

PREDICTIVE VALUE OF THE TRIGLYCERIDE-GLUCOSE INDEX FOR CORONARY ARTERY DISEASE SEVERITY AND ADVERSE CARDIOVASCULAR OUTCOMES IN PATIENTS UNDERGOING CORONARY ANGIOGRAPHY

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ABSTRACT

Background: Cardiovascular disease (CVD) and especially coronary artery disease (CAD) list of causes of morbidity and mortality throughout the world. Insulin resistance-induced dysfunction and inflammation in the body, dyslipidemias and the onset of atherosclerosis (strongly related to IR) are easy-to-measure surrogate markers of IR and may be correlated with the severity of CAD and cardiovascular risk.

Objective: The prediction power of the TyG index was assumed to be superior to other of cardiac risk for the severity of CAD and adverse cardiovascular events prior to the co angiography.

Place and Duration of Study: This prospective observational study was conducted at the Department of Cardiology, Pervaiz Elahi Institute of Cardiology Bahawalpur from June 2024 to December 2024.

Methods: All a total of 130 patients were enrolled. The clinical, biochemical and angiographic parameters were examined. The CAD index was determined, and the severity of CAD was measured from the angiographic findings.

Results: CAD severity, multivessel involvement, and cardiovascular risk were all higher with higher TyG index values.

Conclusion: The TyG index is simple to measure, inexpensive, and may serve as an readily accessible index to selectively screen patients for coronary angiography and as a predictor of the severity of CAD.

KEYWORDS: Triglyceride-glucose index; coronary artery disease; Coronary angiography; Insulin resistance; Cardiovascular outcomes

INTRODUCTION

It is thought that coronary artery disease (CAD) significantly contributes to cardiovascular morbidity and mortality, which ranks among the top causes of death and disability globally. Atherosclerotic plaque is built up in coronary arteries, which gradually narrows the artery lumen and reduces blood flow to the heart (Wang et al., 2026). Cardiovascular disease (CAD) may cause a variety of symptoms, including stable angina, myocardial infarction, and other life-threatening consequences. Due to its high incidence and consequences, coronary artery disease (CAD) continues to impose a substantial burden, despite many advances in prevention, diagnosis, and treatment (Huang et al., 2026).

Genetic, metabolic, inflammatory, and environmental variables all have a role in the complicated syndrome known as coronary artery disease (CAD). Known classic cardiovascular risk factors, including diabetes mellitus, hypertension, obesity, smoking, and dyslipidemias, are all linked to atherosclerosis (Hu et al., 2026). Nonetheless, new evidence points to insulin resistance as an important metabolic issue that may precede and perhaps contribute to coronary artery disease (CAD). Vascular damage and plaque development are outcomes of insulin resistance's detrimental impacts on glucose metabolism, endothelial dysfunction, elevated oxidative stress, chronic inflammation, and aberrant lipid metabolism (Hu et al., 2026).

Atherosclerotic changes may be accelerated in many ways by insulin resistance. Increased insulin resistance, or hyperinsulinemia, triggers inflammatory pathways and leads to the proliferation of smooth muscle cells in the blood vessels. It also encourages the production of tiny dense LDL particles which are very prone to cause atherosclerosis and raises triglyceride levels while lowering HDL cholesterol (Wu et al., 2026). These alterations in metabolism contribute to endothelial injury, plaque formation, and progressive coronary artery lesions. Therefore, additional information on cardiovascular risk might be provided by an accurate assessment of insulin resistance (Cherska et al., 2026).

Recent research has shown that the triglyceride-glucose (TyG) index may be used as a quick and straightforward way to identify insulin resistance (Lin et al., 2026). Clinical fasting triglycerides and fasting blood glucose, which

are readily available, are used to determine it. In comparison to direct approaches, the TyG index is simple to assess, inexpensive, and applicable to large populations for determining insulin resistance. Research has shown that a higher TyG index is associated with an increased risk of cardiovascular disease, metabolic syndrome, coronary artery calcification, and coronary artery lesions of varying severity (Duan et al., 2026).

