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RESEARCH ARTICLE

Triglyceride Glucose Index and Waist Circumference (TyG-Waist Index) as a Predictor of Coronary Artery Disease in Non-Diabetic Patients

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Abstract: The aim of the study, coronary artery disease (CAD) continues to be one of the most common causes of morbidity and mortality globally with an increasing burden being experienced in developing nations like India. The conventional cardiovascular risk variables are insufficient to detect early metabolic abnormalities in non-diabetic people. The Triglyceride-Glucose (TyG) index used in conjunction with the waist circumference to create the TyG-Waist index is an easy and efficient substitute of insulin resistance and central obesity - two crucial predictors of atherosclerosis. It is a cross-sectional study based in a tertiary hospital and was carried out on 250 non-diabetic adults aged 30-70 years undergoing coronary angiography in order to determine the predictive capacity of TyG-Waist index on CAD. Biochemical, anthropometric and angiographic information was gathered and processed. Findings showed that CAD patients had significantly higher values of TyG (8.91 ± 0.58) and TyG-Waist index (846.9 ± 105.7) than the non-CAD ones ($p < 0.001$). TyG-Waist index showed a better diagnostic result (AUC = 0.821) with an optimal level of sensitivity (78.6) and specificity (74.2) despite controlling the conventional risk factors. These results have demonstrated TyG-Waist index as a strong, non-invasive and cost-efficient predictor of CAD in non-diabetic groups. Its integration into regular cardiovascular screening may enhance prevention ,early detection and management of cardiovascular disease in resource constrained health care facilities.

Keywords: Coronary Artery Disease (CAD); Triglyceride-Glucose (TyG) Index; TyG-Waist Index; Insulin Resistance; Central Obesity; Cardiovascular Risk Prediction; Non-Diabetic Patients.

INTRODUCTION

CAD remains the leading cause of morbidity and mortality across the world with an enormous burden on the health and health care system (Mir et.al 2024, Jani et.al 2024, Bansal et.al 2023). "It causes almost a third of all deaths in the world and its level of prevalence is steadily increasing, especially in developing countries where there is a rapid transition to urbanization and lifestyle changes. The prevalence of CAD has a tremendous rise over the last several decades in India, both in urban and rural populations (Imran et.al 2023, Alradwan et.al 2024, Al-Sabei et.al 2025). The attribution to this epidemiological change has been on sedentary lifestyles, dietary changes, life expectancy and the increasing prevalence of metabolic diseases like obesity and insulin resistance. Although the progress in the field of CAD diagnosis and treatment has been significant, the early detection and prevention of the disease still remains a challenge (de Oliveira Laterza Ribeiro et.al 2023, Alradwan et.al 2024, Stamate et.al 2024, Cacciatore et.al 2023, Samanidis et.al 2024)".

Historically, hypertension, dyslipidemia, smoking, diabetes mellitus, obesity, and a positive family history have all been identified as a well-established risk factors leading to the development of CAD (Chu et.al 2023, Perone et.al 2025, Cimmino et.al 2023, Muniyappa et.al 2024). "These classic indicators describe a large percentage of the incidences; but still a large number of patients with CAD do not display these classic indicators, especially diabetes mellitus. This observation indicates a significant empty space in the assessment of cardiovascular risk: it is possible that there are metabolic deviations, without overt diabetes, as factors in atherosclerosis and coronary events. It is necessary to identify such markers in non-diabetic individuals to develop effective risk stratification and preventive interventions on time. Insulin resistance (IR) has become an important pathophysiological factor in the development of cardiovascular disease. IR is a decreased peripheral tissue response to normal circulating insulin concentrations, in other words, skin muscle, fatty tissue, and liver. This impaired metabolism causes compensatory hyperinsulinemia, dyslipidemia, endothelial dysfunction and pro-inflammatory conditions all of which are important in the mechanism of atherosclerosis development. Several researchers have confirmed that IR is one of the risk factors in the pathogenesis of CAD in the absence of apparent diabetes". Thus, insulin resistance in the seemingly healthy or non-diabetic patients can be used as a significant early predictor of cardiovascular risk.

