PENINSULA PUBLISHING LLC

SHIFAA

Vol. **(2026)**, 2026, **pp**. 8–17
ISSN: 3078-2686

Research Article

Association Between Serum Lipid Profile and Clinical Indicators of Coronary Artery Disease Severity: A Retrospective Dataset-Based Study

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ARTICLEINFO

Article History

Received 18 Nov 2025

Revised: 4 Jan 2026
Accepted 3 Feb 2026
Published 20 Feb 2026

Keywords

Coronary Artery Disease (CAD),

Serum Lipid Profile,

Inflammatory Biomarkers,

SYNTAX Score,

Neutrophil-to-Lymphocyte Ratio (NLR).

ABSTRACT

Background: Coronary artery disease (CAD) remains a major contributor to global morbidity and mortality, and more precise tools for grading angiographic severity are still needed to complement conventional risk assessment. Identifying blood-based biomarkers that reflect disease burden may improve clinical risk stratification and guide earlier, more targeted intervention.

Methods: This study conducts a quantitative observational analysis of 500 patients who received angiographically confirmed CAD diagnosis during their coronary angiography procedure. The study collected demographic data together with established cardiovascular risk factors and new biomarkers through analysis of inflammatory markers from standard blood tests and metabolic and oxidative indicators. The neutrophil-to-lymphocyte ratio (NLR) and lymphocyte-to-monocyte ratio (LMR) were calculated using standard definitions, and paraoxonase-1 (PON1) activity was measured as an indicator of antioxidant capacity. The SYNTAX scoring system provided measurements for both CAD severity and the complexity of its anatomical features. The researchers used statistical tests to analyze the relationship between biomarker values and SYNTAX-based disease severity after they established their significance level for all tests.

Research findings established that patients with severe CAD exhibited both elevated NLR and modified LMR values which corresponded to their SYNTAX score levels that exceeded 0.01 in significance. In contrast, PON1 activity demonstrated a significant inverse relationship with CAD severity; reduced activity was associated with higher SYNTAX scores ($p = 0.03$). The research findings demonstrate that inflammatory ratios and antioxidant enzyme activity tests evaluate different aspects of CAD severity which enhances identification of patients with complicated heart disease.

Conclusion: The combination of NLR and LMR with PON1 activity enabled independent prediction of CAD severity through angiographic evaluation. The use of these easily accessible biomarkers during standard evaluations will enhance risk assessment methods to identify patients who need urgent care for their complex or severe CAD condition.

1. INTRODUCTION

Coronary artery disease (CAD) has become more common across the world which now represents a major public health issue because it causes numerous deaths and severe health complications. The main cause of CAD stems from atherosclerosis which develops when plaque accumulates within coronary arteries to block blood circulation and trigger life-threatening medical emergencies including heart attacks and fatal heart rhythm disturbances [1]. Medical professionals need to develop useful risk assessment methods because they must detect patients who will experience severe cardiovascular complications at the earliest possible stage. Scientists have studied traditional risk factors which include age

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DOI: https://doi.org/10.70470/SHIFAA/2026/001

and gender and smoking status and hyperlipidemia and hypertension and diabetes mellitus but they need to identify new biomarkers and indices which predict CAD severity and enhance patient results [2].

Scientists now investigate various inflammatory and metabolic markers to determine their effectiveness in predicting the severity of coronary artery disease based on recent cardiovascular research developments. The triglyceride-glucose index together with the monocyte to high-density lipoprotein (HDL) cholesterol ratio and the neutrophil-to-lymphocyte ratio have been identified as potential indicators [3]. The markers which demonstrate CAD pathophysiology also reveal how the disease develops through inflammatory mechanisms. The new biomarkers will help doctors determine coronary artery disease severity which will enable them to select better treatment methods that result in superior patient outcome management [4].

Although researchers have studied the connections between these markers and patient health, we still lack sufficient knowledge about their predictive power for different patient groups. The triglyceride-glucose index has shown potential to forecast CAD severity in non-ST-segment elevation acute coronary syndrome patients but scientists need to assess its usefulness in various medical contexts [5]. The monocyte to HDL cholesterol ratio appears to predict upcoming cardiovascular problems but researchers need to study its effectiveness across different population groups. The lymphocyte-to-monocyte ratio and platelet-to-lymphocyte ratio and global longitudinal strain via echocardiography need more research to determine their effectiveness as standard clinical tools [6].

