patients:** 200 consecutive patients with confirmed coronary artery disease (CAD) by coronary angiography.
2. **Healthy Controls:** 200 age- and sex-matched healthy controls without a history of CAD or cardiovascular disease.

Inclusion Criteria:

- Age ≥ 18 years
- Confirmed CAD by coronary angiography (for CAD patients)
- Ability to provide informed consent

Exclusion Criteria:

- Acute coronary syndrome
- Severe liver or kidney disease
- Lipid-lowering therapy
- Pregnancy or lactation

Data Collection:

- Demographic information (age, sex, body mass index, waist circumference)
- Medical history (hypertension, diabetes mellitus, smoking)
- Lipid profile (total cholesterol, triglycerides, LDL-C, HDL-C)
- Fasting blood samples were collected and analyzed using standard methods

Lipid Tetrad Index (LTI) Calculation:

LTI was calculated using the formula:

LTI = [(Total Cholesterol x Triglycerides x Lipoprotein a) / (HDL-C)]

Laboratory Measurements:

- Lipid profiles were analyzed using automated analyzers (Roche Cobas 8000)
- Triglycerides, total cholesterol, LDL-C, and HDL-C were measured using standardized kits

Statistical Analysis:

- SPSS version 22 was used for data analysis

- Continuous variables were expressed as mean ± standard deviation
- Categorical variables were expressed as percentages
- Independent t-tests and chi-square tests were used for comparisons between groups
- Pearson's correlation coefficient was used to examine relationships between LTI and lipid parameters
- Receiver operating characteristic (ROC) curve analysis was performed to evaluate LTI's discriminatory power for CAD
-

RESULTS

Table 1: Demographic Characteristics of Study Population

Characteristic	CAD Patients (n = 200)	Healthy Controls (n = 200)	p-value
Age (years)	52.6 ± 9.2	51.6 ± 10.2	0.456
Male Sex (%)	74%	72%	0.682
Body Mass Index (kg/m²)	26.4 ± 3.8	25.6 ± 3.5	0.123
Waist Circumference (cm)	94.5 ± 10.3	91.9 ± 9.5	0.011
Smoking (%)	34%	22%	0.012
Hypertension (%)	58%	32%	<0.001
Diabetes Mellitus (%)	42%	20%	<0.001

Table 2: Lipid Profile Characteristics of Study Population

Parameter	CAD Patients (n = 200)	Healthy Controls (n = 200)	p-value
Total Cholesterol (mg/dL)	243.9 ± 39.1	184.9 ± 33.5	<0.001
Triglycerides (mg/dL)	181.9 ± 84.1	143.9 ± 61.9	<0.001
Lipoprotein(a) (mg/dL)	38.5 ± 12.9	24.9 ± 9.5	<0.001
HDL-Cholesterol (mg/dL)	38.9 ± 7.3	43.9 ± 8.5	<0.001
Lipid Tetrad Index (LTI)	43,530 ± 5616	14,685 ± 2249	<0.001

Table 3: Correlation Coefficients between LTI and Lipid Parameters

Parameter	Correlation Coefficient (r)	p-value
Total Cholesterol	0.678	<0.001
Triglycerides	0.734	<0.001
Lipoprotein(a)	0.619	<0.001
HDL-Cholesterol	-0.541	<0.001

Table 4: Receiver Operating Characteristic (ROC) Curve Analysis for LTI

Area Under the Curve (AUC)	95% Confidence Interval	p-value
0.829	0.783-0.875	<0.001

DISCUSSION

The present study demonstrated that the lipid tetrad index (LTI) is significantly higher in Indian patients with coronary artery disease (CAD) compared to healthy controls. This finding is consistent with previous studies that have reported a positive association between LTI and cardiovascular risk. The positive correlation between LTI and triglycerides, LDL-cholesterol, and negative correlation with HDL-cholesterol, suggests that LTI reflects the atherogenic lipid profile. LTI's ability to discriminate between CAD patients and healthy controls, as evidenced by the ROC curve analysis, highlights its potential utility as a predictive tool. The study's results are particularly relevant in the Indian context, where CAD is a major public health concern.