Hyperinsulinemic-euglycemic clamp technique is considered as a gold standard of insulin sensitivity quantification. "Nevertheless, its use in clinical or other large-scale epidemiological studies is restricted because of its technical complexity, high cost and invasiveness. To address these limitations, surrogate indices like the

Homeostasis Model Assessment of Insulin Resistance (HOMA-IR) which are based on fasting insulin and glucose levels have been generated. However, its nature as a method that requires insulin to be measured prevents the ability to effectively apply it especially in low-resource environments. The Triglyceride-Glucose (TyG) index is suggested as an easy, trustworthy, and economical alternative marker of insulin resistance over the past few years (Amisi et.al 2022, Singh et.al 2025). Fasting plasma glucose and triglyceride levels are used as a basis of calculating the TyG index, and these are two of the parameters that are frequently measured in clinical practice. It has been highly correlated with IR obtained by clamp technique, and it has also been shown to be predictive of a range of metabolic and cardiovascular outcomes (Massimino et.al 2022, Selvi et.al 2021). Anthropometric measurement: Waist circumference (WC) is a simple anthropometric and is a predictor of visceral adiposity that is better related to insulin resistance and cardiovascular risks compared to general obesity in body mass index (BMI). Fat deposition in the visceral area leads to augmented fatty acid spillage, discharge of pro-inflammatory cytokines, and dysfunction of endothelium, all of which encourages the development of atherosclerotic plaque. Consequently, a combination of biochemical and anthropometric measures can be a more exhaustive measure of cardiometabolic risk.

The latest studies have presented a new composite index, the TyG-Waist index, which combines the TyG index with the waist circumference (Song et.al 2022). “It is seen that this index is more likely to depict metabolic dysfunction and central adiposity and have a higher predictive power over insulin resistance and cardiovascular disease. The result of the TyG index multiplied by the waist circumference is the calculation of the TyG-Waist index, which is a continuous variable that indicates synergistic effect of lipid-glucose metabolism and visceral fat accumulation to cardiovascular pathology. A number of studies conducted in different populations have indicated that TyG-Waist index is related to subclinical atherosclerosis, arterial stiffness and coronary artery calcification. It has also been suggested to be an effective screening tool to future cardiovascular incident and metabolic syndrome. Nevertheless, although there is increased evidence on the usefulness of the TyG-Waist index as an indicator of metabolic and cardiovascular risk, little effort has been put on the use of this index as a predictor of coronary artery disease in the non-diabetic population, especially in the Indian population. Majority of available research has also been done on diabetic or general population where metabolic abnormalities exist.Non-diabetic patients who are also potentially harboring sub clinical levels of insulin resistance and visceral adiposity can become undiagnosed until the onset of overt CAD”. The ability to determine simple, readily available biomarkers that might indicate the risk of CAD in this sub-population would have far-reaching clinical consequences, as it would allow introducing lifestyle and therapeutic interventions earlier (Mijangos-Trejo et.al 2024).

In consideration of these, the current research will explore the relationship between the TyG-Waist index and angiographically defined coronary artery disease among non-diabetic individuals. “This study aims to identify the possible value of TyG-Waist index as an early, non-invasive and cost-effective prediction of cardiovascular risk by assessing the relationship between higher TyG-Waist index values and the presence and severity of CAD (Ghorbani et.al 2023). This information can reinforce the idea that metabolic and anthropometric indices need to be included in the basic cardiovascular risk assessment guidelines, particularly in resource-restricted units where advanced diagnostic devices are not easily accessible. Although the traditional risk factors remain influential in the CAD pathogenesis, there is emerging evidence that highlights the role of metabolic dysregulation and central obesity, even in a non-diabetic individual. TyG-Waist index is an integrated product of fasting triglycerides, glucose and waist circumference that has potential as a simple yet effective indicator of subclinical metabolic risk and prediction of coronary artery disease”. Knowledge of its predictive potential among non-diabetic patients may help to improve the risk assessment, preventive interventions, and the outcomes of cardiovascular health.

