CAN WE USE THE TRIGLYCERIDE/HDL RATIO TO DETERMINE INSULIN RESISTANCE IN OBESITY SCREENING AND FOLLOW-UP IN PRIMARY CARE?

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Abstract

Objectives: Obese patients are followed up with periodic laboratory tests. Insulin resistance is also a parameter used in these tests. There is a need for parameters that can determine insulin resistance more easily and practically. The aim of our study is to investigate the discriminative power of triglyceride (Tg) and triglyceride/high-density lipoprotein cholesterol ratio (Tg/HDL) for Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) in our patient population by examining the laboratory findings.

Materials and Methods: In this retrospective study, the laboratory data of patients who applied to the Family Medicine Obesity Polyclinic of Düzce University Hospital between April 2018 and April 2019 with the desire to lose weight and/or have healthy lifestyle suggestions were examined.

Results: Of the 512 patients included in our study, 66.40% (n=340) were female and 33.59% (n=172) were male. In the examination performed on patients grouped according to their Body Mass Index (BMI), Total cholesterol, HDL, Low-density lipoprotein (LDL), Tg, HOMA-IR, Insulin and Tg/HDL ratios were significantly different between the groups. The cut-off value in the ROC analysis of the Tg/HDL parameter between patients with and without insulin resistance was found to be 2.29 with 66% sensitivity and 55% specificity (AUC: 0.634, p<0.001). In Spearman's correlation analysis of Tg/HDL and HOMA-IR, both parameters were found to have a statistically significant correlation (r: 0.248; p< 0.000).

Conclusion: The significant relationship between the high Tg/HDL ratio and HOMA-IR detected in the results of our study shows that the Tg/HDL ratio can be used as a practical tool to evaluate insulin resistance in obese patients.

Keywords: Obesity, insulin resistance, HOMA-IR, Tg/HDL.

Introduction

As it is known, obesity is a disease that is common in our age and has high mortality and morbidity.[1] In the clinic, patients are evaluated by body mass index (BMI), which is expressed as body weight in kilograms divided by square meter height for obesity screening and diagnosis. According to some cut-off values patients are classified as; underweight (<18.5 kg/m^2), normal weight (18.5-24.9 kg/m^2), overweight (25.0-29.9 kg/m^2), obese grade I (30.0-34.9 kg/m^2), obese grade II (35.0-39.9 kg/m^2) and obese grade III (40.0+ kg/m^2).[2] In addition to BMI and various anthropometric measurements, patients are followed up with periodic laboratory tests. HOMA-IR is also a parameter used in these examinations.[3] Detection of insulin resistance can also identify individuals at high risk for diseases such as cardiovascular and diabetes.[4] In order to measure insulin resistance, it is necessary to determine fasting insulin. However, fasting insulin is not a primary care examination, and it is a costly method in a hospital setting.[5] Some studies have formed the idea that insulin resistance in patients can be detected by using the ratio between Tg and HDL, which can also be done in primary care.[6,7] However, this ratio is not yet in routine use due to some conflicting results.[8] It is interpreted that these conflicting results may be related to the variability of the study population.[9] According to our literature search, we found that the Tg/HDL ratio of patients classified according to the BMI index was not studied in a large patient population in our country. The aim of our study is to investigate the discriminative power of the Tg/HDL ratio for HOMA-IR in our patient population by examining the examinations of patients who applied to the healthy living and obesity outpatient clinic in our university hospital.

Materials and Methods

In this retrospective study, the laboratory data of patients who applied to the Family Medicine Obesity Polyclinic of our University hospital with the desire to lose weight and/or healthy lifestyle suggestions between the dates of the year 2018-2019 were examined. Ethical permission for the study was obtained from the local ethics committee.

Study Group

During the study period, 1823 patients were admitted to the obesity outpatient clinic. Chronic diseases such as heart and kidney diseases, thyroid diseases, liver diseases, serious infections, malignancy or taking any drug known to cause discomfort in lipid metabolism were excluded from the study. Since the BMI and laboratory tests measured at the time of the first application of the patients were used for the study, recurrent applications were also excluded from the study. Finally, a total of 512 patients were included in the study (Figure 1).
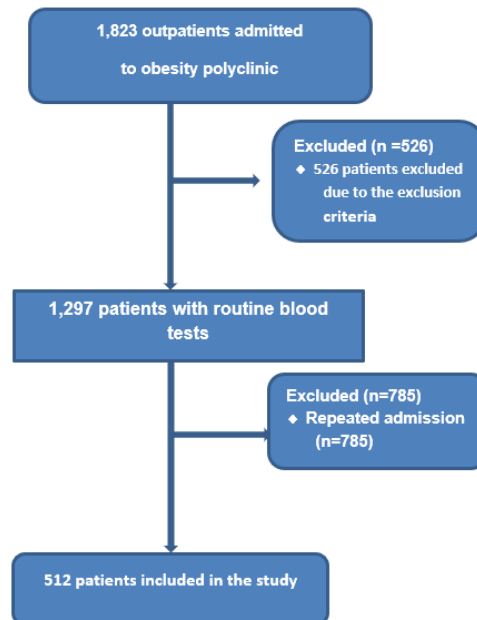
Figure 1. Study design and process

Blood samples were taken after at least 8 hours of fasting. All measurements were carried out in Düzce University Research and Application Hospital Biochemistry Laboratory. From blood tests, fasting blood glucose (FBS), insulin, total cholesterol, LDL, HDL, and Tg levels were scanned. Insulin resistance was calculated with the HOMA-IR formula (fasting glucose (mg/dl) x fasting insulin (µIU/mL) / 405).