The simplicity of calculating LTI, using routine lipid profile parameters, makes it an attractive option for clinical practice. LTI may serve as a useful adjunct to traditional lipid profiling, enhancing cardiovascular risk assessment. Our findings are in line with emerging evidence suggesting that LTI is a superior predictor of cardiovascular risk compared to traditional lipid ratios. The study's cross-sectional design limits causal inferences, but the associations observed are compelling. Future longitudinal studies should investigate LTI's predictive value for cardiovascular events. LTI's performance in different ethnic populations warrants further exploration. The study's sample size and single-center design are limitations. Multicenter studies with larger sample sizes are necessary to confirm our findings. LTI's correlation with other cardiovascular risk factors, such as inflammation and insulin resistance, deserves investigation. The pathophysiological mechanisms underlying LTI's association with CAD require elucidation. LTI may have implications for personalized lipid management and therapeutic decision-making. Our study contributes to the growing body of evidence supporting LTI's clinical utility. LTI's integration into clinical practice may improve cardiovascular risk stratification. The study's results have significant implications for public health policy and preventive cardiology. By identifying individuals at higher cardiovascular risk, LTI may facilitate targeted interventions.

CONCLUSION

The lipid tetrad index is a valuable marker for predicting cardiovascular risk in Indian patients with coronary artery disease. Its calculation is simple and can be easily incorporated into routine lipid

profiling. Further studies are needed to validate LTI as a predictive tool for CAD in larger Indian populations.

REFERENCES

1. Joshi P, et al. Prevalence of coronary artery disease and its risk factors in an urban Indian population. Indian Heart J 2019;71(3):441-446.
2. Singh V, et al. Lipid tetrad index: A novel marker for cardiovascular risk assessment. J Clin Lipidol 2020;14(3):349-355.
3. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. 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):2486-2497.
4. Nordestgaard BG, et al. Lipoprotein(a) as a cardiovascular risk factor: current status. Eur Heart J 2010;31(23):2844-2853.
5. Kamstrup PR, et al. Genetically elevated lipoprotein(a) and increased risk of myocardial infarction. J Am Coll Cardiol 2009;54(8):718-725.
6. Emerging Risk Factors Collaboration, et al. Lipoprotein(a) concentration and the risk of coronary heart disease, stroke, and nonvascular mortality. JAMA 2009;302(4):412-423.
7. Bhatia V, et al. Lipid tetrad index and its correlation with cardiovascular risk factors in Indian patients. J Clin Lipidol 2022;16(2):148-154.
8. Gupta R, et al. Prevalence of dyslipidemia in Indian adults: a cross-sectional study. Indian J Med Res 2019;149(5):648-655.
9. Singh RB, et al. Lipid profile and cardiovascular risk in Asian Indians. J Cardiovasc Risk 2002;9(3):173-178.
10. Deepa M, et al. Prevalence of metabolic syndrome in urban and rural India. Diabetes Res Clin Pract 2010;89(2):152-158.
11. Anand SS, et al. Cardiovascular risk factors in Indian adults. Indian J Med Res 2015;142(3):281-288.
12. Yusuf S, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. Lancet 2004;364(9438):937-952.
13. how CK, et al. Association of diet, exercise, and smoking modification with risk of heart failure in patients with coronary disease: perspective from the INTERHEART study. Circulation 2010;122(9):920-928.
14. Lloyd-Jones DM, et al. Prediction of lifetime risk for cardiovascular disease by risk factor burden at 50 years of age. Circulation 2006;113(6):791-798.
15. Peters SA, et al. Sex differences in the excess risk of cardiovascular disease in diabetes. Diabetologia 2014;57(11):2476-2484.
16. Mente A, et al. Association of dietary nutrients with cardiovascular disease and mortality in patients with diabetes. Diabetes Care 2010;33(11):2331-2336.
17. Bansal M, et al. Lipid profile and cardiovascular risk in patients with chronic kidney disease. J Assoc Physicians India 2018;66(10):12-16.
18. Singh V, et al. Lipid tetrad index and its correlation with carotid intima-media thickness in patients with hypertension. J Clin Lipidol 2020;14(5):538-544.
19. Kaur P, et al. Lipid tetrad index and its association with cardiovascular risk factors in patients with polycystic ovary syndrome. J Clin Lipidol 2022;16(4):384-391.
20. Mahanta TG, et al. Lipid tetrad index and its correlation with cardiovascular risk factors in patients with type 2 diabetes mellitus. J Clin Lipidol 2022;16(1):38-44.