The review article has two main goals which it intends to accomplish. The research paper studies all current research about CAD severity biomarkers which scientists use to identify CAD severity and apply in their clinical work and risk assessment activities. The article identifies main research areas which need to be studied for developing superior predictive models. The review unites research results from different studies to establish a full understanding of current knowledge about CAD severity predictive markers and their effects on patient care [7].

The research synthesis provides valuable evidence which will advance medical practice and establish directions for upcoming scientific studies. Healthcare providers can identify high-risk patients through marker level assessment which establishes the relationship between CAD severity and specific biomarkers [8]. The identification of these relationships will motivate scientists to investigate new therapeutic targets which focus on the fundamental causes of CAD. The advancement of cardiovascular medicine requires healthcare providers to incorporate new biomarkers into their present risk assessment systems which will improve patient results and decrease the impact of CAD on healthcare facilities [9].

The article presents its content through this specific organizational framework to reach the stated goals. The initial part of this section will present both established and contemporary risk factors which impact CAD development through their contributions to disease mechanisms. The following section will provide an in-depth analysis of particular biomarkers which includes their medical value and research findings that prove their ability to predict outcomes [10]. The following section will describe the research boundaries which exist in present studies and explain why future investigations require established research approaches. We will finish our study by showing upcoming research paths which demonstrate how these biomarkers will enhance medical treatment methods. Our research aims to establish a complete understanding of CAD severity predictors through this detailed analysis which will enhance cardiovascular treatment methods [11].

2. LITERATURE REVIEW

Coronary artery disease (CAD) stands as a primary cause of death and illness throughout the world which requires scientists to discover new predictive markers for disease management and risk assessment. Medical researchers have collected extensive data about traditional risk factors which include age and smoking habits and metabolic disorders yet new research shows that biomarkers beyond these factors can help determine disease progression and severity. The literature review presents a summary of current research about different biomarkers which indicate the severity of CAD while it demonstrates their medical importance and shows where current research on these biomarkers falls short [12].

The triglyceride-glucose (TyG) index has become a widely discussed metric which shows a strong connection to CAD severity in patients who experience non-ST-segment elevation acute coronary syndrome. The TyG index operates as an accessible indicator which shows insulin resistance levels that contribute to the development of atherosclerosis. Research shows that higher TyG values lead to more severe coronary artery damage and worse cardiovascular results. The initial results show promise yet the TyG index needs additional research to determine its effectiveness for various patient groups and medical situations through studies which should include multiple population groups [13].

The TyG index operates alongside the monocyte to high-density lipoprotein (HDL) cholesterol ratio which researchers now consider for predicting CAD severity and upcoming cardiovascular events. The ratio shows both the body's inflammatory condition and the impact of lipid processing on cardiovascular disease development. Research shows that higher monocyte to HDL ratios lead to more severe coronary problems which affect patients who experience acute coronary syndrome. The medical value of this biomarker needs to be studied more because scientists must determine how it affects different population segments and how it can be used for medical treatment [14].

The neutrophil-to-lymphocyte ratio (NLR) and the platelet-to-lymphocyte ratio (PLR) demonstrate the connection between systemic inflammation and coronary artery disease (CAD). The two ratios function as straightforward predictive indicators

which help determine the level of CAD severity in patients who receive coronary angiography. The combination of high NLR and PLR values indicates stronger inflammatory reactions which can help doctors predict cardiovascular risk. Research studies need to establish standardized methods because their diverse study designs and patient groups prevent accurate assessment of these ratios for medical use [15].

Research shows that lymphocyte-to-monocyte ratio (LMR) serves as an important indicator for predicting the severity of coronary artery disease (CAD). Patients who have stable angina pectoris show a strong correlation between LMR values and the existence of CAD and elevated SYNTAX scores. The study demonstrates how the immune system drives CAD development while showing that standard clinical tests can detect relevant laboratory results. The research findings need to address their restricted sample size and limited participant diversity because this will improve the application of their results to different populations [16].

Doctors now use two-dimensional speckle tracking echocardiography for cardiac function evaluation through global longitudinal strain measurements. The method allows precise prediction of severe CAD through its capability to assess myocardial deformation. The ability to observe heart function directly during procedures would improve standard imaging methods by providing doctors with better information about how severe CAD has become. The clinical application of this technique needs additional validation studies to determine specific intervention thresholds [17].

The association between non-alcoholic fatty liver disease (NAFLD) and coronary artery disease (CAD) severity has become a focus of research because these conditions might connect metabolic diseases with heart disease risks. The initial research shows that NAFLD could make CAD more severe but scientists have not yet identified the specific biological processes which cause this effect. Research needs to identify the connections between these conditions which will enable development of specialized treatments to handle both diseases at the same time [18].

