INTERNATIONAL JOURNAL OF
MEDICAL BIOCHEMISTRY

DOI: 10.14744/ijmb.2025.43925
Int J Med Biochem 2025;8(3):199–204

Research Article

Assessment of relationship between triglyceride/HDL-C ratio and incident type 2 diabetes mellitus risk

Muzaffer Katar[1], Osman Demir[2]

[1]Department of Medical Biochemistry, Tokat Gaziosmanpasa University Faculty of Medicine, Tokat, Türkiye
[2]Department of Biostatistics, Tokat Gaziosmanpasa University Faculty of Medicine, Tokat, Türkiye

Abstract

Objectives: The most prevalent endocrine condition in the world today is diabetes mellitus (DM). In addition to the recognized markers for assessing glycemic control and insulin resistance (IR), easily available, accurate, and repeatable markers are required. In order to assess the use of the triglyceride (TG), HDL cholesterol ratio (THR) as a marker for insulin resistance and glycemic management, our study was conducted.

Methods: We looked back at the TG, fasting serum glucose (FSG), and Fasting Insulin levels of 953 samples that were concurrently evaluated in our Faculty of Medicine Hospital Laboratory from March 2023 to August 2023. In terms of their homeostasis model assessment-estimated insulin resistance (HOMA-IR) values, the patients were split into two groups: those with good glycemic control and those with poor glycemic control. The THR's capacity to distinguish between good and poor glycemic control was assessed using ROC analysis. The accepted level of statistical significance was $p<0.05$. Additionally, a multivariate logistic regression analysis was conducted.

Results: The mean age was 40.83±16.78 years. All the patients had significant differences ($p<0.001$) in gender, FSG, HOMA-IR, FI, TG, and THR based on glycemic control, except age ($p=0.613$). In pairwise correlation, THR had moderate negative correlation ($r=-0.555$, $p<0.001$) with HDL, while strong positive correlation with TG ($r=0.959$, $p<0.001$). THR had the high selectivity and positive predictive value (PPV) with a cutoff value of ≥2.64 (AUC:0,72, Se:65%, Sp:70% (p<0.001:95% CI:0,66-0,78)). Men are 2.247 times more likely than women to have poor glycemic control ($p=0.022$). Poor glycemic control risk rised by 1.045 times with age, and by 1.056 times with glucose ($p=0.007$).

Conclusion: Based on the current results, we think that the THR may be a useful marker of glycemic control and IR.

Keywords: Diabetes mellitus, glycemic control, HDL-C, insulin resistance, triglyceride

How to cite this article: Katar M, Demir O. Assessment of relationship between triglyceride/HDL-C ratio and incident type 2 diabetes mellitus risk . Int J Med Biochem 2025;8(3):199–204.

One of the biggest socioeconomic and health issues is diabetes mellitus. Diabetes mellitus type 2 (T2DM) is becoming more prevalent globally. According to numerous regional and national studies, the overall prevalence of T2DM in Türkiye ranges from 12.7% to 14.7% [1–4]. Additionally, the frequency of early fatalities brought on by macro- and microvascular complications in diabetes is increasing [5]. The pathophysiology of diabetes and metabolic syndrome is significantly influenced by insulin resistance (IR), which is the reduced insulin sensitivity of peripheral tissues. It may manifest one to two decades prior to the official diagnosis of T2DM [6]. IR's value as a predictor of future diabetes or insulin-sensitizing drugs' ability to prevent T2DM lends credence to this notion [7]. Diabetic dyslipidemia is another cardiovascular disease (CVD) risk factor in individuals with T2DM. Increased triglycerides (TG), decreased HDL-C (high-density lipoprotein cholesterol), and

This article is originated from a presentation delivered at the International Biochemistry Congress 2023 // 34th National Biochemistry Congress, held on October 29 – November 1, 2023, in Fethiye, Türkiye

