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Correlation of Triglycerides to High Density Lipoprotein Cholesterol Ratio with Insulin Resistance in Egyptian Population

KEYWORDS: Egyptians, insulin resistance, obese, TG/ HDL ratio.

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ABSTRACT *The triglyceride to high-density lipoprotein cholesterol ratio (TG/HDL-C) has been advocated as a simple clinical indicator of insulin resistance. The aim of this study is to evaluate the prediction of insulin resistance in Egyptians by TG/HDL-C as an available factor for clinical applications.*

Introduction:
Insulin resistance (IR) has been proposed as an underlying cause of type 2 diabetes and the metabolic syndrome (MetS.) [1].Several studies in human and animals have substantiated a cause and effect relationship between obesity and IR based on the observation that weight gain or loss correlates closely with increasing or decreasing insulin sensitivity [2]. MetS is characteristically defined as a clustering condition of cardiovascular risk factors including hyperglycemia, dyslipidemia, hypertension, and central obesity [3]. The pathophysiology of the MetS remains a subject of controversy but many of its features are associated with IR which is typically defined as decreased sensitivity or responsiveness to metabolic actions of insulin. Currently, there are several directly and indirect methods to assess IR [4]. Previous studies have shown that IR scores based on the homeostasis model assessment (HOMA-R) method was strongly correlated with glucose clamp-assessed IR [5].The model utilize a set of empirically derived nonlinear equations to predict the homeostatic concentrations of fasting insulin and glucose, which reflect the varying degrees of pancreatic b-cell function and IR [6]. It would be of considerable benefit for clinicians if other standardized measures are available for predicting without the need for direct measurements of fasting insulin. Since hypertriglyceridemia and low (HDL-C) are two key metabolic abnormalities associated with IR states [7], the ratio (TG/HDL-C) has been advocated as a simple clinical indicator of IR. It has been evaluated as predictor of diabetes and coronary heart disease. Nevertheless, recent studies reported that racial differences existed in the predictability of the ratio [8]. In addition, depending on ethnicity, different thresholds of TG/HDL-C have been proposed for predicting insulin resistance. In our study we evaluated this relationship in obese adult Egyptians. To our knowledge, no studies have reported that prediction of insulin resistance using TG/HDL-C in Egyptian adults.

Materials and methods:
The study was conducted on one hundred sixty unrelated Egyptian subjects from Benha University Hospital. They have signed an informed consent. Information on clinical characteristics including age, sex, weight, waist circumference (WC) and waist to hip ratio (W/ H) were collected. Body mass index was calculated by dividing weight (in kilograms) by the square of the height (in meters). Triglycerides, total cholesterol, HDL-C and LDL-C were measured using blood samples. Also laboratory investigations including, Fasting blood glucose level by colorimetric method and fasting serum insulin level [9] were done. Insulin resistance was measured using the homeostasis model assessment of insulin resistance (HOMA-IR), a reliable marker for insulin resistance, was calculated as fasting insulin X glucose level/22.5 [10].

Statistical analysis:
The collected data were tabulated and analyzed using SPSS version 16 soft ware. Comparison of variables between groups was made by one way analysis of variance (ANOVA). Subjects were divided into elevated HOMA-R and low HOMA-R groups using a cutoff value of 3.2 as the HOMA1-IR value above 75th percentile was defined as IR, following similar use in other studies [11]. Two-sided value ≤ 0.05 was considered statistically significant. Differences in clinical characteristics of subjects between the low and elevated HOMA-IR groups were examined using the two-sample t test. Estimation of correlation coefficient (r) between values of TG/ HDL ratio and IR was done; ROC curve analysis was done to estimate cut off values for both variables to expect the presence of IR.

Results:
Clinical characteristics of subjects categorized by HOMA1-IR>75th percentile (3.2) were shown in %%3Table 1. There were no significant differences in age, sex, total cholesterol levels, low-density lipoprotein-cholesterol (LDL-C) levels between the two HOMA-IR groups. The mean body weight, body mass index, WC, W/ H ratio, fasting glucose level, TG level, TG/ HDL ratio, and insulin level were significantly higher in the elevated HOMA-IR group. The mean (HDL-C) level was significantly lower in the elevated -IR group. Estimation of correlation coefficient (r) between values of TG/ HDL ratio and IR was done and revealed r value of 0.501 and $p < 0.01$ which means high significant correlation %%3(figure 1).

