

Correlation Between the Ratio TG/HDL-C and Lipid Profile in Nonalcoholic Fatty Liver Disease Patients

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Abstract

Background: Insulin resistance is identified as an impaired biological response to insulin stimulation of target tissues primarily in the liver, muscle, and adipose tissue. The ratio TG/HDL-C has been proposed as a simple marker of insulin resistance. The study aimed to determine the correlation between the ratio TG/HDL-C and lipid profile in nonalcoholic fatty liver disease (NAFLD) patients

Method: The design of the study was a *cross-sectional study* with the dependent variable Fibrosis Score of NAFLD sufferers who came to H. Adam Malik Medan General Hospital network hospital from July-September 2021. Diagnosis of NAFLD from anamnesis, physical examination, laboratory, and abdominal ultrasound. Lipid profile examination is carried out using a spectrophotometer tool colorimetric enzymatic method, observed include TC, HDL-C, LDL-C, and TG.

Results: There are 80 NAFLD patients, aged 54.8±8.7 years, with uncontrol T2DM, and normal weight. There was a correlation significantly between the ratio TG/HDL-C with TC-C, TG, HDL-C, LDL-C ($p < 0.001$), and no correlation between ratio TG/HDL-C with age, BMI, FPG, PPG, and HbA1c ($p > 0.05$)

Conclusion: There is a correlation between ratio TG/HDL-C (as a marker of insulin resistance) and lipid profile in NAFLD patients

Keywords: Ratio of TG/HDL-C, NAFLD, Lipid Profile

Abstrak

Latar Belakang: Resistensi insulin diidentifikasi sebagai gangguan respon biologis terhadap stimulasi insulin di jaringan target terutama hati, otot, dan jaringan adiposa. Rasio TG/HDL-C telah digunakan sebagai penanda sederhana resistensi insulin. Tujuan penelitian adalah menentukan korelasi antara rasio TG/HDL-C dan profil lipid pada pasien penyakit hati berlemak nonalkohol (NAFLD).

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Metode: Desain penelitian adalah potong lintang dengan variabel dependen adalah Fibrosis Score dari penderita NAFLD yang datang ke RSUP H. Adam Malik Medan dan rumah sakit jejaring dari Juli-September 2021. Diagnosis NAFLD dari anamnesis, pemeriksaan, laboratorium dan USG perut. Pemeriksaan profil lipid dilakukan dengan menggunakan metode enzimatik spektrofotometer, yang diamati termasuk TC, HDL-C, LDL-C, dan TG.

Hasil: Ada 80 pasien NAFLD, berusia antara $54,8 \pm 8,7$ tahun, DMT2 tidak terkontrol, dan normoweight. Terdapat korelasi secara signifikan antara rasio TG / HDL-C dengan TC-C, TG, HDL-C, LDL-C ($p < 0,001$), dan tidak ada korelasi antara rasio TG/HDL-C dengan usia, IMT, GP, GDPP dan HbA1c ($p > 0,05$)

Kesimpulan: Terdapat korelasi antara rasio TG / HDL-C (sebagai penanda resistensi insulin) dan profil lipid pada pasien dengan NAFLD