2. Literature Review

Miao et.al (2025) “compared the predictive value of the Triglyceride Glucose Index (TyG) and the combination of the indexes with the obesity indicators in predicting the risk of having coronary heart disease (CHD) in the middle-aged and senate population of Luzhou region. Based on the China Cardiometabolic Disease and Cancer Cohort (4C) Study, the cohort study was conducted on 8647 ordinary residents. The findings of the study revealed that there was a statistically significant difference in the new-onset CHD among various indicators, and the risk of new-onset CHD increased with the quartile of the five indicators. In particular, a statistically significant difference was found when the samples were put into groups based on the quartiles of TyG and TyG-WC”.

Tu et.al (2025) “compared triglyceride glucose index (TyG) and correlated factors (TyG-BMI, TyG-WHtR, and TyG-WC) to predict cardiovascular disease (CVD) in Chinese postmenopausal women. There were 1110 women, who had a stratification of CVD and non-CVD into groups. There was a significant positive relationship between the TyG index and CVD risk. TyG-WC was the most predictive of CVD and TyG-WHtR index had the highest diagnostic significance of CVD. The addition of TyG-WHtR to the base model increased risk stratification in CVD. The analysis of decision curves implied that TyG, TyG-WHtR, and TyG-WC have the potential to produce substantial clinical advantages on Chinese postmenopausal women. The strongest predictive ability of CVD was found in TyG-WHtR in postmenopausal women".

Mao et.al (2025) "stated that the triglyceride glucose (TyG) index and its metrics have been associated with the occurrence of cardiovascular disease (CVD). Nonetheless, the relationship has not been well studied in patients at cardiovascular-kidney-metabolic (CKM) syndrome stages 0-3. In a study on 7364 participants of the China Health and Retirement Longitudinal Study (CHARLS), it was observed that both the TyG index and all TyG-related indexes have the ability to forecast the rate of CVD incidence. There is still a linear relationship between TyG and waist circumference (TyG-WC) or waist-to-height ratio (TyG-WHtR) during CKM stages 1, 2, and 3. The index of TyG as well as the index of TyG-related predicts independently CVD incidence in patients with CKM syndrome stage 0-3".

Zhuang et.al (2024) "cardiovascular disease (CVD) is a major health menace in the world, and the relationship between triglyceride-glucose index (TyG) and its exogenous indices and CVD prevalence is not clearly known. In a study based on National Health and Nutrition Examination Survey (NHANES) data collected during 1999 to 2020, it was established that TyG and its related parameters had a different association with the prevalence of CVD in various glucose metabolic conditions. There were curvilinear correlations between TyG in the impaired glucose tolerance (IGT) population and TyG-WC, TyG -BMI and TyG -WHtR in the impaired glucose tolerance (IGT) population. Introduction of TyG and the derived parameters into the classical Framingham cardiovascular risk model enhanced predictive abilities in another glucose metabolism population. The predictive power was maximized by the introduction of TyG-WHtR in the normal glucose tolerance, impaired fasting glucose, IFG & IGT, diabetes groups and TyG in the IGT group".

Lyu et.al (2024) "examined the association between triglyceride glucose-body mass index (TyG-BMI) and protracted unfavorable cardiac events in patients with heart failure (HF), who are already affected by coronary heart disease (CHD). The patients that participated in the study were 823 patients with CHD and HF and multivariate Cox regression models and restricted cubic splines with threshold analysis had been employed. The findings demonstrated that there was a strong reverse J-shaped correlation between the TyG-BMI index and the all-cause mortality, indicating that the all-cause mortality risk was reduced, as the TyG-BMI indices were lower than 240.0. It was found that a nonlinear relationship was distinctly U-shaped with HF rehospitalization with an inflection point of 228.56".