The TG/ HDL ratio cut off value 5.67 mg/ dl was able to predict IR with high sensitivity (80 %) , specificity (93.3%) and AUC 89% %%3(figure 2).

Table1:The Clinical Characteristics of Subjects categorized by HOMA1-IR>75th percentile (3.2 µU/mL-mmol/L).

Variable	HOMA-IR ≤ 3.2 n = 113	HOMA-IR > 3.2 n = 47	p
Age (years)	50.1±10.8	52.6±6.12	>0.05
male	54 (47.8%)	25 (53.2%)	>0.05
female	59 (52.2%)	22 (46.8%)	
BMI (kg/m2)	33.1±1.4	36.00±4.2	≤ 0.01
Waist circumference(cm)	104.2±7.3	109.5±17.7	≤0.05

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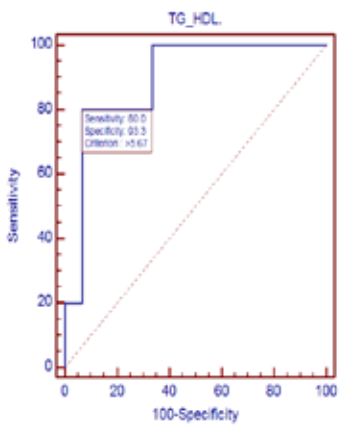
FBG (mg/dL)	88.1±7.42	93.4 ± 10.3	≤0.05
TG (mg/dL)	132±25.83	189.8±27.8	≤ 0.01
Total cholesterol (mg/dL)	187.3±13.8	192±7.6	>0.05
HDL-C (mg/dL)	42.5±7.78	37.3±2.685	≤ 0.01
LDL-C (mg/dL)	109.4±12.22	112.7±5.46	>0.05
Insulin (mU/L)	12.15±1.38	16.46 ± 1.32	≤ 0.01
W/H ratio	0.99+0.09	1+ 0.07	≤0.05
TG / HDL ratio	3.2±1.73	5.7±1.12	≤ 0.01

Figure 1: correlation between TG/ HDL ratio levels and insulin resistance.

Fig2: ROC curve analysis to estimate cut off value of TG / HDL-C ratio to expect the presence of IR.



Discussion:

The main findings of this study demonstrate that the (TG/ HDL-C) ratio are associated with IR measures in Egyptian subjects. In clinical settings, it would be useful to identify individuals with IR using only routinely collected blood test results such as TG and (HDL-C) . Hence, we tested the prediction of IR by the ratio of (TG/HDL-C). The optimal cut-point for (TG/HDL-C) ratio to detect IR was 5.67 mg/ dL. Previous studies have reported the (TG/HDL-C) ratio is a valid marker of IR, particularly in White populations [11-15]. However in African-Americans this lipid ratio can demonstrate a weak or non-significant association with IR, particularly in women [11,12]. Previous study in South Asians has analyzed the relationship between the (TG/HDL-C) ratio and IR, the study failed to show an association [16]. Another study demonstrated a significant association in South Asian men but not women, which was also suggested by a significant sex interaction[17], the appreciated controversy of results could be explained that proportion of HDL subtypes is known to vary between these ethnic groups [18]. In the present study, we found that the IR as assessed by HOMA-R correlates strongly with (TG/HDL-C) ratio in Egyptians. Not surprising, this ratio did not correlate with either total or LDL-C. This poor correlation is well known [19]. The WC and W/H ratio (as measures for central obesity), have been used as indicators or measures of the health of a person, and the risk of developing serious health conditions. Research shows that people with "apple-shaped" bodies (with more weight around the waist) face more health risks than those with "pear-shaped" bodies who carry more weight around the hips [20]. Our study showed that both measures significantly higher in the high IR group, this is in accordance with Reilly et al [20], this means that the obese patients may be prone to the development of health problems including diabetes. Previous studies have demonstrated also the cut points to detect IR are between 2.0 to 2.5 mg/dl in African-Americans and 3.0 mg/dl in both non-Hispanic Whites and Mexican-Americans without diabetes. Using international units. The reported differences between optimal cut-points in various studies may represent a mix of ethnic differences and/or different methods employed, such as measuring IR directly or using HOMA-IR models.

Conclusion

The potential translational value of the (TG/HDL-C) ratio into clinical practice has yet to be determined. Our study has demonstrated that (TG/HDL-C) ratio could be a predictor of insulin resistance in Egyptians.

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