Kata kunci: Rasio TG/HDL-C, NAFLD, Profil Lipid

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1 Introduction

Homeostasis model assessment insulin resistance (HOMA-IR) scores are useful indicators of insulin resistance (IR) for research purposes, they are expensive and are not readily available to clinicians. Thus, early identification of insulin resistance, preferably by using simple and inexpensive diagnostic tools, which is essential for preventing and detecting T2DM. Ratio triglyceride (TG) to high-density lipoprotein cholesterol (HDL-C) has been proposed as a simple marker of insulin resistance.[1] The potential utility of the ratio TG/HDL-C to detect insulin resistance was firstly reported by McLaughlin in a Caucasian population [2]. Similar results were found in different racial groups such as Korean,[3] non-Hispanic Black, and Mexican American.[4] However, studies showed that the ratio TG/HDL-C might not be a marker of insulin resistance for African populations.[5] It is possible that given the racial variations in both TG and HDL-C levels, the association between ratio TG/HDL-C and insulin resistance is ethnicity-dependent. There is limited evidence supporting that the ratio TG/HDL-C is a surrogate marker of insulin resistance in Chinese individuals.[6] What's more, few studies have been conducted on newly diagnosed T2DM patients. Thus, this study focused on the plasma lipid profiles and explored the association between the ratio TG/HDL-C and insulin resistance in Chinese patients with newly diagnosed T2DM. Association between the ratio TG/HDL-C and IR in newly diagnosed T2DM patients. An increase in triglyceride (TG) and decrease in high-density lipoprotein cholesterol (HDL-C) may be caused by inflammatory cytokines, and it has been suggested that triglyceride to high-density lipoprotein cholesterol the ratio (TG/HDL-C), a simple, non-invasive, and convenient measurement the indicator could integrate predictive risks of two parameters into a single risk factor and showed better predictive value than TG and HDL-C alone in atherosclerotic disturbances,[7] Klisic et al demonstrated that the ratio TG/HDL-C had a positive correlation with high sensitivity C-reactive protein (hs-CRP) and inflammatory biomarker cystatin C in adolescent girls.[8] Based on this the premise, other indexes have been proposed to predict the cardiovascular risk, among which, what stands out is the ratio between triglycerides (TG) and HDL-C

(TG/HDL-C), which reflects small and dense particles of low-density lipoprotein (LDL), which are more atherogenic than the larger floating LDL particles.[9] The TG/HDL ratio has proven to be a good predictor of myocardial infarction,[10] and was associated with the incidence of cardiovascular diseases, T2DM, and metabolic syndrome.[11] In addition, it was reported that a high the ratio TG/HDL-C the relationship is significantly associated with an increase in the resistance to insulin in apparently healthy individuals, thus suggesting that this measure can serve as a simple and clinically useful method to identify healthy young individuals who are resistant to insulin and who present an increased cardiometabolic risk. The ratio TG/HDL has proven to be a good predictor for myocardial infarction and was associated with the incidence of cardiovascular diseases, T2DM, and metabolic syndrome.[11]

The purpose of the study was to evaluate the relationship between the ratio TG/HDL-C and lipid profiles in nonalcoholic fatty liver disease (NAFLD) patients. NAFLD is a condition resulting from the accumulation of excessive fat in the form of triglycerides (steatosis) in the liver more than 5% of the total hepatocytes.

Insulin resistance is identified as an impaired biological response to insulin stimulation of target tissues primarily in the liver, muscle, and adipose tissue. The ratio TG/HDL-C has been proposed as a simple marker of insulin resistance.

2 Method

The design of the study was *cross-sectional* with the dependent variable being the NAFLD *Fibrosis Score*. The target population of the study was NAFLD sufferers, who came to H. Adam Malik Medan General Hospital in July-September 2021 and met the inclusion criteria for diagnosis of NAFLD from anamnesis, examination, laboratory, and abdominal ultrasound. Patients who meet the criteria for metabolic syndrome, lead a high-fat diet lifestyle, have a history of alcohol consumption (<30 grams/day for men, <20 gr/day for women), and clinical symptoms of fatigue, malaise, right upper quadrant pain, and obesity are carried out laboratory tests and abdominal ultrasound measures. Stages of NAFLD are divided into Degree I, Degree II, and Degree III.[12] by two examiners. Lipid profile examination is carried out using a spectrophotometer tool colorimetric enzymatic method observed include TC, HDL-C, LDL-C, and TG.

Data Analysis

Data univariate analysis is presented descriptively, displaying average data and standard deviations. Test normality of data using the Shapiro Wilk test. The bivariate analysis uses a T-independent test if data is distributed abnormally. If data is not distributed normally using the Mann-Whitney test. Test Pearson correlation when distributed data is normal, and use spearman correlation if data is not distributed normally. Analysis using computer programs SPSS (Statistical Product and for Social Sciences) and confidence intervals of 95%, where $p < 0.05$ considered significant

3 Results

From table 1, there are 80 NAFLD cases in baseline data of cardiovascular risk shows that all patients were uncontrolled T2DM.