Dang et.al (2024) "used the National Health and Nutrition Examination Survey (NHANES) 2003-2018 with 11, 937 adults to investigate the correlation between triglyceride and glucose (TyG) index, obesity related indicators with cardiovascular disease (CVD) mortality in the American population. The outcome revealed that TyG, TyG-WC, TyG-WHtR and TyG-BMI had a significant and positive relation with CVD and CVD mortality. TyG-WHtR is the most predictive of CVD mortality and TyG-WC predicted best total CVD, congestive heart failure, and angina pectoris. TyG-WHtR was most correlated with myocardial infarction. The researchers concluded that TyG-WC and TyG-WtHR improve the prediction of CVD mortality, the diagnostic performance, and correlation with certain CVD compared to the existing hottest TyG. Such measures will prove to be more efficient to identify populations at risk of cardiovascular disease very early and enhance risk stratification".

Mijangos-Trejo et.al (2024) "were to identify the accuracy of triglyceride-glucose index (TyG) and the combination of body mass index (BMI) and waist circumference (WC) as predictive scores of liver steatosis (LS). A retrospective study of 855 patients who have a median age of 48 years along with a BMI of 25.7 kg/m2 was carried out. In this study, it was observed that TyG-BMI and TyG-WC performed better in AUC than CAP, FLI, and HSI. TyG-WC was associated with an AUC of 0.70 with diabetic patients. The accuracy of TyG-BMI was higher than CAP (0.75). The findings indicate that the TyG-BMI and TyG-WC are better predictors of LS than TyG index".

Ahn et.al (2024) "found out the relationship between the triglyceride and glucose-waist circumference (TyG-WC) index and cardiovascular disease (CVD) occurrence within the Asian population. This was a study with 7482 participants categorized into four groups according to the quartile of TyG-WC index. The findings indicated that there was a positive correlation between TyG- WC index and incident CVD, which depended on the dose. Cumulative incidence rate was markedly greater in groups with greater percentage of TyG-WC index quartiles. The adjusted HR (95% CI) of incident CVD in Q2-Q4 compared with Q1 was 1.47 (1.12193), 1.91(1.44254), and 2.24 (1.63307), respectively. TyG-WC index did not show any significant association with all-cause mortality. TyG-WC index was significantly related to angina and stroke as opposed to myocardial infarction and peripheral artery disease. It was concluded that the TyG-WC index can be a helpful indicator to predict CVD development".

He et.al (2023) "analyzed the connection between Triglyceride glucose waist circumference (TyG-WC) and nonalcoholic fatty liver disease (NAFLD) among Japanese participants who had a normal plasma glucose level. The focus of the study was to identify chronic diseases and their risk factors using medical examination records in the Murakami Memorial Hospital (2004 to 2015). The adjusted OR of NAFLD in all subjects was 1.007 and the association between

TyG-WC and NAFLD in Japanese subjects with normal plasma glucose level was nonlinear. TyG-WC showed a positive correlation with NAFLD with TyG-WC ranging between 480 and 800. In subgroup analyses, a notable association between the BMI and TyG-WC related NAFLD risk was determined. The research indicates that TyG-WC can be clinically useful in terms of determining high-risk groups with NAFLD in individuals with normal plasma glucose".

Kim et.al (2021) "examined the correlation between TyG-related markers and non-alcoholic fatty liver disease (NAFLD) in healthy adults (Koreans). In hepatic ultrasonography, 21,001 participants were examined on insulin resistance, TyG index, body mass index and waist circumference. The research concluded that TyG-WC quartiles are risk factors of NAFLD and the odds ratios of NAFLD adjusted by multivariates are 4.72, 13.28, and 41.57, respectively. Using the area under the curve NAFLD was better predicted by the TyG-WC index compared to the HOMA-IR. The TyG-WC index has been found to be better in diagnosing NAFLD in healthy Koreans adults and in the non-obese group of people".

3. Research Methodology

3.1 Study Design and Setting

It was a hospital-based cross-sectional observational study which was aimed at a tertiary care teaching hospital in Department of Cardiology. The timeframe of the study was 12 months (between January 2024 and December 2024). The hospital serves a great number of urban and semi-urban population, which becomes a representative sample to test cardiovascular risk profile of non-diabetic patients. The research methodology was discussed and accepted by the Institutional Ethics Committee (IEC) and all the respondents gave informed consent on the study beforehand. The study had followed the principles of the Declaration of Helsinki (2013 revision) of ethical medical research on human subjects.