Address for correspondence: Muzaffer Katar, MD. Department of Medical Biochemistry, Tokat Gaziosmanpasa University Faculty of Medicine, Tokat, Türkiye
Phone: +90 532 575 78 79 **E-mail:** drkatar@hotmail.com **ORCID:** 0000-0002-6296-2390
Submitted: February 15, 2025 **Revised:** April 15, 2025 **Accepted:** April 18, 2025 **Available Online:** June 17, 2025

postprandial lipemia are its constituents. The atherogenic index of plasma, which measures the ratio of blood triglycerides to high-density lipoprotein cholesterol (THR), is a significant risk factor for cardiovascular disease and metabolic syndrome [8, 9]. There is a correlation between endothelial dysfunction and a higher THR. Additionally, the THR has been suggested as an indicator of IR [10]. This is because lipid metabolism is altered by the metabolic processes that induce IR, and these alterations are mirrored in serum triglyceride and HDL cholesterol levels [11]. THR has also been demonstrated by Quispe et al. [12] to be a measure of glycemic control, particularly in obese individuals with T2DM. A further indicator linked to IR is the triglyceride to glucose (TyG) index. It assists in identifying asymptomatic T2DM patients who are at high risk of CVD [13]. THR and IR in diabetic individuals have been the subject of the majority of research to date [14].

In order to evaluate insulin sensitivity, the medical profession has therefore looked for substitute, indirect biomarkers. Strong predictive ability, high specificity, and sensitivity make Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) and Fasting Insulin (FI) popular surrogate markers for IR assessment. However, although being more practical than the hyperinsulinemic–euglycemic clamp technique, they are still difficult to use in day-to-day situations [11, 15]. Since insulin is not measured in every hospital, and due to transportation problems of blood samples from small family medicine offices to the hospital laboratories or HOMA-IR measurement handicaps, the quest for easier biomarkers to incorporate into a routine test is ongoing. Because measurement of triglyceride, HDL, and glucose levels is common and reasonably priced, THR can be calculated more frequently in clinical practice [16]. Over the past 20 years, efforts have been made to define the precise predictive power, constraints, and idiosyncrasies of THR, because of the unquestionable ease of use and accessibility of these two biomarkers.

Studies that sought to evaluate the relationship between glycemic control and the THR are scarce in our country, nevertheless. Thus, this study's objective was to assess the relationship between our population's THR and incident T2DM risk.

Materials and Methods

After taking approval from the ethical committee of Tokat Gaziosmanpaşa University Faculty of Medicine Clinical Research Ethics Committee (Date 26/10/2023, No: 23-KAEK-252), this cross-sectional retrospective study was conducted in Tokat Gaziosmanpaşa University. The study was designed in accordance with the Helsinki Declaration. All 953 participants aged between 18–75 years old, had blood tests for fasting serum glucose (FSG), HOMA-IR, FI, and TG levels between March and August 2023 were included in the study. THR was calculated according to following formula “serum triglyceride(mg/dL)/serum HDL(mg/dL)” [17] and HOMA-IR was derivedu (FSG): (mg/dL) / 405 [18]. We excluded participants under 18 years, having chronic thyroid disease, liver diseases, chronic kidney disease, hematological disorders or malignancies, systemic inflammatory or infectious diseases, a history of metabolic or bariatric surgery and use of anti-inflammatory or steroid therapy.

All the information of the patients was collected retrospectively from our hospital data system (ENLIL HBYS Co. Türkiye). Cobas c501 (Roche Diagnostics, GmbH, Manheim, Germany) instrument was used to estimate FSG, TG, levels. Serum FI estimation was performed on Cobas e411 (Roche Diagnostics, GmbH, Mannheim, Germany).

Statistical analysis

Participants were grouped on the basis of HOMA-IR values and evaluated according to their cutoff value as 2.5 [19]. After evaluating the qualitative variables, we looked at the distributions of the quantitative variables.

The relationship between the significant variables and THR was evaluated for HOMA-IR group. We defined the cutoff values and The Receiver Operating Characteristic (ROC) curves of THR for HOMA-IR group. Then, we performed logistic regression analysis of the selected variables based on our study group.

To learn more about the overall traits of the research group, descriptive analyses were carried out. Continuous variable data are displayed as mean±standard deviation, whereas categorical variable data are displayed as n (%). Independent sample t test was used to compare the normally distributed age, FSG, HDL variables between two groups and Mann-Whitney U Test was used to compare the non-normally distributed HOMA-IR, FI, TG, THR variables between two groups. To find performance metrics for predicting THR variable, ROC analysis was employed. In examining the relationships among the variables THR and age, FSG, HOMA-IR, HDL, FI, and TG, Spearman correlation coefficient was used. A multivariate logistic regression model was implemented to determine relation among selected variables and HOMA-IR. If a P value was less than 0.05, it was deemed statistically significant. For the computations, pre-made statistical software (SPSS 22.0 Chicago, IL, USA) was utilized.