Table 1 Baseline Data of Cardiovascular Risk Parameters

Parameters	Mean±SD (n=80)
Age	year 54.8±8.7
BMI	kg/m ² 23.1±3.1
FPG	mg/dl 210.5±106.8
PPG	mg/dl 279.7±108.5
HbA1c	10.1±2.0
TC-C	mg/dl 122.2±38.1
TG	mg/dl 112.9±30.2
HDL-C	mg/dl 28.4±14.3
LDL-C	mg/dl 89.6±36.8
TG/HDL-C	5.6±4.0
NAFLD	N (%)
Degree	
Degree I	32 (40)
Degree II	29 (36,3)
Degree III	19 (23,8)

BMI: body mass index; FPG: fasting plasma glucose; PPG: postprandial glucose; TC: total cholesterol; TG: triglyceride; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; *: $p < 0.05$; **: $p < 0.01$

In table 2, there was a correlation significantly between TG/HDL-C with TC-C, TG, HDL-C, LDL-C ($p < 0.001$)

Table 2 Correlation between the ratio TG/HDL-C with other Cardiovascular Risk

Parameters		r	p
Age	yr	0.040	0.724
BMI	kg/m ²	-0.054	0.637
FPG	mg/dl	0.029	0.801
PPG	mg/dl	0.010	0.930
HbA1c		0.036	0.748
TC-C	mg/dl	-0.542	0.001*
TG	mg/dl	0.563	0.001*
HDL-C	mg/dl	-0.907	0.001*
LDL-C	mg/dl	-0.427	0.001*

BMI: body mass index; FPG: fasting plasma glucose; PPG: postprandial glucose; TC: total cholesterol; TG: triglyceride; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; *: $p < 0.05$; **: $p < 0.01$

4 Discussion

The ratio triglycerides (TG) and HDL is an important factor in the formation of IR.[13] There is a negative correlation between the ratio TG/HDL-C with TC-C ($r = -0,542$), HDL-C ($r = -0,907$), and LDL-C ($r = -0,427$). There is a positive correlation between the ratio TG/HDL-C with TG ($r=0,563$).

An increase in TG was shown to be a risk factor for the development of IR, while an increase in HDL was considered a protective factor. Many scholars have used the ratio of the two to investigate the relationship of both factors with IR. The ratio TG/HDL was found to be more closely linked to the development of IR either TG or HDL alone. Notably, studies indicate that the TG/HDL ratio is straightforward quantifiable measurement of IR and a marker of diabetes and coronary heart disease.[14]

However, results from previous studies on the relationship between TG/HDL ratio and IR suggest that more investigation is needed, especially since the sample sizes were small.[15] Therefore, more research is needed to understand the differences in study design, target population, and data processing. In the study, they used data from the National Health and Nutrition Examination Survey (NHANES) to investigate whether the ratio TG/HDL was linked to IR in adults in the United States. In the current edition of the International Journal of Cardiovascular Sciences, Silva et al,[16] evaluated 833 individuals, of whom 62.8% were women, with an the average age of 62 years, with high blood pressure and/or diabetes, who received medical care at the Family Health Unit in the city of Viçosa, Minas Gerais, Brazil. Exams showed that the cut-off values of the ratio TG/HDL that reflect the cardiovascular risks were ≥ 3.26 for men and ≥ 2.72 for women.[16] The data suggest that

TG/HDL is a marker of increased atherosclerotic extension in prediabetes and newly diagnosed T2DM and may be useful to identify subjects with a higher cardiovascular risk profile. *TG/HDL-C was associated with insulin resistance in Chinese patients with newly diagnosed T2DM* ($r = 0.21$, $P < 0.01$). [17] The results showed that, after adjusting the potential confounding factors, the ratio of TG/HDL was positively correlated with the occurrence of prediabetes and diabetes, and there was a saturation effect. [18]

5 Conclusion

There are a correlation between the ratio TG/HDL-C (as a marker of insulin resistance) and lipid profile in NAFLD patients

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