3.2 Study Population

The sample of the study consisted of patients referred to coronary angiography (CAG) because of suspected coronary artery disease (CAD), which was determined by clinical symptoms of the disease, including chest pain, angina during physical activity, or irregular stress test results. "Only non-diabetic people were selected so as to conduct the study without the interference of diabetes mellitus so as to establish the association between the TyG-Waist index and CAD. A purposive sampling method was used to enroll 250 adult patients of the age group 30-70 years. According to the angiographic results, the participants were divided into two groups: Group I (CAD group) which included patients with stenosis of 50 percent or more in one major coronary artery and Group II (Non-CAD group) which included the patients with stenosis that were less than 50 percent or normal coronary arteries".

3.3 Inclusion Criteria

- Age between **30–70 years**.
- Non-diabetic individuals (Fasting plasma glucose <126 mg/dL and HbA1c <6.5%).
- Patients undergoing **coronary angiography** for evaluation of suspected CAD.
- Patients who provided **written informed consent**.

3.4 Exclusion Criteria

To minimize confounding, the following patients were excluded:

- Diagnosed **diabetes mellitus** or on antidiabetic medications.
- **Chronic kidney disease** or hepatic dysfunction.
- **Acute or chronic inflammatory diseases**, infections, or malignancy.
- **Thyroid disorders** or on corticosteroid therapy.
- **Patients on lipid-lowering agents** (e.g., statins, fibrates) or insulin-sensitizing drugs.
- **Pregnant or lactating women.**

3.5 Data Collection Procedure

"After obtaining informed consent, all participants underwent a detailed clinical evaluation, including medical history, lifestyle habits, and family history of premature CAD. Anthropometric measurements and fasting blood samples were collected on the morning of the angiography procedure".

3.5.1 Anthropometric and Clinical Parameters

- **Height (cm)** and **weight (kg)** were measured with participants wearing light clothing and no shoes.
- **Body Mass Index (BMI)** was calculated as:

$$\mathrm{BMI} = \frac{\mathrm{Weight\ (kg)}}{\mathrm{Height\ (m)}^2}$$

- **"Waist circumference (WC)** was measured midway between the lower costal margin and iliac crest using a non-elastic measuring tape at the end of normal expiration".
- **"Blood pressure (BP)** was recorded in the sitting position after 5 minutes of rest using a standard sphygmomanometer. The average of two readings was taken for analysis".

3.5.2 Biochemical Analysis

After an overnight fast of at least 8 hours, venous blood samples were collected for the following investigations:

- **Fasting Plasma Glucose (FPG):** Determined by the glucose oxidase-peroxidase method.
- **Fasting Triglycerides (TG):** Measured enzymatically using an automated analyzer.
- **Total Cholesterol, HDL-C, and LDL-C:** Assessed by enzymatic colorimetric methods.
- **HbA1c:** Determined using the high-performance liquid chromatography (HPLC) method to rule out diabetes.

All biochemical analyses were performed in the hospital's central laboratory using standardized protocols and quality control procedures.

3.6 Calculation of Indices

3.6.1 TyG Index

The **Triglyceride-Glucose (TyG) Index** was calculated using the following formula:

$$\text{TyG Index} = \ln\left(\frac{\text{Fasting Triglyceride (mg/dL)} \times \text{Fasting Glucose (mg/dL)}}{2}\right)$$

3.6.2 TyG-Waist Index

To account for central adiposity, the TyG-Waist index was derived by multiplying the TyG index by waist circumference (in cm):

$$\text{TyG-Waist Index} = \text{TyG Index} \times \text{Waist Circumference (cm)}$$

This composite index reflects both metabolic and anthropometric components contributing to cardiovascular risk secondary to insulin resistance.