Statistical analysis

In descriptive statistics, quantitative data were given as mean and standard deviation, and categorical data were given as numbers and percentages. The distribution of numerical data was examined by using histogram graphics. One-way ANOVA was used for parametric data, and Kruskal Wallis tests were used for non-parametric data to compare data between groups. The cut-off value was calculated in the ROC analysis of the Tg/HDL parameter between patients with and without insulin resistance. The AUC and cut-off value (cut-off value) of each measurement were determined, and the sensitivity, specificity, and LR + cut-off values of these values were calculated and evaluated together. A value of $p < 0.05$ was accepted as statistically significant. Spearman's correlation analysis was used for the relationship between Tg/HDL and HOMA-IR. All statistics were performed by using SPSS 23.0 package program (SPSS, version 23X, IBM, Armonk, New York 10504, NY, USA).

Results

Of the 512 patients included in our study, 66.40% (n=340) were female and 33.59% (n=172) were male. According to the examination made from the routine examinations of the patients grouped according to their BMI, FBS, total cholesterol, HDL, LDL, Tg, HOMA-IR, Insulin and Tg/HDL ratio showed significant differences between groups (Table 1).

Table 1. Comparison of laboratory results of patients and BMI group

Parameters	Group I* (n=126)	Group II* (n=158)	Group III* (n=141)	Group IV* (n= 87)	P**
Gender (Female/Male)	86/40	93/65	81/60	80/7	**<0.001**
Age	38.21±11.42	40.93±9.63	43.82±9.55	43.92±11.23	**<0.001**
Weight	75.23±11.21	86.32±10.32	98.34±12.34	112.24±15.31	**<0.001**
BMI	27.91±1.61	32.53±1.42	36.93±1.46	44.23±4.23	**<0.001**
FBS	95.82±11.14	95.93±10.60	99.21±13.24	102.13±17.21	**<0.001**
Total Cholesterol	183.10±41.52	199.12±40.94	202.24±41.13	199.91±43.32	**<0.001**
HDL	56.23±17.8	50.49±12.3	49.24±11	47.97±10	**<0.001**
LDL	101.34±32.2	123.68±43.7	118.39±32	123.84±34	**<0.001**
Tg	89 (20-412)	118 (25-565)	127 (38-722)	129 (62-387)	**0.005**
HOMA-IR	2.59±1.21	2.77±1.76	3.81±1.12	4.13±1.73	**<0.001**
Insulin	9.87(1.9-31)	10.29(2.7-61)	12.62 (3.3-79)	12.31 (5.4-59)	**<0.001**
Tg/HDL	1.61(0.3-11.9)	2.46 (0.25-18)	2.82 (0.56-18.8)	2.87 (0.9-10)	**<0.001**

*The patients were grouped according to their BMI
F/M; Female/Male
BMI: Body Mass Index
FBS: Fasting blood sugar
HDL: High-density lipoprotein, LDL: Low-density lipoprotein Tg: Triglyceride
HOMA-IR: Homeostatic Model Assessment of Insulin Resistance
** One-way ANOVA and Kruskal Wallis tests were used to compare data between groups

In the ROC (Receiver Operating Characteristic) analysis of the Tg/HDL parameter between patients with and without insulin resistance; The cut-off value was 2.29 with a sensitivity of 66% and a specificity of 55% (AUC: 0.634, p< 0.001) (Figure 2, Table 2).
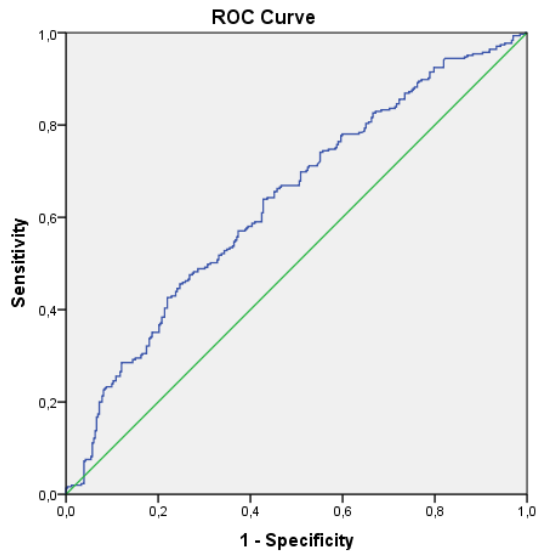
Figure 2. ROC curve of Tg/HDL variables for insulin resistance