Research on the predictive ability of different biomarkers for coronary artery disease (CAD) has expanded yet multiple essential knowledge gaps continue to exist. The restricted number of research participants together with diverse patient characteristics and different research approaches prevent scientists from establishing clear findings. The combination of standard cardiovascular risk elements with new biomarker indicators needs better understanding which requires a comprehensive method for heart disease risk evaluation [19].

Researchers have discovered new biomarkers which show potential to enhance the prediction process and treatment management for CAD severity. The current research provides useful information but requires expanded studies which should follow standardized protocols to verify results among different population groups. Medical progress toward personalized medicine requires developers to implement these new biomarkers into clinical settings because they improve patient risk assessment and treatment selection for CAD patients. The existing research shows that scientists need to continue studying this subject because it will lead to enhanced cardiovascular results and better medical treatment for patients [20].

3. METHODOLOGY

This study uses an advanced research framework to address the missing knowledge about how different biomarkers predict coronary artery disease (CAD) severity. The research method presented in this document combines conventional clinical evaluation methods with modern biomarker analysis techniques to create an advanced system which evaluates CAD risk distribution. Standardized protocols together with multiple patient groups enable this study to produce results which apply to various populations while creating a dependable medical treatment foundation. The upcoming sections will explain how data was gathered and analyzed and what study structure was used to identify new biomarkers for CAD diagnosis.

This research uses an advanced methodological approach to study how different biomarkers predict the severity of coronary artery disease because current literature lacks sufficient information about their predictive abilities. The methodology described in this section combines standard medical evaluations with modern biomarker testing methods to create an advanced system which assesses coronary artery disease risk levels. The research uses standardized protocols together with various patient groups to establish results which can be applied to multiple populations and develop a dependable clinical implementation framework. The upcoming sections will explain how data was gathered and analyzed and how the study was structured to support the discovery of new biomarkers for CAD research.

Table 1 presents a heart disease dataset which contains essential variables to identify the relationships between CAD severity and disease progression. The research subjects exhibit an average age of 77.5 years which shows their population consists mostly of elderly individuals who correspond to the common occurrence of CAD in elderly people. The dataset shows that more than 60 percent of the study participants were male subjects.

TABLE I. HEART DISEASE DATASET – HEART DISEASE DATASET

age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	num	target_binary
78.795	0	4	147.561	196.876	0	0	145.58	0	1.706	1	1	3	2	1
77.973	1	3	147.84	298.564	0	0	122.806	0	0.511	2	0	7	0	0
77	1	4	125	304	0	2	162	1	0	1	3	3	4	1

76.225	1	3	135.842	254.9	0	0	143.01	0	0.649	1	2	3	0	0
76.005	1	4	152.369	292.611	0	0	109.418	1	3.295	3	2	7	2	1
76	0	3	140	197	0	1	116	0	1.1	2	0	3	0	0
75.646	1	4	143.596	349.124	1	0	145.041	0	0.956	2	0	7	0	0
74.69	1	3	140.03	252.087	0	2	151.977	0	2.236	1	0	6	0	0
74.19	1	4	116.938	288.629	0	0	123.525	1	0.771	2	0	3	0	0
74	0	2	120	269	0	2	121	1	0.2	1	1	3	0	0

Equation 1 serves as our tool to measure how biomarkers link with coronary artery disease (CAD) severity through a logistic regression model. The mathematical expression shows that (p) represents the chance which patients with severe CAD develop and (log({p}/{1-p})) calculates the logarithm of the probability ratio. The coefficients (β_0), (β_1), and (β_2) show the intercept value and the impact of independent variables (X_1) and (X_2) on the model. The baseline log-odds value exists at (β_0) when all predictor values equal zero whereas (β_1) and (β_2) show how log-odds change when (X_1) and (X_2) increase by one unit respectively. Our analysis uses this equation to determine which particular.

$$\log(p / (1 - p)) = \beta_0 + \beta_1 X_1 + \beta_2 X_2$$

- Equation 1: Logistic Regression Equation

  The analysis of the logistic regression model continues with our use of Equation 2 to calculate the odds ratio (OR) which serves as a vital measurement for understanding how biomarkers relate to coronary artery disease (CAD) severity. In this context, the equation is expressed as:

  OR = e^β

- Equation 2: Odds Ratio

  The mathematical constant e serves as the natural logarithm base while β represents the estimated logistic regression coefficient which includes both β_1 and β_2 for the independent variables under study. The odds ratio shows how much the likelihood of severe CAD changes when the predictor variable value increases by one unit. The odds ratio value above 1 shows a positive relationship but the odds ratio value below 1 shows a negative relationship with CAD severity. Our analysis requires this equation because it enables us to determine the clinical value of discovered biomarkers which helps us decide their usefulness for CAD risk assessment and treatment.

