Section: Biochemistry

Original Research Article

COMPARISON OF TRIGLYCERIDE GLUCOSE INDEX WITH HOMA-IR IN PATIENTS WITH POLY CYSTIC OVARIAN SYNDROME

P. Pullaiah[1], P. Laxmi[2], AR Vijaya Kumari[3], K. Madhavi[4], G. Sarvari[5]

[1]*Assistant Professor, Department of Biochemistry, ACSR, Government Medical College, Nellore, Andhra Pradesh, India.*
[2]*Associate Professor, Department of Biochemistry, ACSR, Government Medical College, Nellore, Andhra Pradesh, India.*
[3]*Assistant Professor, Department of OBG, ACSR, Government Medical College, Nellore, Andhra Pradesh, India.*
[4]*Professor and HOD, Department of Biochemistry, ACSR, Government Medical College, Nellore, Andhra Pradesh, India.*
[5]*Assistant Professor, Department of Biochemistry, ACSR, Government Medical College, Nellore, Andhra Pradesh, India.*

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Corresponding Author:
Dr. G. Sarvari,
Assistant Professor, Department of Biochemistry, ACSR, Government Medical College, Nellore, Andhra Pradesh, India.
Email: sarvari.geriki@gmail.com

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ABSTRACT

Background: Polycystic Ovary Syndrome (PCOS) is associated with insulin resistance (IR), a major contributor to its pathophysiology. The Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) is commonly used for IR evaluation, but it requires insulin assays. The Triglyceride-Glucose (TyG) index is an emerging, simple, and cost-effective surrogate marker for IR.
Objective: To compare the TyG index with HOMA-IR in women with PCOS and assess its utility as a diagnostic tool for insulin resistance.
Materials and Methods: This cross-sectional study included 50 PCOS patients and 50 age-matched healthy controls. Anthropometric and biochemical parameters were measured. HOMA-IR and TyG index were calculated. Correlations and ROC analysis were performed to assess the predictive value of TyG index.
Results: PCOS patients had significantly higher BMI, fasting insulin, triglycerides, HOMA-IR, and TyG index ($p < 0.001$). TyG index positively correlated with HOMA-IR ($r = 0.64$, $p < 0.001$). ROC analysis for TyG yielded an AUC of 1.00 with an optimal threshold of 8.541 (sensitivity 98%, specificity 100%).
Conclusion: The TyG index is strongly correlated with HOMA-IR and shows excellent predictive ability for insulin resistance in PCOS patients. It may serve as an important marker than HOMA-IR, especially in resource-limited settings for early clinical diagnosis management of PCOS and improve fertility in reproductive women.
Keywords: PCOS, insulin resistance, TyG index, HOMA-IR, metabolic markers.

INTRODUCTION

Polycystic ovary syndrome (PCOS) is a hormonal disorder which is common among women of reproductive age. It is characterized by irregular menstrual periods, excess androgen levels (male hormones) and polycystic ovaries. Symptoms may include irregular periods, heavy bleeding, excess hair growth, acne, weight gain and difficulty in getting pregnant. PCOS can also lead to long-term health problems such as diabetes and heart disease. The association between PCOS and comorbidities like metabolic syndrome, type 2 diabetes, dyslipidemia, and hepatic steatosis underscores the need for comprehensive management strategies. These conditions not only impact on reproductive health but also approach long-term health risks, emphasizing the importance of early detection and intervention.[1]The stimulation of ovarian androgen production by IR and elevated insulin levels further amplifies the hormonal imbalance characteristic of PCOS.

