ORIGINAL ARTICLE

Optimal cut off point of the triglyceride to HDL-C ratio for insulin resistance among Egyptian obese premenopausal women: a cross-sectional study

Moushira Zaki, Wafaa Kandeel and Eman Refaat Youness

ABSTRACT

Background: Previous research suggested that the ratio of triglycerides to high-density lipoprotein cholesterol (TG/HDL-C) could be a straightforward clinical diagnostic of insulin resistance (IR), but the findings showed that there were differences between different ethnic groups.

Objective: This study aimed to determine an optimal cut off point of TG/HDL-C ratio for IR among premenopausal obese women.

Methods: A total of 220 blood samples of premenopausal obese women were analysed for fasting glucose, lipids and insulin. They were divided into an insulin resistance (IR) group and a non-insulin resistance group, using homeostasis model assessment (HOMA). A receiver operating characteristic (ROC) analysis was conducted to evaluate the ability of the developed clinical prediction rule to correctly discriminate between subjects of insulin resistance (IR) positive and insulin resistance negative groups.

Results: The optimal cut off point of triglycerides to HDL-C ratio with was 3.39, with a sensitivity of 88.89% and specificity of 76.27% (AUC=0.854) which was significant, with a p-value lower than 0.001.

Conclusion: Triglycerides to high-density lipoprotein cholesterol (TG/HDL-C) ratio could be used as a reliable marker for insulin resistance among premenopausal obese women.

Keywords: Insulin resistance, TG/HDL-C ratio, cut off point, obese women

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INTRODUCTION

The most prevalent aspect of obesity, insulin resistance (IR), plays a significant pathophysiological role in the onset and progression of cardiovascular disease and diabetes mellitus (DM) (1–3). Despite insulin's normal or elevated blood levels, insulin resistance is a condition of glucose homeostasis characterized by a diminished sensitivity of the liver, adipose tissue, muscles and other body tissues to the hormone(4). The hyperinsulinemic euglycemic clamp is the gold standard technique for measuring IR. However, the complexity and high cost of the test has prevented its use in daily clinical practice and in epidemiological studies(5). As a substitute, the homeostasis model assessment for insulin resistance (HOMA-IR) index is frequently utilized to gauge insulin resistance in adults. The measurements of plasma fasting insulin and glucose are necessary for the HOMA calculations. A simple diagnostic procedure that can identify insulin resistance is required, which provides good precision, is inexpensive and a routine test for triglycerides (TG) and HDL-C is less expensive than an insulin test. Currently, portable analysers can be used in clinical settings to determine lipid profiles. The utility of the triglyceride to HDL-C ratio (TG/HDL-C ratio) as a predictor or marker of IR and its ethnic dependence have been the subject of conflicting findings in previous studies (5–8). TG levels increased whereas HDL-C levels decreased in people with insulin resistance. An alternate method for determining insulin resistance is presented in the current work, using a defined population using the ratio of triglycerides to high-density lipoprotein cholesterol (TG/HDL-C) (9). The TG/HDL-C ratio of ≥ 3 has been reported to be closely correlated to insulin resistance in previous studies (10). TG/HDL-C ratio has been recognized as a simple clinical indicator of IR and a predictor of diabetes (11) and coronary heart disease (9). In a previous study, the TG/HDL-C ratio and HOMA-IR in obese children were significantly correlated (12).

The goal of the current study was to evaluate whether the use of the TG/HDL-C can identify IR among the middle-aged Egyptian women and assess its clinical utility.

METHODS

Two hundred and twenty obese women between ages of 30 and 35 years were recruited from the obesity clinic, National Research Centre. Written informed consent was gained from each woman after a complete description of the study. The research has been authorized by the Ethical Committee of National Research Centre, Egypt (number = 16361), in accordance with the World Medical Association's Declaration of Helsinki.

These subjects underwent a detailed clinical, biochemical and hormonal evaluation and were found to be free of any systemic illness. HOMA-IR was calculated by fasting glucose (mmol/L) × fasting insulin (mU/mL)/22.5. HOMA-IR was used to identifying those with insulin resistance (13, 14).

Anthropometric examinations

All patients and controls underwent thorough clinical examinations and medical histories. Weight in kilograms divided by height in square metres (kg/m^2) is used to calculate Body Mass Index (BMI). A plastic, non-stretchable tailor's tape, the circumferences of the hips and the waist have been measured in centimetres (cm). The Waist-to-Hip-Ratio (WHR) was then determined by dividing the waist circumference (WC) by the hip circumference (HC). The measurements' complete description has been provided elsewhere (15).