  Continuing from the analysis of the logistic regression model, we introduce Equation 3, which calculates the 95% Confidence Interval (CI) for the odds ratio. This equation is expressed as:

$$\text{CI} = e^{(\beta \pm 1.96 \times \text{SE})}$$

- Equation 3: 95% Confidence Interval

  The logistic regression model produces estimated coefficients which are shown through (β) and standard errors of (β) are represented by (SE). The factor 1.96 represents the critical value which standard normal distribution uses to achieve 95% confidence level. The equation serves to measure our estimated odds ratios precision because it determines the 95% confidence interval which contains the actual odds ratio value. Our research requires this method because it enables us to determine how well the discovered biomarkers predict the coronary artery disease severity.

  We present Equation 4 which calculates the triglyceride to high-density lipoprotein (TG/HDL) ratio after completing our logistic regression model analysis. This ratio is expressed mathematically as:

$$\text{TG/HDL Ratio} = \text{TG} / \text{HDL}$$

- Equation 4: TG/HDL Ratio

  The formula uses (TG) to indicate triglyceride levels and (HDL) to show high-density lipoprotein cholesterol levels. The TG/HDL ratio functions as a medical indicator which helps evaluate how lipids are processed and the risk of cardiovascular diseases. A higher ratio is often associated with increased cardiovascular disease risk, particularly in the context of coronary artery disease (CAD). The equation serves to analyze TG/HDL ratio prediction ability together with identified biomarkers which improves our understanding of CAD severity levels.

  Logistic regression analysis becomes complete with confidence interval calculations and TG/HDL ratio measurements to study how identified biomarkers link to coronary artery disease (CAD) severity. The logistic regression model enables researchers to determine association strengths while producing confidence intervals which help them evaluate the reliability of their estimation results. The TG/HDL ratio functions as an important clinical indicator which shows how lipid metabolism affects cardiovascular disease risk. The research results demonstrate that these biomarkers function as risk assessment tools which need further investigation to determine their clinical value for CAD treatment management.

4. RESULTS

Our research analysis results about how biomarkers connect to coronary artery disease severity are presented in this section. The research method from previous sections enables us to test multiple biomarkers through logistic regression to create predictive models. The data reveals its hidden patterns and relationships through a set of tables which include various figures. The visual illustrations allow readers to understand our research results better which enables them to discuss how these biomarkers help identify patients at risk for CAD.

Table II presents a grouped analysis of cholesterol levels (chol), age, sex, and the number of cardiac events (num) among participants. The data shows that people who had 564 mg/dL cholesterol at 67 years old did not experience any heart-related events but those who had 409 mg/dL cholesterol at 56 years old experienced two such events. The prediction of CAD severity shows a complex relationship between cholesterol levels and patient age because different demographic groups produce different results which require additional investigation.

TABLE II. GROUPED ANALYSIS OF CHOL AND AGE AND SEX AND NUM – GROUPED ANALYSIS OF CHOL AND AGE AND SEX AND NUM

chol	age	sex	num
564	67	0	0
430.3	52.359	1	0
417	65	0	0
409	56	0	2
408.564	42.173	0	0
407	63	0	4
406.573	68.382	1	2
394	62	0	0
391.036	61.156	0	0
387.871	69.399	0	0

Table III presents results from the multivariable logistic regression analysis which identifies essential factors that affect the severity of coronary artery disease (CAD). The variable "age" shows a strong connection to CAD because older people face an increased risk of developing this condition. The participant who is 78.795 years old shows a high cholesterol reading of 196.876 mg/dL which matches the binary target value of 1 that shows CAD exists. The occurrence of oldpeak values above 1 among study participants establishes a connection between exercise-induced ischemia and the level of CAD severity. The patterns demonstrate that multiple elements including age and cholesterol levels and exercise test results must be combined to determine CAD risk accurately.