Results

Participants in the study included 953 patients, whose mean age was 40.83±16.78. Research groups had significant differences ($p<0.001$) in FSG, HOMA-IR, FI, TG, and THR parameters, based on HOMA-IR cut off value of 2.5 (Table 1). In research groups, THR had a moderate negative correlation with HDL ($r=-0,555$, $p<0.001$), while strong positive correlation with TG ($r=0,959$, $p<0.001$) in pairwise correlation (Table 2). For HOMA-IR, THR had the highest selectivity and positive predictive value (PPV) with a cut off value of ≥2.64 (AUC:0,72, Se:65%, Sp:70% ($p<0.001$: 95% CI:0,66–0,78)) and ROC analysis results for THR are shown in Table 3. THR had the value of Area Under Curve (AUC) of 0.72 for HOMA-IR group in Receiver Operating Characteristic (ROC) analysis (Fig. 1). According to multivariate logistic regression analysis, men are 2.247 times more likely than women to have poor glycemic control and this difference is statistically significant ($p=0.022$). The risk of having poor glycemic control rises by 1.045 times with each unit of age, and this difference is statisti-

Table 1. Distribution of quantitative variables

Variables		HOMA-IR group		p
	Total (n=953) Mean±SD	<2.5 (n=379) Mean±SD	≥2.5 (n=574) Mean±SD	
Age (Year)	40.83±16.78	41.42±16.6	40.5±16.89	0.130
FSG (mg/dL)	115.28±59.91	99.88±34.48	123.77±68.67	<0.001
HDL-C (mg/dL)	50.97±12.51	56.62±13.93	47.94±10.53	<0.001
HOMA-IR	3.2 [2.08–5.22]	1.82 [1.34–2.24]	4.64 [3.47–7.13]	<0.001*
FI (mIU/mL)	12.63 [8.14–19.36]	7.78 [5.32–9.36]	17.7 [13.79–25.12]	<0.001*
TG (mg/dL)	127 [93.3–179]	109 [77–141.95]	145.1 [107–204]	<0.001*
THR	2.65 [1.54–4.07]	1.74 [1.2–2.89]	3.26 [1.96–5.12]	<0.001*

Data are shown as mean±standard deviation or median [Quartile 1-Quartile 3]. Independent Samples t test was used. *: Mann Whitney U test was used. HOMA-IR: Homeostasis model assessment-estimated insulin resistance; SD: Standard deviation; FSG: Fasting serum glucose; HDL-C: High-density lipoprotein cholesterol; FI: Fasting insulin; TG: Triglycerides; THR: Triglyceride/HDL-C ratio

Table 2. Pairwise correlation between variables

Variables	Total THR	HOMA-IR <2.5 THR	HOMA-IR ≥2.5 THR
Age (year)			
r	0.069	0.268*	0.111
p	0.258	0.005	0.165
FSG (mg/dL)			
r	0.276*	0.399*	0.219*
p	<0.001	<0.001	0.006
HOMA-IR			
r	0.372*	0.239*	0.292*
p	<0.001	0.012	<0.001
HDL (mg/dL)			
r	-0.555*	-0.613*	-0.549*
p	<0.001	<0.001	<0.001
FI (mIU/mL)			
r	0.254*	0.087	0.146
p	<0.001	0.364	0.066
TG (mg/dL)			
r	0.959*	0.924*	0.962*
p	<0.001	<0.001	<0.001

Spearman correlation coefficient was used. *: Statistically significant positive correlations. HOMA-IR: Homeostasis model assessment-estimated insulin resistance; THR: Triglyceride/HDL-C ratio; FSG: Fasting serum glucose; HDL: High-density lipoprotein; FI: Fasting insulin; TG: Triglycerides.

cally significant (p=0.007). The likelihood of having poor glycemic control rises by 1.056 times for every unit of FSG, and this increase is statistically significant (p=0.001) (Table 4).

Discussion

Patients in our study who had uncontrolled T2DM had elevated THR levels as well. Additionally, there was a negative association between THR and HDL levels, while there was a significant high positive association with TG, and a low positive association with FSG and HOMA-IR. These findings imply that THR can be considered independently as a major predictor to determine the increased risk of acquiring incident T2DM.

IR and reduced βeta-cell activity are characteristics of incident T2DM [20]. The presence of IR causes hyperglycemia and hyperlipidemia in a variety of tissues, including muscle, liver, adipose, and pancreatic β-cells [21]. Triglycerides reduce glucokinase activity and glucose-stimulated insulin release in islets during hypertriglyceridemia [22]. Hyperglycemia results in ongoing oxidative stress on islet cells, even if the cells themselves have a lower antioxidant capacity [23]. Therefore, lipotoxicity and glucose toxicity may have an effect on β-cell failure [21].