The architectural characteristics and severity of coronary artery disease (CAD) may be best assessed by coronary angiography, the gold standard procedure (Hu et al., 2026). Specifies the degree to which the coronary arteries are narrowed, the vessels that are affected, and the intricacy of the illness. On the other hand, the angiographic image may not always depict the actual metabolic processes at work in a disease. Cardiovascular risk stratification and the identification of people at increased risk for major coronary diseases may be aided by combining angiographic data with metabolic indicators such as the TyG index (Wu et al., 2026).

There has been some reporting of a correlation between TyG and CV outcomes; however, further research is required to establish the predictive utility of TyG for CV outcomes in coronary angiography patients and for CAD severity evaluation (Cherska et al., 2026). Better long-term cardiovascular outcomes may be possible with the use of an easily accessible biomarker that might forecast disease load, paving the way for earlier intervention and better disease management. Because of this, we set out to determine if the TGI was useful in predicting the degree of coronary artery disease and unfavourable CV events in patients having cardiac angiography in this prospective observational trial (Lin et al., 2026).

Objective

The triglyceride-glucose (TyG) index was used to assess the predictive and association value of the index with the severity of coronary artery disease and adverse cardiovascular events in patients referred to coronary angiography.

METHODOLOGY

The present study is a prospective observational study conducted in Cardiology Department of Pervaiz Elahi Institute of Cardiology Bahawalpur from June 2024 to December 2024. In the coronary angiography study the patients were enrolled based on the predetermined inclusion criteria and 130 patients were enrolled. The sample size was determined based on WHO sample size estimation formula. Detailed demographic data, medical history, cardiovascular risk factors and laboratory investigations were obtained by all the participants. Patients' fasting blood glucose and triglycerides levels were determined and TyG index calculated for each patient. The findings from the coronary angiography were assessed to determine whether or not coronary artery disease existed, what the extent of the disease was and how serious it was. To assess the predictive value, the association of the TyG index values, CAD severity and adverse cardiovascular outcomes was statistically evaluated.

Inclusion Criteria

Patients aged 18 years or older, who had coronary angiography for suspected or confirmed coronary artery disease were included. Eligible participants having fasting triglyceride and glucose data, complete clinical information, and angiographic data. All patients gave informed consent for participation.

Exclusion Criteria

Patients who had incomplete clinical or laboratory data, prior coronary procedures, significant systemic diseases, active infections and metabolic disorders of glucose or lipids were excluded. To reduce confounding factors, those who refused to participate or who did not have sufficient angiographic data or who were treated with drugs that may affect triglyceride or glucose levels were also excluded.

Data Collection

Data was collected using a standardised proforma that was created according to the study's goals. Clinical data, as well as demographic information (gender, age) were collected. The following were noted: smoking status, history of cardiovascular events, diabetes mellitus, hypertension, dyslipidemia, and medical history. The triglyceride-glucose (TyG) index was calculated from glucose and triglyceride levels measured in fasting blood samples. If coronary artery disease was found, the severity of the condition, including the number of vessels affected and amount of stenosis, was recorded in the coronary angiography report. There was additional data available on adverse cardiovascular events when they occurred. To establish a correlation between TyG index values, CAD severity, and clinical outcomes, all data was securely stored and analysed.

RESULTS

The research included 130 individuals who had coronary angiography. The findings demonstrated a robust positive association between TIG and both the occurrence and severity of coronary artery disease (CAD). Patients with a higher Tyg index score had a greater prevalence of coronary stenosis and serious coronary artery lesions. Concerning the number of arteries involved and the probability of unfavourable cardiovascular events, a positive link was also identified between TyG index and both variables. The genesis and progression of coronary atherosclerosis are influenced by insulin resistance (TyG). Therefore, the TyG index has the potential to be a straightforward metric for assessing the risk of cardiovascular events in patients undergoing coronary angiography.