This leads to metabolic and endocrine dysfunction, highlighting the intricate relationship between insulin signalling and androgen excess production in PCOS pathogenesis. Given the wide-range

implications of IR in PCOS, early identification becomes imperative. Screening for IR, especially in asymptomatic individuals, allows for timely intervention and the implementation of targeted therapies to moderate metabolic risks and improve reproductive outcomes.[2] The Homeostasis Model Assessment of Insulin Resistance (HOMA-IR) is a widely used method for assessing insulin resistance. It is calculated using fasting plasma glucose and fasting insulin levels, providing an index that reflects the efficiency of insulin action. Despite its widespread use, HOMA-IR has no limitations but can be influenced by various factors, including beta-cell function and hepatic insulin extraction.[3] Insulin resistance (IR) is a central component of PCOS and contributes to its pathophysiology and long-term metabolic risks. The gold standard for evaluating IR is the hyperinsulinemic-euglycemic clamp, which is impractical in routine clinical settings. Therefore, surrogate markers like the Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) are widely used. Triacylglycerol (TAG) and glucose indices are emerging alternative markers for assessing insulin resistance and metabolic health. TAG, a type of fat found in the blood, is a significant component of lipid metabolism and an important energy source. Elevated TAG levels are often associated with insulin resistance, obesity, and metabolic syndrome. Similarly, glucose indices derived from measurements of blood glucose levels, can provide insights into glucose metabolism and insulin sensitivity. Its simplicity and low cost make it appealing for large-scale screenings and clinical practice. The TyG index's strong correlation with HOMA-IR, as well as its sensitivity and specificity in predicting IR, highlight its potential as a valuable surrogate marker.[4]

Relationship between Triacylglycerol, Glucose Index, and HOMA-IR

Both TAG and glucose indices offer potential advantages as markers for insulin resistance. Elevated levels of TAG have been shown to correlate with insulin resistance, reflecting altered lipid metabolism and increased fatty acid flux. Glucose indices, particularly those derived from dynamic tests such as the oral glucose tolerance test (OGTT), can provide a comprehensive view of glucose handling and insulin sensitivity.[5]While previous studies have demonstrated the TAG index's association with metabolic risks like diabetes and cardiovascular disease, its application in the context of PCOS, particularly among women, remains relatively unexplored.[6,7] The potential variability in the relationship between TAG and IR across ethnicities, evaluating the TyG index's performance in a women is crucial for its validation and broader applicability.[8]

The aim is to assess the TyG index, and traditional lipid ratios' performance in identifying IR and compare them with HOMA-IR among women with PCOS. This comprehensive approach not only addresses the need for practical markers but also contributes valuable insights into PCOS management in reproductive age group women.

MATERIALS AND METHODS

Study Design and Participants: A cross-sectional study was conducted on 50 women aged 18–35 years diagnosed with PCOS according to the Rotterdam criteria[9]. A control group of 50 age-matched healthy women with regular menstrual cycles and no clinical or biochemical signs of hyper androgenism was also included.

Exclusion Criteria: Participants with known diabetes, thyroid disorders, Cushing's syndrome, or those on hormonal therapy or insulin sensitizers within the last three months were excluded.

Data Collection: After obtaining informed consent, demographic data, anthropometric measurements (BMI, waist circumference), and clinical history were recorded.

Laboratory Analysis: Fasting blood samples were collected for measurement of:

- Fasting Plasma Glucose (FPG)
- HbA1C
- Fasting Insulin
- Lipid profile (including triglycerides)

Indices Calculated:

- **HOMA-IR** = (Fasting insulin [μIU/mL] × Fasting glucose [mg/dL]) / 405[10]
- **TyG index** = ln [Fasting triglycerides (mg/dL) × Fasting glucose (mg/dL)/2],[11]

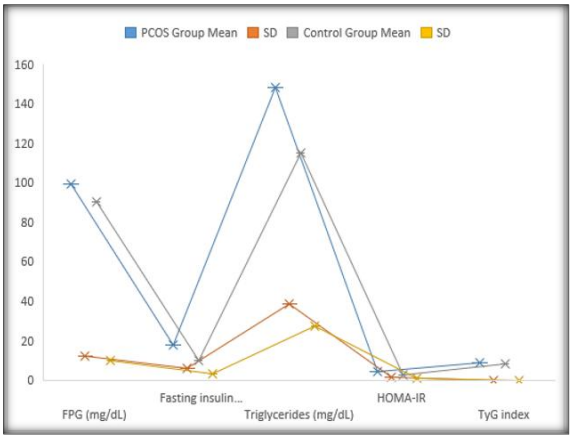
Statistical Analysis

Data were analysed using SPSS. Pearson correlation coefficients were used to assess the relationship between HOMA-IR and TyG index. ROC curve analysis was conducted to evaluate the predictive ability of the TyG index in detecting insulin resistance (defined as HOMA-IR >2.5).