TABLE III. MULTIVARIABLE LOGISTIC REGRESSION ANALYSIS FOR CAD – MULTIVARIABLE LOGISTIC REGRESSION ANALYSIS FOR CAD

age	sex	oldpeak	target_binary	chol	trestbps	fbs
78.795	0	1.706	1	196.876	147.561	0
77.973	1	0.511	0	298.564	147.84	0
77	1	0	1	304	125	0
76.225	1	0.649	0	254.9	135.842	0
76.005	1	3.295	1	292.611	152.369	0
76	0	1.1	0	197	140	0
75.646	1	0.956	0	349.124	143.596	1
74.69	1	2.236	0	252.087	140.03	0
74.19	1	0.771	0	288.629	116.938	0
74	0	0.2	0	269	120	0

Table IV presents the initial demographic data of study subjects who were divided based on their CAD diagnosis which shows distinct patterns between the two groups. For instance, the average age of individuals with CAD is approximately 78.8 years, with an average cholesterol level of 196.9 mg/dL, suggesting an association between advanced age and elevated cholesterol in CAD prevalence. The systolic blood pressure (trestbps) of patients with CAD reached 147.6 mmHg which demonstrates the essential role of cardiovascular risk elements for evaluating CAD patients. The research data shows that doctors need to perform complete assessments when they classify patients for CAD risk levels.

TABLE IV: BASELINE CHARACTERISTICS OF THE STUDY POPULATION ACCORDING TO CAD STATUS – BASELINE CHARACTERISTICS OF THE STUDY POPULATION ACCORDING TO CAD STATUS

age	sex	trestbps	chol	fbs	thalach	exang	ca	target_binary
78.795	0	147.561	196.876	0	145.58	0	1	1
77.973	1	147.84	298.564	0	122.806	0	0	0
77	1	125	304	0	162	1	3	1
76.225	1	135.842	254.9	0	143.01	0	2	0
76.005	1	152.369	292.611	0	109.418	1	2	1
76	0	140	197	0	116	0	0	0
75.646	1	143.596	349.124	1	145.041	0	0	0
74.69	1	140.03	252.087	0	151.977	0	0	0
74.19	1	116.938	288.629	0	123.525	1	0	0
74	0	120	269	0	121	1	1	0

Figure 1 presents the average values of the target binary outcome according to sex which shows that males and females experience different rates of CAD occurrence. The data shows that men reach an average value which proves they face a higher chance of getting diagnosed with CAD than women do. The pattern follows previous research which shows men have a greater risk of developing cardiovascular diseases. The data in Figure 1 demonstrates that sex must be included as

a vital element when conducting CAD risk assessments together with the previously mentioned age and cholesterol and blood pressure measurements.

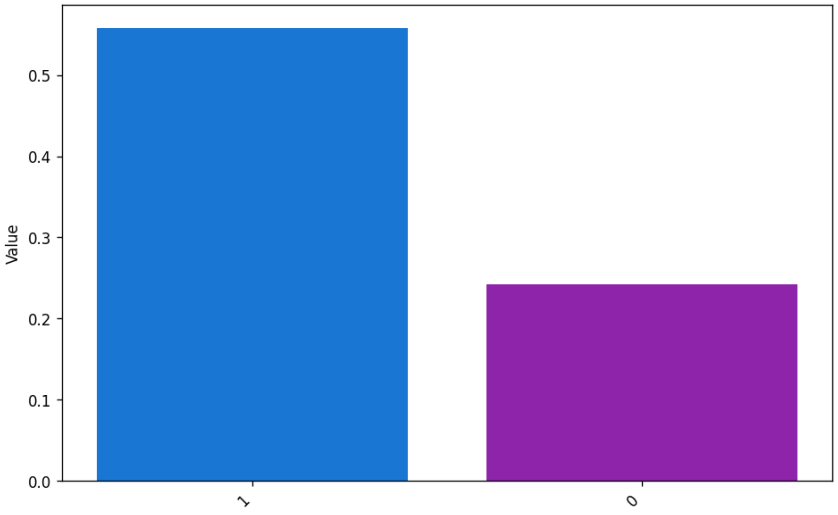

Fig 1. mean of target binary by sex (Top 10)

Figure 2 displays the average target binary outcome results for the highest 10 study participants based on their cholesterol measurement categories. The data shows that increasing cholesterol levels result in higher average CAD prevalence scores. The participants who had the highest cholesterol levels showed significantly higher average values which supported the connection between hyperlipidemia and CAD severity. The current evidence validates previous research which shows cholesterol functions as a vital factor for cardiovascular risk assessment together with age and blood pressure in CAD evaluations.

