

# Triglyceride-Glucose Index: A Potential Indicator of Body Adiposity in Apparently Healthy Young Adults

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## ABSTRACT

**INTRODUCTION:** The increasing burden of obesity has become a major public health problem worldwide. According to recent studies, 650 million adults worldwide are obese and over 1.9 billion are overweight. More than 135 million people in India suffer from obesity. One essential part of the human body is adipose tissue. It serves as the primary energy store during times of dietary scarcity. Although it varies greatly among populations, total body fat (BF) typically accounts for 15% of men's and 25% of women's body weight. A sustained excess of calories consumed is generally accompanied by increased fat accumulation and leads to Insulin resistance. As a marker for insulin resistance (IR), the triglyceride-glucose index (TyG) can be easily computed through fasting measurements of plasma glucose and triglycerides, which are standard clinical laboratory tests. This study aims to find out the relationship of the triglyceride-glucose index with body fat percentage.

**METHOD:** The present study, which was a prospective analytical cross-sectional study, was carried out at the Department of Physiology, King George's Medical University, Lucknow, Uttar Pradesh over one year in apparently healthy young adults recruited from King George's Medical University by setting up a health camp. After obtaining ethical approval and informed consent from the participants, a total of 128 participants were enrolled in the study using the inclusion and exclusion criteria. Individuals aged 18 to 45 years were included and individuals with a history of diabetes, hypertension, cardiovascular disease, renal disease, or any acute or visible illness were excluded.

**RESULT:** In the present study, the triglyceride-glucose index was found to have a strong positive correlation with body fat percentage (Spearman's rho correlation coefficient=0.51,  $p < 0.01$ ; Regression equation  $y=0.03x + 7.19$ ,  $R^2=0.24$ ).

**CONCLUSION:** It can be concluded that the triglyceride-glucose index can be used as a potential indicator of body adiposity.

**KEYWORDS:** Triglyceride-Glucose Index, Adipose Tissue, Body Fat Percentage, Insulin Resistance.

## INTRODUCTION

The increasing burden of obesity has become a major public health problem worldwide. According to recent studies, more than 135

million people in India suffer from obesity. Obesity is one of the most neglected health problems which leads to diabetes and cardiovascular disease (1). Adipose tissue, an

essential part of the human body, serves as the primary energy store during times of dietary scarcity. Although it varies greatly among populations, total body fat (BF) content varies throughout life and typically accounts for 15% of men's and 25% of women's body weight (2).

Following food ingestion, insulin is secreted from the pancreas and induces the uptake of circulating glucose in its target tissues by binding to an insulin receptor (3). When the body has more glucose than it needs for energy and has reached its glycogen storage capacity, the increased insulin prompts the liver to convert glucose into triglycerides, which are then transported to adipocytes. Between meals, triglycerides are released for energy. A sustained excess of calories consumed is typically accompanied by increased fat accumulation, primarily in the form of subcutaneous adipocytes (4).

Excess body fat leads to a condition known as insulin resistance (5) which results in Impaired glucose disposal into insulin-resistant tissues— particularly skeletal muscle. Insulin resistance may appear even before elevated blood glucose and impaired glucose regulation.

In previous studies, the Triglyceride-glucose index (TyG) has been used as a marker for insulin resistance (IR), and can be easily computed through fasting measurements of plasma glucose and triglycerides, which are standard clinical laboratory tests. The TyG index is determined using the formula  $\text{Ln} [\text{fasting triglycerides (mg/dL)} \times \text{fasting plasma glucose (mg/dL)} / 2]$  (6).

This study aims to find out the relationship between the Triglyceride- glucose Index with Body fat percentage

## **MATERIAL & METHOD**

The present study, which was a prospective analytical cross-sectional study, was carried out at the Department of Physiology, King George's Medical University, Lucknow, Uttar Pradesh over one year in apparently healthy young adults recruited from King George's Medical University. 128 participants, individuals aged 18 to 45 years were included

and individuals with a history of diabetes, hypertension, cardiovascular disease, renal disease, or any acute or visible illness were excluded from the study.