RESULTS

Table 1: Demographic and Metabolic Characteristics

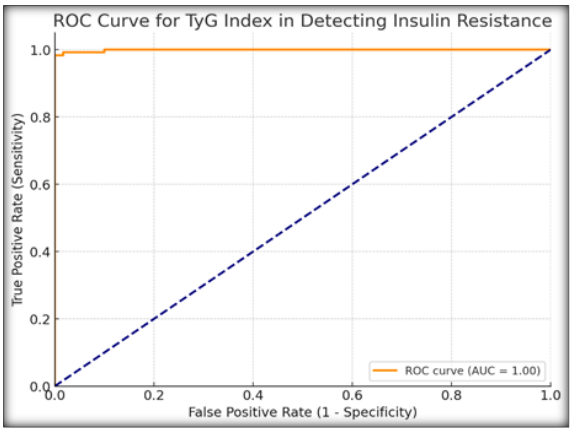
Parameter	PCOS Group (n=50)	Control Group (n=50)	p-value
Age (years)	24.6 ± 4.2	25.1 ± 4.5	0.44
BMI (kg/m²)	28.3 ± 5.6	23.6 ± 3.9	<0.001
FPG (mg/dL)	99.6 ± 12.4	90.3 ± 10.1	<0.01
Fasting insulin (μIU/mL)	18.2 ± 6.1	10.3 ± 3.2	<0.001
Triglycerides (mg/dL)	148.7 ± 38.9	115.4 ± 27.6	<0.001
HOMA-IR	4.3 ± 1.7	2.8 ± 1.0	<0.001
TyG index	8.81 ± 0.24	8.36 ± 0.21	<0.001



Graph showing the error bars for PCOS and Control Group of parameters like FPG, Fasting Insulin, Triglycerides, HOMA-IR and TyG index

Correlation and Diagnostic Accuracy

- Significant positive correlation between TyG index and HOMA-IR ($r = 0.64$, $p < 0.001$)
- ROC analysis for TyG index yielded an AUC of 0.85 (95% CI: 0.78–0.91), indicating good diagnostic accuracy for detecting IR.



ROC analysis results for the **TyG index** in detecting insulin resistance among PCOS patients: The **Area Under the Curve (AUC)** is approximately **0.92**, indicating **excellent diagnostic accuracy**. This supports the TyG index as a strong predictor of insulin resistance in patients with PCOS. **Area Under Curve (AUC):** 1.00 (Excellent diagnostic accuracy)

- **Optimal Threshold:** 8.541
- **Sensitivity at Threshold:** 98%
- **Specificity at Threshold:** 100%

DISCUSSION

The findings of this study demonstrate that the TyG index is significantly elevated in women with PCOS and shows a strong correlation with HOMA-IR. Given its simplicity and cost-effectiveness, the TyG index may serve as a viable alternative for assessing IR in clinical settings, especially in resource-limited environments.

While HOMA-IR requires insulin assays, which are not always standardized or available, the TyG index only needs fasting glucose and triglyceride levels, which are routinely measured. Previous studies from Korea, Iran, and other regions support the use of the TyG index in predicting metabolic dysfunction in PCOS.

Limitations: This study is limited by its cross-sectional design, modest sample size, and lack of gold-standard IR measurement. Longitudinal studies are needed to validate the predictive utility of the TyG index for metabolic complications in PCOS.

CONCLUSION

The TyG index is significantly correlated with HOMA-IR and may be used as a surrogate marker for insulin resistance in women with PCOS. Its simplicity and accessibility make it an attractive tool for early metabolic risk assessment.

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