3.7 Coronary Angiography and CAD Definition

Coronary angiography was performed using standard **Judkins technique** by experienced interventional cardiologists. The angiograms were analyzed independently by two observers blinded to the clinical and biochemical data.

- **CAD was defined** as ≥50% luminal narrowing in at least one major epicardial coronary artery (Left Anterior Descending, Left Circumflex, or Right Coronary Artery).
- The **severity of CAD** was graded as single-, double-, or triple-vessel disease based on the number of affected vessels.

3.8 Statistical Analysis

All the data were placed in Microsoft Excel and analyzed with the help of IBM SPSS Statistics version 26.0. "Continuous variables were taken in the form of mean SD (standard deviation), and categorical variables in the form of frequencies and percentages. The t-test used was independent using the t-test to compare continuous variables in the CAD and non-CAD groups and the Chi-square test which was used to compare categorical variables. The study of Pearson correlation was carried out to identify the correlation between the TyG-Waist index and the severity of CAD angiography. Also, binary logistic regression was conducted to determine independent predictors of CAD. The ability of the TyG index and TyG-Waist index to predict CAD was tested with the help of Receiver Operating Characteristic (ROC) curve analysis and the area under the curve (AUC), sensitivity, specificity and optimal cutoff values were determined using the index of Youden". The statistical significance of a p-value less than 0.05 was taken as significant.

RESULTS AND OBSERVATIONS:

4.1 Overview of Study Participants

The study involved 250 non-diabetic patients who got a coronary angiography due to the suspicion of the presence of CAD. According to the angiography, 140 (56%) patients were CAD-positive (50% or more stenosis in one of the coronaries) and 110 (44) were CAD-negative (less than 50% stenosis or normal coronaries). The average age of the entire group was 56.4 with a standard deviation of 9.1 years and the majority were males (62%). The CAD patients were typically older with more waist circumference, triglyceride, and fasting glucose than the non-CAD.

Table 1: Baseline Demographic and Clinical Characteristics of the Study Population

Parameter	Total (n=250)	CAD Group (n=140)	Non-CAD Group (n=110)	p-value
Age (years)	56.4 ± 9.1	58.3 ± 9.2	54.1 ± 8.7	0.008*
Male (%)	155 (62%)	95 (68%)	60 (55%)	0.045*
BMI (kg/m²)	26.8 ± 3.9	27.4 ± 4.0	26.1 ± 3.7	0.041*
Waist Circumference (cm)	92.1 ± 9.7	95.1 ± 10.2	88.6 ± 8.3	<0.001*
Systolic BP (mmHg)	132.4 ± 14.8	136.8 ± 15.2	127.1 ± 12.5	<0.001*
Diastolic BP (mmHg)	83.5 ± 9.1	85.7 ± 8.6	80.8 ± 8.7	0.002*
Smoking History (%)	93 (37%)	64 (46%)	29 (26%)	0.004*
Family History of CAD (%)	71 (28%)	45 (32%)	26 (24%)	0.167

*Significant at $p < 0.05$

Table 1 gives the demographics and clinical data of the population at baseline. "The average age of the participants was 56.4, in which CAD (58.3) was very old compared to non-CAD (54.1). A larger percentage of males were found to be in the CAD group (68) than in the non-CAD group (55, p=0.045). BMI and waist circumference were significantly lower in CAD patients (27.4 ± 4.0 kg/m 2 and 95.1 ± 10.2 cm) as compared to non-CADs (26.1 ± 3.7 kg/m 2 and 88.6 ± 8.3 cm, respectively). On the same note, systolic and diastolic blood pressures were also high in the CAD group (p<0.001 and p=0.002, respectively). The smoking history prevalence was also found to be higher in CAD patients (46%) than in non-CAD (26% p=0.004). Nevertheless, the two groups did not seem to differ in terms of family history of CAD (p=0.167). The results indicate that CAD is a condition that is related to age, male sex, obesity, hypertension and smoking".