Considering its critical role in T2DM and metabolic syndrome, IR assessment is important. In epidemiological studies and clinical practice, HOMA is a widely used and proven technique to measure IR from FSG and insulin [24]. In 28 studies, HOMA-IR was the most commonly used technique to measure IR [18]. In our study, HOMA-IR was significantly increased in poor glycemic control group and it was positively and significantly associated with THR, which was consistent with the existing research results.

Baneu et al. [25] stated in their review that ROC curve analysis for the assessment of IR was used in 17 studies with an AUC greater than 0.7, indicating a reasonable predictive power. In line with this result, we found an AUC of 0.72 in our study, indicating a moderate predictive power of THR.

FI is a measurement that assesses insulin levels in the blood following an overnight fast. Despite its simplicity, it does not provide a complete picture of insulin sensitivity, which limits its usefulness [26, 27]. FI was significantly increased in poor glycemic control group and it had a positive significant association with THR in our study.

The hyperinsulinemic-euglycemic clamp technique is the gold standard for determining insulin sensitivity and resistance. This approach is labor-intensive, expensive, and re-

Tablo 3. ROC analysis results for THR

Variable	Cut-off	AUC (95% CI)	Se	Sp	PPV	NPV	p
THR	≥2.64	0.72 (0.66–0.78)	0.65	0.70	0.76	0.58	<0.001

ROC: Receiver operating characteristic; THR: Triglyceride/HDL-C ratio; AUC: Area under curve, CI: Confidence interval; Se: Sensitiviy; Sp: Specifity; PPV: Positive predictive value; NPV: Negative predictive value.

Table 4. Logistic regression analysis of selected variables

Model	Univarite				Multivariate			
	p	Odds ratio	95% CI for odds ratio		p	Odds ratio	95% CI for odds ratio	
			Lower	Upper			Lower	Upper
Gender (F/M)	0.026	1.382	1.040	1.835	**0.022**	2.247	1.051	4.504
Age (year)	0.130	1.007	0.986	1.002	**0.001**	1.056	1.033	1.081
FSG (mg/dL)	<0.001	1.016	1.010	1.021	0.007	1.045	1.012	1.079
HDL_cholesterol	<0.001	1.066	0.918	0.958	**0.032**	1.053	1.004	1.103
TG (mg/dL)	<0.001	1.009	1.006	1.012	0.884	1.002	0.979	1.025
THR	<0.001	1.534	1.295	1.818	0.991	0.996	0.487	2.034

Reference category: Women for Gender. CI: Confidence interval; FSG: Fasting serum glucose; HDL: High-density lipoprotein; TG: Triglycerides; THR: Triglyceride/HDL-C ratio.

quires extensive knowledge [28, 29]. We could not evaluate this technique in our cross-sectional study.

According to diabetic medical care guidelines, asymptomatic adult patients with high blood levels of TG and low HDL cholesterol are at risk for developing pre-diabetes and diabetes [30]. Finding relevant biomarkers like THR for T2DM can aid in the follow-up and development of new treatment plans to increase patient survival [31].

In the study by Jabeen et al. [17], THR levels were found to be increased in patients with uncontrolled T2DM in line with our results. In the study by Gedikli et al. [32]. increased FSG levels were positively associated with THR in Chinese T2DM patients, which was consistent with our findings. THR was significantly increased in poor glycemic control group.

Cutoff levels for THR are an important consideration in clinical practice. In 50% of research, authors provided particular cutoff values, whereas the rest treated the THR as a continuous variable. When exact ratios were provided, they were either generic for the entire group or based on race or gender, with many cutoffs proposed. According to three research studies conducted between 2005 and 2008 [33–35], the highest score was 3.5 for both genders. The median cutoff value for women was 2.53, while men's was 2.8. Li et al. [36] addressed the ethnicity question in 2008 and found no significant difference in Odd Ratio (OR) in 3 separate subpopulations of their study, non-Hispanic whites, non-Hispanic blacks, and Mexican Americans, respectively; using ethnicity-specific cutoff points, the THR was 3.0 for Caucasians and Mexican Americans and 2.0 for African Americans. In our study, the THR cutoff value was determined as 2.64 with a moderate predictive value. In addition, men were 2.2 times more likely than women to have poor glycemic control. Poor glycemic control risk rised by 1.045 times with age and by 1.1 times with FSG levels.