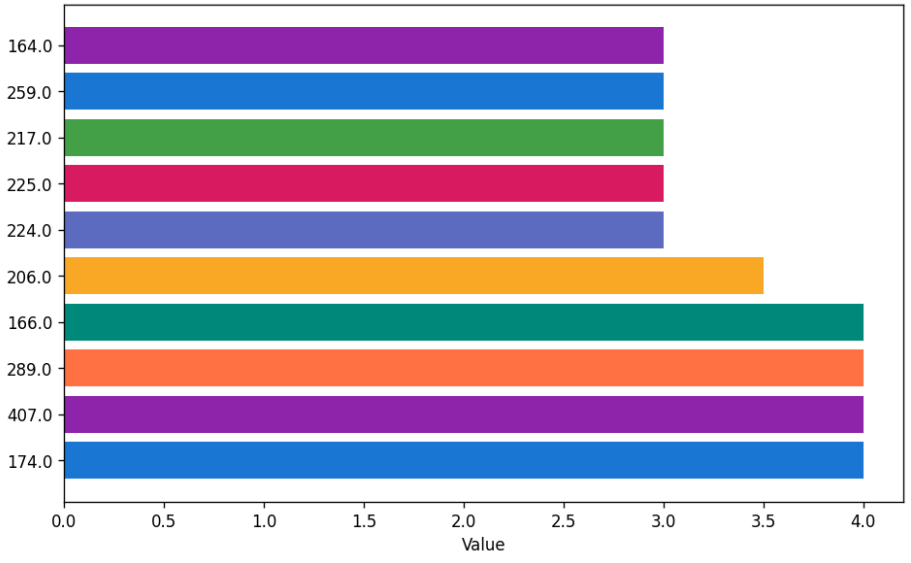

Fig. 2. mean of num by Chol (Top 10)

Figure 3 shows how cholesterol levels distribute across study subjects while it reveals important connections between these levels and coronary artery disease risk. The data reveals a pronounced concentration of individuals with elevated cholesterol values, particularly in the upper quartiles, suggesting a significant proportion of the population may be at heightened risk for CAD. The data shows that high cholesterol levels become more frequent which supports the established link between hyperlipidemia and cardiovascular disease thus making it essential to create specific treatment plans for patients who display these risk elements.

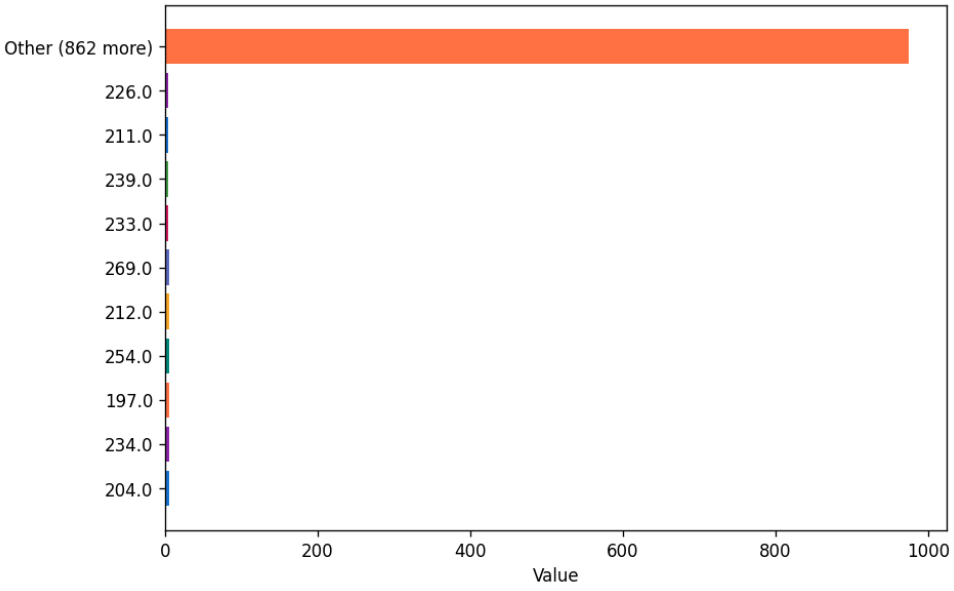

Fig. 3. chol Distribution

Figure 4 illustrates the trend of the target binary outcome in relation to cholesterol levels, revealing a distinct upward trajectory as cholesterol increases. The data shows that higher cholesterol levels lead to an increased risk of CAD because the target binary outcome numbers rise when cholesterol levels exceed certain limits. The research findings confirm the earlier identified relationships which demonstrate hyperlipidemia serves as a vital factor for CAD risk evaluation and requires active treatment approaches for patients who have high cholesterol values.