Table 2. The cut-off value of Tg/HDL with sensitivity and specificity for insulin resistance

Parameter	AUC (CI)	p	Sensitivity (%)	Specificity (%)	Cut-Off
Tg/HDL	0.634(0.591-0.677)	<0.001	66	55	2.29

AUC: *Area Under the Curve, CI: Confidence Interval*

In Spearman's correlation analysis of Tg/HDL and HOMA-IR, both parameters were found to have a statistically significant correlation (r: 0.248; p<0.001) (Figure 3).
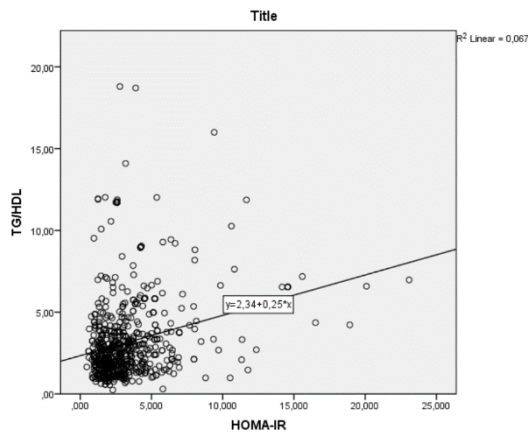

Figure 3. Spearman's correlation plot of Tg/HDL and HOMA-IR

Discussion

In our study, the laboratory findings of patients who applied to our obesity outpatient clinic at the time of their first admission were examined. In order to predict insulin resistance in primary care, it was investigated whether the Tg/HDL ratio is a practical alternative to HOMA-IR. According to our study results, as the obesity degree of the patients increased, it was determined that the FBG and Tg levels increased. Studies have revealed that as BMI increases, impaired glucose metabolism and lipid metabolism are also observed more.[10,11] Effects of insulin on lipid metabolism; insulin suppresses lipolysis in adipose tissue by inhibiting hormone-sensitive lipase, thereby controlling the release of free fatty acids into circulation. Free fatty acids reduce insulin receptor signaling. Fat cells that are saturated with free fatty acids form the infrastructure of insulin resistance with a reverse effect.[12] This dyslipidemia caused by obesity causes permanent changes in the adipose tissue and becomes a vicious circle as a condition characterized by insulin resistance and hyperinsulinemia.[13]

In many studies, the diagnosis of health problems secondary to obesity and the possibility of early treatment in obese patients with simple hematological and biochemical tests have been suggested.[14,15] The most important result of our study is the demonstration of a significant relationship between Tg/HDL and HOMA-IR parameters. Together with the results of ROC analysis of the Tg/HDL parameter among patients with and without insulin resistance, we can say that patients with Tg/HDL ratio above 2.29 have insulin resistance. In a large-scale study in Japan, they found that as the HOMA-IR ratio increased, the Tg/HDL ratio increased. It was also found that Tg/HDL values were lower in both men and women who exercised regularly and had high physical activity.[16] Tg/HDL ratio is considered a useful and practical laboratory parameter in many studies as a predictive marker for HOMA-IR.[17-19] Comparing the usefulness of HOMA-IR markers in the prediction of metabolic syndrome, the TG/HDL-C ratio seems to be the best and is also recommended for use in clinical practice to detect metabolic syndrome.[20] In studies conducted to predict insulin resistance using the Tg/HDL ratio, the cut-off value of this ratio varies between 1.1 and 3.[6,21] In the literature, there is no standard value yet determined for these various rates. However, high Tg and low HDL levels in obese patients, and therefore high Tg/HDL ratios, may provide insight into insulin resistance.

As it is known, preventive health services are the most important component of primary care medicine. Obesity and the diseases it causes are preventable and manageable diseases in primary care. Preventing chronic diseases such as insulin resistance and metabolic syndrome before they occur provides significant advantages to the patient and the health system. Periodic follow-up of physical examination and other routine controls is recommended in obese patients.[22-24] Being able to do these checks and scans in an easy and inexpensive way is very attractive for the primary care physician. Tg and HDL values are a test that can be

evaluated in primary care. In addition, they are tests that can be evaluated practically without sending the patient to the hospital, without any additional cost.

Limitations

Our study has some limitations. First of all, our results cannot be generalized to the whole population since our study was a single-centered study. Since it is a retrospective study, up-to-date information on the patients could not be reached. Longitudinal and large-scale studies are needed in terms of causal relationships.

Conclusion

The significant relationship between the high Tg/HDL ratio and HOMA-IR detected in the results of our study shows that the Tg/HDL ratio can be used as a practical tool to evaluate insulin resistance in obese patients. Practical and inexpensive laboratory parameters that can predict insulin resistance in primary care provide benefits to the patient in preventive health services.

Ethical considerations: Ethical approval for the study was obtained from the ethics committee of Düzce University (Approval No: 2021/228, Date: 01.10.2021).

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

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