## **STUDY PROCEDURE:**

BIOELECTRIC IMPEDANCE ANALYSER (BIA) was used for analyzing body fat. Before the session, participants were asked to avoid consuming anything that can impact body water content like (1) no food intake within the four hours before the experiment, (2) no extreme exercise in the twelve hours before the assessment,

(3) no alcohol intake in the twelve hours before assessment, (4) no water

Consumption for the four hours before testing, (5) no caffeine the day of the test,

(6) The bladder should be empty. Participants were asked to lie down in a supine position on a flat surface. Arms should not be touching the trunk, legs should not be touching each other and the body should be at rest. Electrodes were typically placed on the hand and foot on the same side of the body. Two electrodes were used: one for the hand, at the level of the knuckles and dorsum of the wrist; and another at the level of the ankle and dorsum of the foot. A safe, low-level electrical current is sent through the body via these electrodes. Entries of height, weight, waist circumference, hip circumference, and level of physical activities were done in BIA. Impedance to the flow of this current was measured and readings of percentage body fat were noted.

Lab investigation for Fasting blood glucose and Fasting serum triglyceride was done. Before the sample collection, 1) Participants were told to fast for 12 hours at night i.e. to avoid Food and drink (except water) 2) To avoid high carbohydrate and fatty food before fasting 3) To avoid physical activities (exercise) that he/she doesn't perform regularly 4) To avoid alcohol consumption for 24 hours before blood sampling 5) Not to consume cigarettes, tea, and coffee before the blood sampling. Approximately 5 ml of venous Blood sample was collected under aseptic circumstances between 7 to 9 a.m. in a Red-capped vacutainer tube and analyzed for

glucose and triglyceride levels using GOD-POD and GPO-POD methods respectively in the department of Pathology, KGMU, Lucknow.

TRIGLYCERIDE-GLUCOSE INDEX (TyG Index) was Calculated using the formula, TyG index= $\ln$  [Fasting triglyceride(mg/dl)  $\times$  fasting glucose(mg/dl)/2]

**STATISTICAL ANALYSIS:**

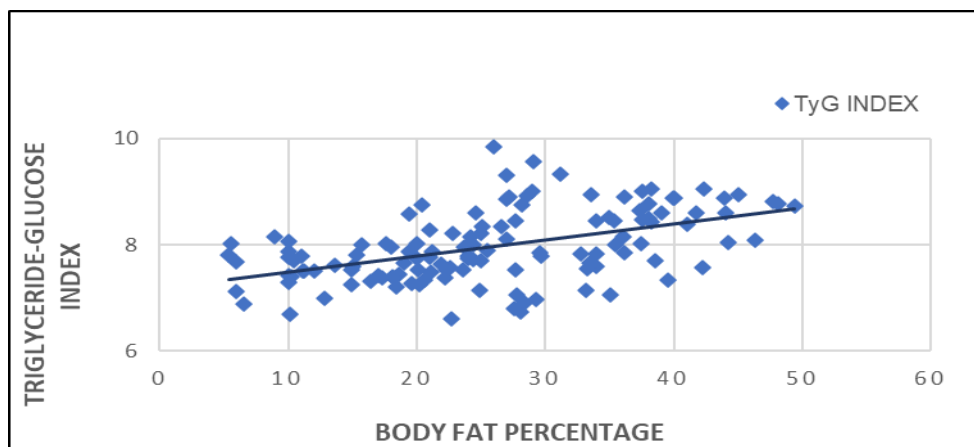
Data collected from the study was fed into the computer using Microsoft Excel2021 software. Data analysis was done using IBM SPSS version 25 software. Data has been presented as numbers and percentages or

mean. Simple Linear Regression analysis and Spearman correlation were used to establish the relationship of the triglyceride-glucose index with body fat percentage. The ‘p’ value less than 0.05 was considered to be statistically significant.

