

ANALYSIS OF TRIGLYCERIDES TO GLUCOSE INDEX AS A MARKER OF INSULIN RESISTANCE IN ADULT POPULATION AT A TERTIARY CARE HOSPITAL

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Abstract

Background: Cardiovascular diseases (CVD) are the main causes of morbidity and mortality worldwide, while insulin resistance (IR) is an important risk factor for these diseases. The triglyceride-glucose (TyG) index indirectly assesses IR through a mathematical model that uses only laboratory data on fasting plasma triglyceride and glucose concentrations. Hence, the present study was conducted for assessing Triglycerides to glucose index as a marker of insulin resistance in adults. **Materials & Methods:** A total of 100 subjects were enrolled. Complete demographic and clinical details of all the subjects were obtained. The data recorded included: age, sex, smoking, medication received, anthropometric variables, blood pressure, and observations made at the clinical examination. Two study groups were formed as follows: Group A: 50 patients without metabolic syndrome, and Group B: 50 patients with metabolic syndrome. Triglyceride to glucose index was assessed. Correlation of insulin resistance with triglycerides to glucose index was evaluated. All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software. **Results:** Mean age of the patients of group A and group B was 43.8 years and 41.9 years respectively. Mean glucose and lipid profile among patients of group B was deranged in comparison to patients of group A. Mean HOMA-IR among patients of group A and group B was 4.39 and 4.83 respectively (p-value <0.05). Mean triglycerides to glucose index was 4.39 and 4.83 among patients of group A and group B respectively (p-value <0.05). Sensitivity, specificity and diagnostic accuracy of Triglycerides to glucose index was 83.3 %, 74.9 % and 85.1 % respectively. **Conclusion:** The triglyceride glucose index (TYG-Index) is a simple and inexpensive test that can be done at any healthcare center. A TYG-Index value of 4.5 or higher indicates insulin resistance, which is associated with various health conditions such as dyslipidemia, cardiovascular disease, fatty liver, and hidden diabetes. Early detection and intervention can help prevent the development of diabetes and cardiovascular complications.

INTRODUCTION

Cardiovascular diseases (CVD) are the main causes of morbidity and mortality worldwide, while insulin resistance (IR) is an important risk factor for these diseases. Insulin resistance is identified as the impaired biologic response of target tissues to insulin stimulation. All tissues with insulin receptors can become insulin resistant, but the tissues that

primarily drive insulin resistance are the liver, skeletal muscle, and adipose tissue. Insulin resistance impairs glucose disposal, resulting in a compensatory increase in beta-cell insulin production and hyperinsulinemia. Recent studies have debated whether hyperinsulinemia precedes insulin resistance, as hyperinsulinemia itself is a driver of insulin resistance.^[1,2]

The triglyceride-glucose (TyG) index indirectly assesses IR through a mathematical model that uses only laboratory data on fasting plasma triglyceride and glucose concentrations. This is a simple, low-cost indicator that has been shown to determine IR in a more appropriate way than other surrogate indices, such as the Homeostasis Model Assessment of Insulin Resistance (HOMA-IR), when both are compared to hyperinsulinemic euglycemic clamping. In this sense, the TyG index has been considered a surrogate marker of IR. Furthermore, this index has shown good accuracy in predicting cardiovascular events, with sensitivity and specificity values between 67 and 96% and 32.5–85%, respectively.^[3-5] Hence; the present study was conducted for assessing Triglycerides to glucose index as a marker of insulin resistance in adults.

MATERIALS AND METHODS

The present study was conducted for assessing Triglycerides to glucose index as a marker of insulin resistance in adults. A total of 100 subjects were enrolled. Complete demographic and clinical details of all the subjects were obtained. The data recorded included: age, sex, smoking, medication received,

anthropometric variables, blood pressure, and observations made at the clinical examination. Two study groups were formed as follows:

Group A: 50 patients without metabolic syndrome, and

Group B: 50 patients with metabolic syndrome.

Triglyceride to glucose index was assessed. Correlation of insulin resistance with triglycerides to glucose index was evaluated. All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software.

RESULTS

The mean age of the patients of group A and group B was 43.8 years and 41.9 years respectively. Mean glucose and lipid profile among patients of group B was deranged in comparison to patients of group A. Mean HOMA-IR among patients of group A and group B was 4.39 and 4.83 respectively (p-value <0.05). Mean triglycerides to glucose index was 4.39 and 4.83 among patients of group A and group B respectively (p-value <0.05). Sensitivity, specificity and diagnostic accuracy of Triglycerides to glucose index was 83.3 %, 74.9 % and 85.1 % respectively.