Strengths of the study

It includes a large community-based sample size across a wide age range, high participation rates, standardized high-quality clinical and laboratory procedures, and adjustment for numerous potential confounding factors.

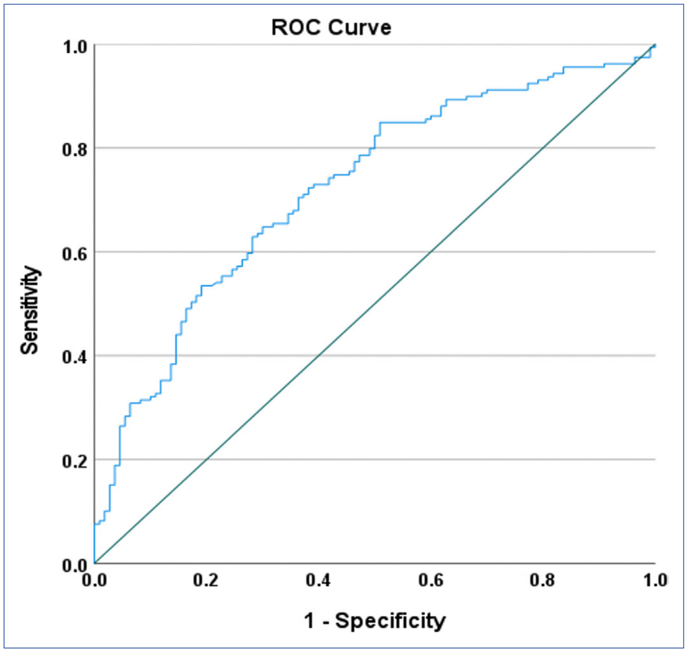

Figure 1. ROC curve of THR.

ROC: Receiver operating characteristic; THR: Triglyceride/HDL-C ratio.

Limitations of our study

The main limitations are that the study was a retrospective cross-sectional study and its relationship with T2DM complications was not assessed, the progression of diabetes was not followed and any causal relationship between our findings was not inferred. Although the results appear significant, they should be confirmed by the euglycemic clamp method.

Conclusion

Our results raise the prospect of using THR for diabetes risk assessment in actual clinical settings or extensive epidemiologic research because it is simple to compute from standard laboratory data.

Ethics Committee Approval: The study was approved by the Tokat Gaziosmanpaşa University Faculty of Medicine Clinical Research Ethics Committee (no: 23-KAEK-252, date: 26/10/2023).

Informed Consent: Informed consent was obtained from all participants.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Funding: The authors declared that this study received no financial support.

Use of AI for Writing Assistance: No AI technologies utilized.

Authorship Contributions: Concept – M.K., O.D.; Design – M.K., O.D.; Supervision – M.K., O.D.; Funding – M.K., O.D.; Materials – M.K., O.D.; Data collection and/or processing – M.K., O.D.; Data analysis and/or interpretation – M.K., O.D.; Literature search – M.K., O.D.; Writing – M.K., O.D.; Critical review – M.K., O.D.

Acknowledgments: We thank our laboratory staff for their great contribution to our study.

Peer-review: Externally peer-reviewed.