Exclusion criteria

Women with other chronic illnesses, with type 2 diabetes mellitus, gestational diabetes mellitus, thyroid disease history, heart, hepatic, and muscular problems and those with irregular cycles also were not included.

Statistical analysis

The statistical analyses were conducted using SPSS version 20.0 (SPSS Inc. Chicago, USA). The information is displayed as mean standard deviation. The independent student t-test was used to assess all parametric data in categorical groups. The use of TG/HDL-C and the presence or absence of IR allowed for the plotting of receiver operator characteristic (ROC) curves. Using the curve's coordinates, sensitivity - (1-specificity) was used to calculate Youden's index. The highest Youden's index value was utilized to determine the TG/HDL-C cut off value. Less than 0.05 p-value was regarded as statistically significant.

RESULTS

Table 1 demonstrates the basic participant characteristics as determined by the IR positive and IR negative classifications made by HOMA-IR. There was no significantly differences in age and BMI between IR positive and IR negative groups. Significant increase of WC, HC, WHR and diastolic blood pressure (referred to as DBP and SBP) levels was observed in IR positive group compared to IR negative group. As shown in Table 2, the ideal cut off point for predicting the HOMA-IR index using the TG/HDL-C ratio was 3.39, with a sensitivity and specificity of 88.89 and 76.27, respectively, and a p-value of <0.001.

The ROC curve for TG/HDL-C as a predictor for HOMA-IR index is shown in Figure 1. The HOMA-IR index was predicted with an AUC of 0.854 using TG/HDL-C. (95% CI: (57.7-91.4). The Youden's index determined that 3.39 was the ideal cut off value to use for predicting the HOMA-IR index using the TG/HDL-C ratio. In addition, it had the highest diagnostic accuracy and positive predictive value. The point with the shortest distance value from the point (0,1) has a Youden index of [sensitivity-(1-specificity)] and is [(1-sensitivity)2 + (1-specificity)2]. were determined (16). The positive probability ratio (PLR), which compares the likelihood of individuals with the disease to have a certain test result to those of patients without the disease, was also calculated. Sensitivity / (100% specificity) is used to determine PLR.

Table 1. Clinical characteristics of IR positive and IR negative participants

	IR Negative	IR Positive	P-value
Age (years)	33.44±2.45	31.41±2.35	0.65
BMI (kg/m^2)	29.67±9.88	32.83±10.12	0.06
MUAC (cm)	28.35±7.65	35.91±8.23	0.07
WC (cm)	79.88±10.81	89.54±12.99	0.01
HC (cm)	94.59±9.78	105.77±10.11	0.01
WHR	0.76±0.66	0.84±0.99	0.03
SBP (mmHg)	139.8±11.8	159.8±12.8	0.02
DBP (mmHg)	84.5±5.95	95.5±9.91	0.02

BMI: body mass index; WC: waist circumference; HC: hip circumference; WHR: waist to hip ratio; MUAC: mid upper arm circumference; Diastolic blood pressure is referred to as DBP and SBP, respectively. <0.05 p-value considered statistically significant.

Table 2. Cut off points for TG/HDL-C index for early identification of IR among obese women

TG/HDL	Sensitivity % (95% CI)	Specificity % (95% CI)	+LR	+PV (95% CI)	AUC (95% CI)	Youden index
3.39	88.89 (57.7-91.4)	76.27 (69.1- 90.3)	4.17	65.6 (51.9 - 77.1)	0.854 (0.762- 0.921)	0.87 (0.76- 0.92