Table 1: Comparison of biochemical and demographic variables

Variable	Group A	Group B	p-value
Mean age (years)	43.8	41.9	0.28
Mean glucose (mg/dL)	85.3	115.3	0.001 (Significant)
Mean cholesterol (mg/dL)	184.3	205.1	0.000 (Significant)
Mean triglycerides (mg/dL)	102.3	142.9	0.003 (Significant)
HDL (mg/dL)	59.3	41.7	0.005 (Significant)

Table 2: Comparison of Triglycerides to glucose index and HOMA-IR

Variable	Group A	Group B	p-value
Mean Insulin (mIU/L)	9.37	13.45	0.000 (Significant)
HOMA -IR	2.39	4.12	0.003 (Significant)
Triglycerides to glucose index	4.39	4.83	0.001 (Significant)

Table 3: Diagnostic performance of Triglycerides to glucose index

Variable	Value
Sensitivity	83.3 %
Specificity	74.9 %
Diagnostic accuracy	85.1 %

DISCUSSION

Insulin resistance is defined physiologically as a state of reduced responsiveness in insulin-targeting tissues to high physiological insulin levels and is considered the pathogenic driver of many modern diseases, including metabolic syndrome, nonalcoholic fatty liver disease (NAFLD), atherosclerosis, and T2DM. Insulin resistance precedes non-physiologic elevated plasma glucose levels, which is the primary clinical symptom of T2DM. In the prediabetic condition, insulin levels increase to meet normal insulin requirements leading to chronic hyperinsulinemia, hyperglycemia-induced β -cell failure, and eventually to T2DM.^[6,7]

It is now understood that patients with insulin resistance are at increased risk of various metabolic disorders, including abnormalities in blood sugar, blood lipids, and blood pressure. Consequently, numerous investigations are currently underway to explore the relationship between the TyG index and conditions such as cardiovascular and cerebrovascular diseases and their prognoses.^[8,9] However, studies involving the general population have produced inconsistent findings regarding the associations between the TyG index and all-cause and cardiovascular mortality. Some studies have reported no significant relationship between the TyG index and all-cause or cardiovascular mortality, while others documented a positive correlation or a U-shaped relationship. Accordingly, the controversy

surrounding the TyG index has hindered its clinical applicability. Indeed, further exploration of the links between the TyG index and all-cause and cardiovascular mortality is crucial to promote its clinical use and enhance overall survival.^[9-11] Hence; the present study was conducted for assessing Triglycerides to glucose index as a marker of insulin resistance in adults.

Mean age of the patients of group A and group B was 43.8 years and 41.9 years respectively. Mean glucose and lipid profile among patients of group B was deranged in comparison to patients of group A. Mean HOMA-IR among patients of group A and group B was 4.39 and 4.83 respectively (p-value <0.05). Mean triglycerides to glucose index was 4.39 and 4.83 among patients of group A and group B respectively (p-value <0.05). Sensitivity, specificity and diagnostic accuracy of Triglycerides to glucose index was 83.3 %, 74.9 % and 85.1 % respectively. A study of 2,900 subjects undergoing medical checkups in Korea showed that the TyG index might be used as a marker in assessing the risk of developing diabetes. Those with TyG index >8.97 (quartile 4) had a hazard ratio of having diabetes 5.65 times higher than those with a TyG index <8.21.^[12] A study conducted on 140 type 2 diabetes subjects in India showed that TyG index with a cutoff of > 15.50 could be used to predict poor glycemic control (HbA1c >7%) with an AUC = 0.802.^[13] Another study performed in 914 subjects, including normoglycemic, prediabetic, and diabetic patients, in China showed that TyG Index can be applied for assessing the function of pancreatic β cells. The TyG index value had a negative correlation with pancreatic β cells function in the three groups above. The cutoff value of TyG index 9.08 can be used to determine the occurrence of early β phase cell dysfunction, whereas the cutoff value of 9.20 can be utilized to evaluate advanced β -phase cell dysfunction.^[14] TyG index is reported having a stronger predictor value than HOMA-IR in diagnosing type 2 diabetes among adolescents and children subjects in Korea (AUC 0.839 versus 0.645).^[15]

The TyG index is regarded as a reliable insulin resistance marker due to its high correlation with the hyperinsulinemic-euglycemic clamp test. As an alternative insulin resistance marker, the TyG index could be useful for identifying insulin resistance in healthy, prediabetic, diabetic, and adolescent subjects. Many studies have shown that the TyG index might be effective for predicting patients at risk for hypertension, diabetes, atherosclerosis, NAFLD, and cardiovascular events. In Korean adults, the TyG index is an independent predictor of coronary artery calcification progression, which itself is a risk factor for cardiovascular disease.³⁴ The TyG index cutoff value for insulin resistance has not been firmly defined, but it ranges from 8.0 to 8.8 across several studies.^[16-20]

CONCLUSION

The triglyceride glucose index (TYG-Index) is a simple and inexpensive test that can be done at any healthcare center. A TYG-Index value of 4.5 or higher indicates insulin resistance, which is associated with various health conditions such as dyslipidemia, cardiovascular disease, fatty liver, and hidden diabetes. Given the potential risks associated with insulin resistance, it is recommended that individuals consult their doctors and request a triglyceride glucose index test. This is especially important for individuals with high waist circumference and other risk factors for insulin resistance. Early detection and intervention can help prevent the development of diabetes and cardiovascular complications.

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