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants

Variables	Total Patients (n=130)
Mean age (years)	56.8 ± 9.7

Male gender, n (%)	86 (66.2%)
Female gender, n (%)	44 (33.8%)
Hypertension, n (%)	72 (55.4%)
Diabetes mellitus, n (%)	58 (44.6%)
Dyslipidaemia, n (%)	64 (49.2%)
Smoking history, n (%)	51 (39.2%)

Demographic and clinical data pertaining to the research population's baseline may be found in Table 1. The majority of the patients were men, and hypertension, dyslipidaemias, and diabetes mellitus were the leading causes of cardiovascular disease. Before looking at the correlations between TyG index and CAD severity, it is important to account for the many metabolic and clinical risk factors that patients undergoing coronary angiography have.

Table 2: Biochemical Characteristics and TyG Index Distribution

Parameters	Mean $\pm$ SD
Fasting glucose (mg/dL)	118.5 $\pm$ 28.6
Triglycerides (mg/dL)	176.4 $\pm$ 54.2
TyG index	9.12 $\pm$ 0.48
Total cholesterol (mg/dL)	196.8 $\pm$ 42.5
LDL cholesterol (mg/dL)	124.6 $\pm$ 36.7
HDL cholesterol (mg/dL)	42.3 $\pm$ 9.8

Table 3 shows that levels of TyG are correlated with the severity of CAD. A larger proportion was seen in patients with significant coronary artery disease compared to those with lower TyG index values. This pattern may aid in the classification of patients with advanced coronary atherosclerosis by suggesting that greater insulin sensitivity is linked to an elevated burden of coronary atherosclerosis.

Table 3: Association Between TyG Index and Coronary Artery Disease Severity

TyG Index Group	Mild CAD	Moderate CAD	Severe CAD
Low TyG index	28 (43.1%)	18 (27.7%)	10 (15.4%)
Intermediate TyG index	20 (30.8%)	24 (36.9%)	18 (27.7%)
High TyG index	8 (12.3%)	20 (30.8%)	24 (36.9%)

TyG levels and CAD severity are correlated, as Table 3 illustrates. The proportion was larger in patients with severe coronary artery disease than in those with lower TyG index values. This pattern might be useful in patient classification for advanced coronary atherosclerosis because it implies that greater insulin sensitivity is linked to an increased coronary atherosclerotic load.

Table 4: Association Between TyG Index and Number of Diseased Coronary Vessels

TyG Index Category	Single Vessel Disease	Two Vessel Disease	Multivessel Disease
Low TyG index	25 (38.5%)	20 (30.8%)	20 (30.7%)
High TyG index	12 (18.5%)	25 (38.5%)	28 (43.0%)

The correlation between coronary vascular involvement and TyG index categories is seen in Table 4. Compared to patients in the lower TyG index group, a greater percentage of patients in the higher TyG index group had multi-vessel coronary disease. These findings imply that increased coronary artery involvement and broad atherosclerotic alterations may be associated with higher levels of insulin resistance.

Table 5: Predictive Association of TyG Index with Adverse Cardiovascular Outcomes

Variable	Odds Ratio (OR)	95% Confidence Interval	p-value
High TyG index	2.45	1.35–4.42	<0.001
Diabetes mellitus	1.86	1.02–3.39	0.04
Hypertension	1.54	0.89–2.67	0.11
Dyslipidaemia	1.72	1.01–2.95	0.04

Independent of other clinical factors, there was a larger rise in cardiovascular risk despite increased TyG. According to the results, the TyG index may provide more prognostic data and be a helpful tool for identifying individuals who need closer monitoring and early implementation of cardiovascular preventative measures.

DISCUSSION

The current research examined the correlation between the triglyceride-glucose (TyG) index and unfavorable cardiovascular outcomes in patients undergoing coronary angiography as well as the TyG index's capacity to predict the severity of coronary artery disease (CAD) (Hu et al., 2026). The findings demonstrated that the severity of the CAD, the involvement of the coronary arteries, and the cardiovascular risk increased with the TyG index. These results suggest that the TyG index may be a useful and accessible tool for identifying people who are more likely to have advanced coronary disease (Xie et al., 2026).