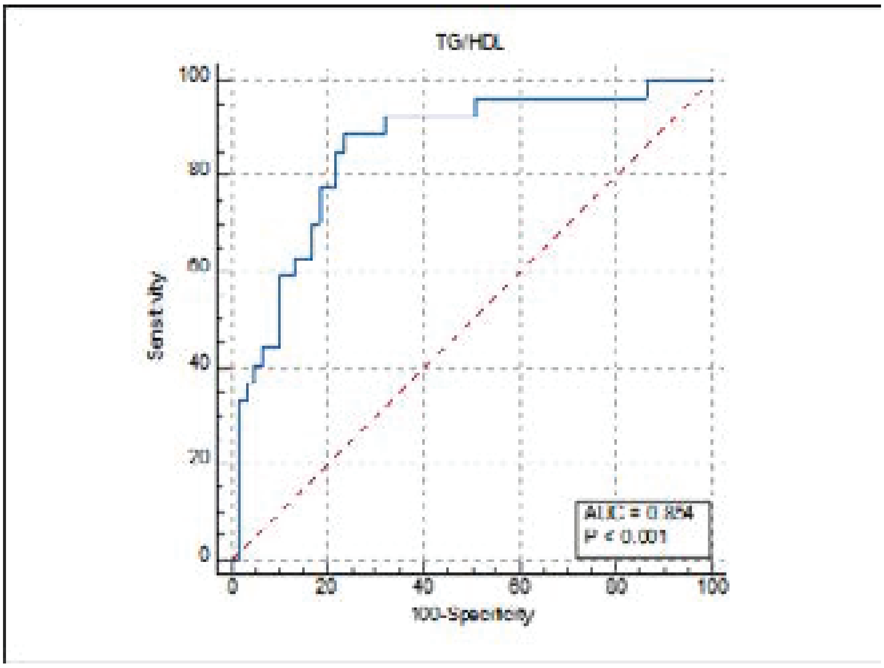

Figure 1. ROC curve for TG/HDL-C marker for IR among obese women

DISCUSSION

The adipose tissue captures and maintains less fatty acid in IR condition, which is the mechanism of high TG and low HDL-C (17). As a result, more free fatty acids are delivered to the liver, where they are used to produce more TG and TG-containing very low-density lipoproteins (VLDL). In addition, as the plasma TG concentration rises, the TG content of TG-containing VLDL and the cholesteryl ester of HDL-C exchange. The TG-rich HDL-C that results from this process is easily metabolized (18). As a result, IR patients have a high TG, high TG/HDL-C, and low HDL-C levels (18). According to several research, the TG, rather than factors such the TG/HDL-C index, visceral adiposity index, leptin, Apo-B/Apo-AI, and lipid parameters, more accurately predicts HOMA-IR values (18,19). TG levels are elevated whereas HDL-C levels diminished in people with insulin resistance (2,10,19). A higher ratio would indicate a worsening state of health since there are more fats circulating in the blood and/or less good cholesterol. Insulin resistance has been proven to be closely connected with a TG/HDL-C ratio of ≥ 3. Additionally, it has been demonstrated that among Iranian men, the TG/HDL-C ratio represents a distinct risk factor for coronary heart disease(20). A prior research among healthy Spanish children indicated that both girls and boys HOMA-IR gradually increased with age (21). While the association between WHR and HOMA-IR was weak, HOMA-IR had strong relationships with BMI, WC, and WHR. The significant association between HOMA-IR and WC was also seen in other research, including one from India (22–24). In other work, WHR has also been demonstrated that strongly correlated with HOMA-IR. A significant study from Europe reported a similar outcome (25). According to previous findings, IR (as determined by HOMA-IR) in middle-aged Egyptian women is strongly correlated with the TG/HDL-C ratio (26). Adipose tissue traps and retains less fatty acid in IR condition, which is the cause of high TG and low HDL-C (27,28). The present optimal threshold was 3.39 with a corresponding sensitivity and specificity of 88.89 and 76.27% in middle-aged obese women, we concluded that TG/HDL-C is a suitable marker that can be utilized alone for IR assessment. Another study suggested that middle-aged and elderly Taiwanese might detect IR just using the TG/HDL-C ratio (29, 31). A study of 812 Taiwanese adults (31) demonstrated that models incorporating the TG/HDL-C ratio, sex, larger waist circumferences, and higher ALT levels for IR. Different cut off values of the TG/HDL-C ratio had been reported in other studies to identify the presence of IR. The outcomes of the cut off values were varied significantly amongst different ethnic groupings (10, 28). Previously, TG/HDL-C ratio was used as a predictor of IR in cross-sectional research of 258 participants. Previously, the TG/HDL-C ratio was studied that predict metabolic syndrome in overweight individuals (19). However, other cross-sectional cohort of 90 overweight African Americans (32) reported that the TG/HDL-C ratio was not reliable marker for IR.

A limitation of this study is that the blood samples of all women were not collected at the same point of the menstrual cycle.

CONCLUSION

In conclusion, our results demonstrate that the elevated TG/HDL-C ratio was significantly related to IR and could be used as an indicator of IR amongst the middle-aged Egyptian obese women and might be a useful tool to recognize high risk individuals for early intervention and thereby delay or prevent the onset of IR-related illnesses such as hypertension and type 2 diabetes.

AUTHOR INFORMATION

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