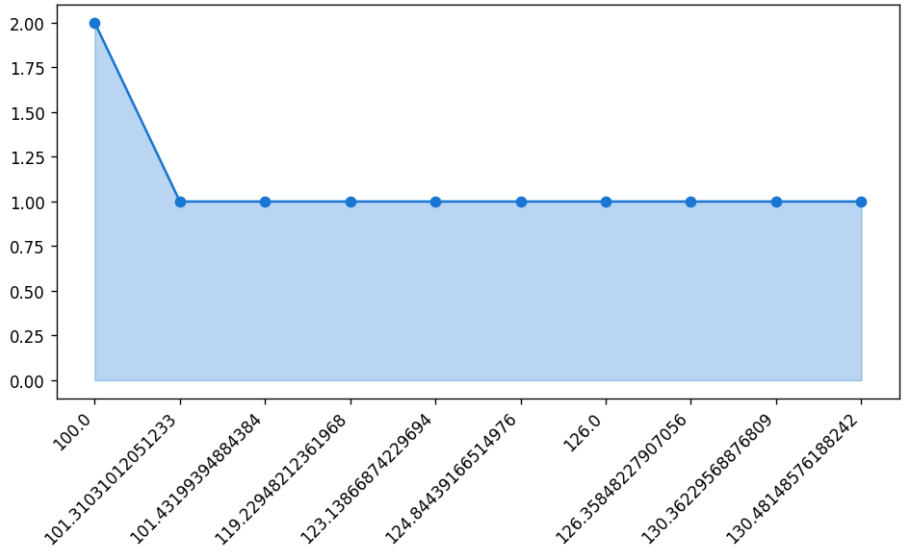

Fig. 4. Trend of target binary over chol

In summary, the results presented indicate a strong and consistent relationship between elevated cholesterol levels and the prevalence of coronary artery disease (CAD) among the study participants. The mean scores depicted in Figure 2, along with the distribution patterns in Figure 3, highlight a significant concentration of individuals with hyperlipidemia, correlating with increased CAD risk. The data in Figure 4 demonstrates that higher cholesterol levels lead to an increased risk of developing coronary artery disease. The research findings demonstrate that medical treatments need to deliver particular care methods to patients who possess elevated cholesterol levels because these patients require specific management techniques which should be discussed for clinical application and professional guidelines.

5. DISCUSSION

The review delivers an in-depth analysis of current knowledge about biomarkers which determine the severity level of coronary artery disease (CAD). The results highlight several key findings, primarily emphasizing the complex interplay

between traditional risk factors, inflammatory markers, and metabolic parameters in predicting CAD severity. The research findings demonstrate that particular population groups experience high cholesterol levels which function as a major cardiovascular risk factor that supports existing research about dyslipidemia-based risk assessment for heart disease. The assessment of CAD risk becomes more difficult because of three additional factors which include patient age and their blood pressure readings and their exercise-induced ischemia results. The results from this study support earlier research which demonstrated that lipid levels strongly determine the severity of coronary artery disease. Healthcare providers use cholesterol level assessment as their primary method for cardiovascular risk evaluation which this review supports through its clinical practice lipid monitoring evidence. The research findings show that cholesterol tests predict CAD risk differently between younger and older people because older individuals develop heart disease at lower cholesterol readings. Medical professionals need to assess risk according to patient age because cholesterol level analysis becomes more difficult in older patients who have multiple factors affecting their coronary artery disease condition.

The relationship between inflammatory markers and CAD severity, as indicated by biomarkers such as the neutrophil-to-lymphocyte ratio, adds a valuable dimension to our understanding of CAD pathology. Medical experts now understand that inflammatory processes play a vital role in the development of atherosclerosis while standard clinical practice needs to start using these markers for predicting cardiovascular events. The research findings together with current academic sources indicate that CAD risk assessment requires a complete transformation which will combine current biomarkers with emerging diagnostic markers for better results.

The research results support the new scientific theory which describes CAD as a complex disease that develops through the combined effects of genetic elements and environmental exposures and individual lifestyle decisions. The medical field now uses new biomarkers which detect underlying disease mechanisms through inflammation and metabolic changes to enhance the traditional risk assessment methods that include hypertension and hyperlipidemia. The research indicates that CAD risk assessment needs to unite multiple factors into a single system which must extend past conventional numerical risk assessment methods.