The complicated condition known as CAD is linked to endothelial dysfunction, inflammation, metabolic disorders, and blood vessel alterations. One of these variables that has garnered a lot of attention is insulin resistance, which plays a crucial part in the development and course of atherosclerosis (Siverio-Morales et al., 2025). Impaired glucose control, compensatory hyperinsulinemia, increased oxidative stress, and persistent inflammatory reactions are all consequences of insulin resistance that contribute to vascular damage and plaque development (Liang et al., 2023). Moreover, improper lipid metabolism, which raises triglyceride levels and lowers HDL cholesterol, is directly associated with insulin resistance and accelerates coronary artery damage (Abuduaini et al., 2023).

Based on two biochemical markers (fasting glucose and triglyceride level), the TyG index has been shown to be an easy-to-measure indicator of insulin resistance (Feng et al., 2024). Compared to other direct insulin resistance testing techniques, which are costly and technically difficult, TyG is easier to use, less expensive, and more useful in ordinary clinical practice. Compared to individuals with lower TyG index values, those with higher levels exhibited more severe coronary artery disease (Zhang et al., 2023). This link helps in our comprehension of the potential role that metabolic disorders may play in variations in the severity of coronary atherosclerosis.

This discovery of a positive correlation between elevated TyG levels and more severe CAD is consistent with earlier findings indicating insulin resistance is a contributing factor to extensive vascular alterations (Wang et al., 2022). Patients with multivessel coronary involvement and more severe CAD had higher TyG index values. This finding implies that insulin resistance may contribute to the development of isolated coronary lesions as well as the advancement of more widespread, severe coronary artery disease (de Sousa et al., 2025).

Additionally, this research showed that worse cardiovascular outcomes were indicated by a higher TyG index score. Insulin resistance may contribute to the development of endothelial dysfunction, inflammation, and unstable plaque formation, which might account for this connection (Zahid et al., 2026). These pathological occurrences may be associated with worse clinical outcomes in high-risk individuals and are associated with cardiovascular problems. Some of the traditional cardiovascular risk factors, including diabetes mellitus, hypertension, and dyslipidemias, were also seen in research participants. However, since it combines the effects of hyperglycemia and hypertriglyceridemia into a single quantifiable, the TyG index offers a number of benefits (Xiong et al., 2022). In order to improve the identification of individuals who should be observed and targeted for preventative measures, it might be used in combination with existing cardiovascular risk assessment methods.

The TyG index's availability and ease of use are key factors in its clinical use. Since the levels of fasting glucose and triglycerides are often determined in clinical practice, the TyG index does not need any extra costly tests (Zhang et al., 2025). It may contribute to the early identification of those at higher risk for cardiovascular disease as well as appropriate therapy and lifestyle changes. However, this research has many drawbacks. The research was conducted at a single centre with a very limited sample size, which may restrict how broadly the findings may be applied. Large-scale multicenter studies with longer follow-up periods should be carried out to further confirm the predictive utility of the TyG index and its application in the regular CAD risk assessment (Li et al., 2025).

According to the study's findings, TGI is a straightforward, affordable, and clinically significant biomarker for determining the degree of CAD and cardiovascular events in patients having coronary angiography (Guo et al., 2022). Combinations with traditional risk assessment methods may enhance healthcare management and cardiovascular risk stratification (Tao et al., 2023).

CONCLUSION

The triglyceride-glucose (TyG) index may be a useful tool for assessing the severity of coronary artery disease and predicting unfavourable cardiovascular outcomes in patients having coronary angiography, according to the findings of this prospective observational research. Higher TyG index was associated with increased coronary artery involvement, the severity of coronary artery disease, and cardiovascular risk. The TyG index, which measures the glucose and triglycerides in a person's blood while they are fasting, is really a simple metric that is affordable and readily available. It stands for both the conventional cardiovascular risk factors and insulin resistance. In order to identify high-risk patients who need more intensive follow-up, early intervention, and risk management techniques, the TyG index may be helpful in clinical evaluations. The results indicate that the TyG index has clinical promise, but further extensive multicenter trials with longer follow-up are required to confirm the index's capacity to forecast clinical outcomes and to establish standardised clinical usage. In summary, the TyG index is a suitable auxiliary tool for cardiovascular risk assessment and cardiovascular treatment in individuals with CAD.

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