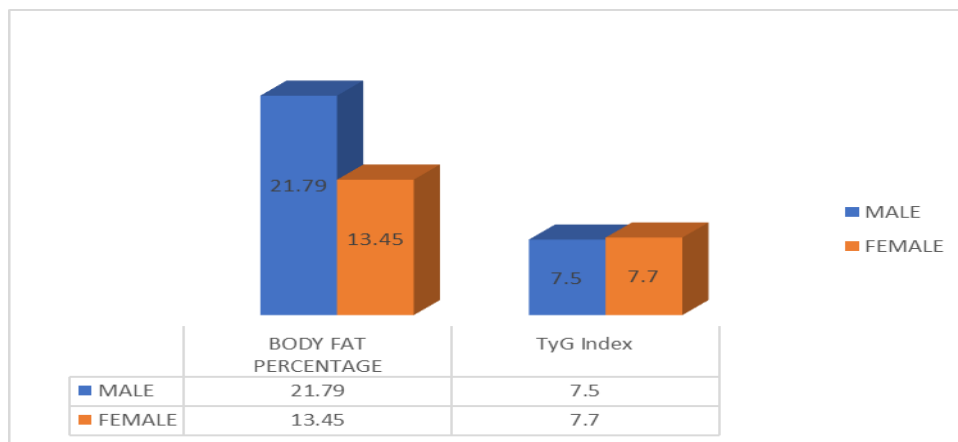
**RESULTS**

In the present study, the triglyceride-glucose index was found to have a strong positive correlation with body fat percentage (Spearman’s rho correlation coefficient = 0.51,  $p < 0.01$ ; Regression equation  $y = 0.03x + 7.19$ , R square = 0.24).

**Scatter Plot of Triglyceride-Glucose Index by Body Fat Percentage**



**Bar chart of Mean Body Fat Percentage and Mean Triglyceride-glucose index in Normal weight Males and Females**



**DISCUSSION & CONCLUSION**

Purnell JQ et al 2000, Overweight and obesity occur when fat accumulation (globally,

regionally, and in organs such as ectopic lipids) occurs in excess, increasing the risk for adverse health outcomes. like other chronic

diseases, this does not require the manifestation of an obesity-related complication, (like diabetes type 2, etc.), simply the risk (like insulin resistance) for one is increased. This allows weight management strategies to target the treatment and prevention of these chronic conditions (7). A better measure of overweight and obesity should be based on an individual's percent body fat (PBF) (6). Without an optimal gold standard technique to assess body fat, many proxy techniques like anthropometric, biochemical, and radiological measurements have been adopted. Still, these measures have some other kinds of limitations. (8)

The triglyceride-glucose index has been linked to many cardiometabolic conditions associated with overweight and obesity and it is accessible from a single sample, which is an advantage for its use in clinical settings and epidemiological studies. In terms of applicability, glucose and triglycerides are routinely performed biochemical tests in the primary care setting. Hence, the TyG index can be an important parameter for accurately detecting overweight and obesity.(9)

In the present study, out of 128 participants, 60% were females and 40% were males. The mean age of participants was 31.73 years. The mean body fat percentage of normal-weight females and males was 21.79 % and 13.45 % (normal-weight individuals sorted out based on Body Mass Index). The mean Triglyceride-Glucose Index of normal-weight females and males was 7.5 and 7.7 respectively. In the present study, the triglyceride-glucose index was found to have a strong positive correlation with body fat percentage (Spearman's rho correlation coefficient =0.51,  $p < 0.01$ ; Regression equation  $y = 0.03x + 7.19$ ,  $R^2 = 0.24$ ).

This cross-sectional study confirmed that a high TyG index strongly correlates with higher body fat. Thus, TyG index may be considered a potential indicator of body adiposity in young adults. Further studies with larger sample sizes may help in a better understanding.

#### Declaration by Authors

**Ethical Approval:** Approved

**Acknowledgement:** None

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**Conflict of Interest:** The authors declare no conflict of interest.

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