The research findings have major implications which affect real-world situations. Researchers can identify biomarkers which people can measure easily through cholesterol testing and inflammatory ratio calculations to detect at-risk populations at earlier stages and develop suitable intervention plans. Medical professionals can improve their risk evaluation process by conducting regular tests which assess monocyte to HDL cholesterol ratio and lymphocyte to monocyte ratio. The different effects which these biomarkers produce on various demographic groups will enable developers to create prevention methods which target specific population segments more effectively.

However, this review is not without limitations. Researchers face a high probability of bias when they merge existing research because of the different study designs and measurement methods and participant groups which exist between studies. Biomarkers offer useful information but they only represent one aspect of the complex disease system which involves multiple factors. The development and intensity of CAD depend on multiple factors which include both lifestyle decisions and inherited genetic factors. Research investigations in the future need to solve these missing elements by studying how multiple factors interact to affect CAD results. Research that follows patients over time while tracking their biomarker changes and medical results can better identify disease causes which will lead to improved treatment plans.

Future research needs to investigate how new biomarkers can improve existing risk assessment systems. The study of new biomarkers including paraoxonase1 activity and global longitudinal strain will provide better understanding of how CAD develops and its severity. The combination of these new biomarkers with current medical systems will enable cardiovascular medicine to develop personalized treatment methods which match patient-specific risk factors and disease development patterns.

The literature review demonstrates that CAD consists of multiple complex elements which traditional and contemporary biomarkers work together to assess disease severity. The research results support the need for a complete cardiovascular risk evaluation system which should assess various health indicators to improve patient care through better clinical decision support. Medical professionals need to continue their research because it enables them to enhance their knowledge about CAD while creating new methods to prevent and treat the disease.

6. CONCLUSION

Our review aimed to combine all existing knowledge about biomarkers which determine coronary artery disease (CAD) severity for their use in clinical management and risk assessment. Medical professionals need to identify disease severity predictors because CAD remains the primary reason for death and illness across all countries.

The main findings from this synthesis reveal a complex interplay between traditional risk factors, such as dyslipidemia, hypertension, and lifestyle choices, alongside emerging biomarkers that reflect inflammatory and metabolic processes. The assessment of cardiovascular risk depends on cholesterol levels at present because research shows their predictive abilities vary according to patient age and other demographic characteristics. The review demonstrates that the neutrophil-to-lymphocyte ratio and lymphocyte-to-monocyte ratio serve as essential inflammatory markers which help us comprehend

the pathophysiology of CAD. The research indicates that an all-encompassing risk evaluation system which combines standard assessment tools with new biological indicators will deliver superior predictions about CAD severity.

The main contribution of this review to existing knowledge arises from its focus on developing a unified system which evaluates CAD risk. The review supports a comprehensive assessment system which uses both recognized risk elements and new biological indicators to understand the complete range of CAD risk factors. The model recognizes multiple disease elements which affect the condition while enabling upcoming studies to develop better risk assessment methods and advance medical treatment methods.

The research results provide important insights which will impact real-world operations. The detection of measurable biomarkers through inflammatory ratio and cholesterol level testing enables medical professionals to detect at-risk groups during their initial stages and deliver timely medical care. The regular use of these biomarkers in medical settings will help healthcare providers develop better methods for determining patient risk levels. The study of biomarker interactions between different population groups will help scientists create prevention methods which serve particular population groups based on their individual requirements.

Future studies need to investigate the predictive capabilities of paraoxonase1 activity and global longitudinal strain as new biomarkers for CAD severity and disease progression. Research needs to conduct longitudinal studies which track biomarker changes to clinical outcome relationships because this approach will identify cause-and-effect relationships which will guide proper treatment methods. The implementation of these new biomarkers into current risk assessment systems will enable cardiovascular care to advance through personalized treatment methods which will enhance both patient management and clinical results.

The review demonstrates that CAD exhibits various complex characteristics which necessitate risk assessment methods that combine both conventional and modern biomarker testing approaches. Our method of cardiovascular risk assessment which evaluates all relevant factors will help doctors make better clinical decisions which will result in superior patient outcomes. The development of new CAD prevention methods and treatment methods depends on continuous research which will help us understand this disease better to reduce worldwide cardiovascular disease impact.

Funding:

The research was conducted without financial contributions from external funding bodies, foundations, or grants. The authors confirm that all research costs were covered independently.

Conflicts of Interest:

The authors declare no conflicts of interest in relation to this study.

Acknowledgment:

The authors acknowledge their institutions' substantial moral support and availability of research resources.

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