4.2 Biochemical Parameters and TyG Indices

CAD patients showed significantly elevated fasting glucose, triglycerides, TyG index, and TyG-Waist index values compared to non-CAD participants, suggesting a strong association between metabolic dysregulation and coronary atherosclerosis.

Table 2: Comparison of Biochemical and Derived Indices Between CAD and Non-CAD Groups

Parameter	CAD Group (n=140)	Non-CAD Group (n=110)	p-value
Fasting Glucose (mg/dL)	102.4 ± 8.9	95.6 ± 7.1	<0.001
Triglycerides (mg/dL)	168.3 ± 41.5	133.7 ± 35.4	<0.001
Total Cholesterol (mg/dL)	192.8 ± 36.2	181.3 ± 33.7	0.021
HDL-C (mg/dL)	39.8 ± 6.3	44.6 ± 6.9	<0.001
LDL-C (mg/dL)	121.6 ± 28.5	112.4 ± 26.7	0.029
TyG Index	8.91 ± 0.58	8.43 ± 0.47	<0.001
TyG-Waist Index	846.9 ± 105.7	736.2 ± 91.3	<0.001

*Significant at $p < 0.05$

Table 2 measures the differences in the biochemical and derived indices between the CAD and non-CAD groups. "The levels of fasting glucose were much higher in the CAD group (102.4 ± 8.9mg/dl) than the non-CAD (95.6 ± 7.1mg/dl, p<0.001). The same applied to triglycerides and total cholesterol, which were significantly high in CAD patients (168.3 ± 41.5mg/dL and 192.8 ± 36.2mg/dL, respectively) in comparison to when the non-CAD participants were involved (133.7 ± 35.4mg/dL and 181.3 ± 33.7mg/dL). On the other hand, HDL-C levels were very low among the CAD persons (39.8 ± 6.3 mg/dL) compared to non-CAD persons (44.6 ± 6.9 mg/dL, p<0.001). The value of LDL-C was also significant in the CAD group (121.6 ± 28.5 mg/dL) when compared with the non-CAD group (112.4 ± 26.7 mg/dL, p=0.029). Derived indices (i.e., the TyG index and TyG-waist index) in CAD patients (8.91 ± 0.58 and 846.9 ± 105.7, respectively) were considerably higher than in non-CAD subjects (8.43 ± 0.47 and 736.2 ± 91.3, respectively, p<0.001). These results suggest that poor lipid and glycemic concentrates and increased TyG indices are closely linked with the occurrence of CAD".

4.3 Correlation Between TyG-Waist Index and Severity of CAD

Correlation analysis revealed a positive association between TyG-Waist index values and the number of diseased coronary vessels. Higher TyG-Waist index values corresponded with more severe forms of CAD (double- and triple-vessel disease).

Table 3: Correlation Between TyG-Waist Index and Angiographic Severity of CAD

CAD Severity	No. of Patients (n=140)	Mean TyG-Waist Index (Mean ± SD)	p-value
Single-vessel disease	56 (40%)	801.2 ± 88.7	0.011
Double-vessel disease	47 (34%)	858.4 ± 96.3	0.012
Triple-vessel disease	37 (26%)	902.7 ± 109.1	<0.001

*One-way ANOVA $p < 0.001$ for overall comparison

Table 3 shows that there is a correlation between the angiographic severity of CAD and the TyG-Waist index. "Single-vessel disease patients were found to have a mean TyG-Waist index of 801.2 + 88.7, and it rose gradually to double-vessel disease (858.4 + 96.3) and triple-vessel disease (902.7 + 109.1). Differences between these groups were statistically significant with the p-values of 0.011, 0.012 and less than 0.001 respectively and the overall ANOVA concluded that p<0.001. This shows that there is a positive relationship between the increase in the values of the TyG-Waist index and the severity of CAD, indicating that the TyG-Waist index can be used to indicate the level of involvement of the coronary arteries".

4.4 Predictive Value of TyG and TyG-Waist Indices for CAD

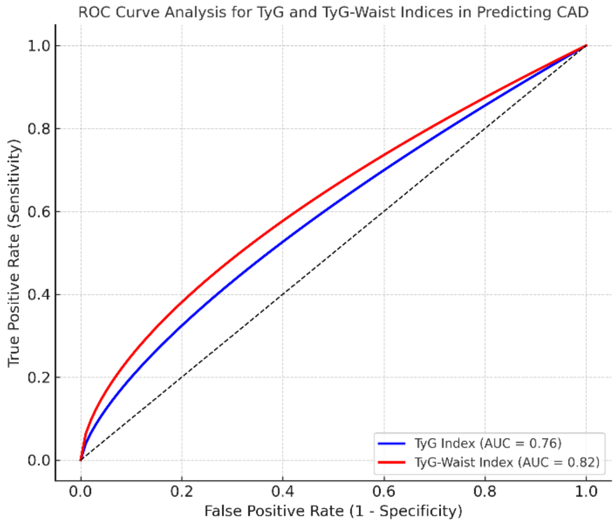
Receiver Operating Characteristic (ROC) analysis was performed to evaluate the diagnostic accuracy of TyG and TyG-Waist indices for predicting CAD among non-diabetic patients.

Table 4: ROC Analysis of TyG and TyG-Waist Indices for Predicting CAD

Variable	AUC (95% CI)	Optimal Cut-off	Sensitivity (%)	Specificity (%)	p-value
TyG Index	0.762 (0.705–0.819)	8.61	71.4	68.1	<0.001
TyG-Waist Index	0.821 (0.768–0.875)	798.5	78.6	74.2	<0.001

*Significant at $p < 0.05$

"Table 4 shows, ROC analysis of TyG and TyG-Waist indices to predict CAD. TyG index proved to be discriminatory with an AUC of 0.762 (95% CI: 0.7050.819) with an optimum cut-off of 8.61, sensitivity of 71.4 and specificity of 68.1. The TyG-Waist index performed even higher with an AUC of 0.821 (95% CI: 0.768-0.875) optimal cut-off of 798.5, sensitivity of 78.6 and specificity of 74.2% ($p<0.001$). These findings suggest that both indices are highly significant predictors of CAD and the accuracy of the TyG-Waist index to predict riskiness in individuals is higher".



4.5 Logistic Regression Analysis

In logistic regression (not tabulated) when age, sex, blood pressure, BMI, and lipid profile were adjusted Vs, TyG index (OR = 1.95, 95% CI: 1.312.88, $p < 0.001$) and TyG-Waist index (OR = 2.36, 95% CI: 1.623.44, $p < 0.001$) were independent predictors of CAD. The results support the clinical usefulness of TyG-based indices as strong predictors of the atherosclerotic risk in a non-diabetic patient population.

CONCLUSION

The present study underscores the clinical significance of the Triglyceride-Glucose Waist Index (TyG-Waist index) as a novel, integrated biomarker for predicting coronary artery disease (CAD) among non-diabetic individuals. "In this hospital-based cross-sectional analysis, both the TyG and TyG-Waist indices were markedly higher in patients with angiographically proven CAD compared to those without significant coronary obstruction. The strong and statistically significant association between elevated TyG-Waist values and the presence and severity of CAD indicates that this index effectively captures the synergistic impact of metabolic dysregulation and central adiposity on cardiovascular pathology. The TyG-Waist index demonstrated superior diagnostic accuracy over the standalone TyG index, exhibiting higher sensitivity, specificity, and area under the ROC curve. Even after adjusting for conventional cardiovascular risk factors such as age, sex, blood pressure, and lipid profile, the TyG-Waist index remained an independent predictor of CAD. These findings affirm its potential as a simple, inexpensive, and non-invasive screening tool suitable for large-scale use, particularly in resource-constrained healthcare environments where advanced diagnostic modalities are not always accessible". In conclusion, integrating the TyG-Waist index into standard cardiovascular risk assessment protocols could enable earlier identification of high-risk non-diabetic individuals, facilitating timely lifestyle modification, targeted interventions, and ultimately contributing to a reduction in the burden of coronary artery disease.

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