References

1. Ergör G, Soysal A, Sözmen K, Ünal B, Uçku R, Kılıç B, et al. Balcova heart study: Rationale and methodology of the Turkish cohort. Int J Public Health 2012;57(3):535–42. [CrossRef]
2. Süleymanlar G, Utaş C, Arinsoy T, Ateş K, Altun B, Altiparmak MR, et al. A population-based survey of chronic renal disease In Turkey--the CREDIT study. Nephrol Dial Transplant 2011;26(6):1862–71. [CrossRef]
3. Teo K, Chow CK, Vaz M, Rangarajan S, Yusuf S. The Prospective Urban Rural Epidemiology (PURE) study: Examining the impact of societal influences on chronic noncommunicable diseases in low-, middle-, and high-income countries. Am Heart J 2009;158(1):1–7. [CrossRef]
4. Ünal B, Sözmen K, Uçku R, Ergör G, Soysal A, Baydur H, et al. High prevalence of cardiovascular risk factors in a Western urban Turkish population: A community-based study. Anadolu Kardiyol Derg 2013;13(1):9–17. [CrossRef]
5. Tohidi M, Baghbani-Oskouei A. Fasting plasma glucose is a stronger predictor of diabetes than triglyceride-glucose index, triglycerides/high-density lipoprotein cholesterol, and homeostasis model assessment of insulin resistance: Tehran Lipid and Glucose Study. Acta Diabetol 2018 2018;55(10):1067–74. [CrossRef]
6. Wulandari P, Andika, Halide H. Determining significant factors associated with daily COVID-19 cases within three social distancing regimes. Gac Sanit 2021;35(2):455–8. [CrossRef]
7. Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med 2002;346(6):393–403. [CrossRef]
8. Dobiásová M, Frohlich J. The plasma parameter log (TG/HDL-C) as an atherogenic index: Correlation with lipoprotein particle size and esterification rate in apoB-lipoprotein-depleted plasma (FER(HDL)). Clin Biochem 2001;34(7):583–8. [CrossRef]
9. González-Chávez A, Simental-Mendía LE, Elizondo-Argueta S. Elevated triglycerides/HDL-cholesterol ratio associated with insulin resistance. Cir Cir 2011;79(2):126–31.
10. Keles N, Aksu F, Aciksari G, Yilmaz Y, Demircioglu K, Kostek O, et al. Is triglyceride/HDL ratio a reliable screening test for assessment of atherosclerotic risk in patients with chronic inflammatory disease? North Clin Istanb 2016;3(1):39–45. [CrossRef]
11. Caleyachetty R, Thomas GN, Toulis KA, Mohammed N, Gokhale KM, Balachandran K, et al. Metabolically healthy obese and incident cardiovascular disease events among 3.5 million men and women. J Am Coll Cardiol 2017;70(12):1429–37. [CrossRef]
12. Quispe R, Martin SS, Jones SR. Triglycerides to high-density lipoprotein-cholesterol ratio, glycemic control and cardiovascular risk in obese patients with type 2 diabetes. Curr Opin Endocrinol Diabetes Obes 2016;23(2):150–6. [CrossRef]
13. Lee EY, Yang HK, Lee J, Kang B, Yang Y, Lee SH, et al. Triglyceride glucose index, a marker of insulin resistance, is associated with coronary artery stenosis in asymptomatic subjects with type 2 diabetes. Lipids Health Dis 2016;15(1):155. [CrossRef]
14. Ren X, Chen ZA, Zheng S, Han T, Li Y, Liu W, et al. Association between triglyceride to HDL-C ratio (TG/HDL-C) and insulin resistance in Chinese patients with newly diagnosed type 2 diabetes mellitus. PLoS One 2016;11(4):e0154345. [CrossRef]
15. Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, et al. Harmonizing the metabolic syndrome: A joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. Circulation 2009;120(16):1640–5. [CrossRef]
16. Hong S, Han K, Park CY. The triglyceride glucose index is a simple and low-cost marker associated with atherosclerotic cardiovascular disease: A population-based study. BMC Med 2020;18(1):361. [CrossRef]
17. Jabeen WM, Jahangir B, Khilji S, Aslam A. Association of triglyceride glucose index and triglyceride HDL ratio with glucose levels, microvascular and macrovascular complications in Diabetes Mellitus Type-2. Pak J Med Sci 2023;39(5):1255–9. [CrossRef]

18. Matthews DR, Hosker JP, Rudenski AS, Naylor BA, Treacher DF, Turner RC. Homeostasis model assessment: Insulin resistance and beta-cell function from fasting plasma glucose and insulin concentrations in man. Diabetologia 1985;28(7):412–9. [CrossRef]
19. Yıldız M, İnci H, Korkut B, Kalem P, Ozkan AE, Adahan D. The role of triglyceride/glucose index in determining insulin resistance in patients diagnosed with hypertension. Unika Sag Bil Derg [Article in Turkish] 2024;4(1):652–60.
20. Zheng Y, Ley SH, Hu FB. Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. Nat Rev Endocrinol 2018;14(2):88–98. [CrossRef]
21. DeFronzo RA, Ferrannini E, Groop L, Henry RR, Herman WH, Holst JJ, et al. Type 2 diabetes mellitus. Nat Rev Dis Primers 2015;1:15019. [CrossRef]
22. Man ZW, Zhu M, Noma Y, Toide K, Sato T, Asahi Y, et al. Impaired beta-cell function and deposition of fat droplets in the pancreas as a consequence of hypertriglyceridemia in OLETF rat, a model of spontaneous NIDDM. Diabetes 1997;46(11):1718–24. [CrossRef]
23. Robertson RP, Harmon J, Tran PO, Poitout V. Beta-cell glucose toxicity, lipotoxicity, and chronic oxidative stress in type 2 diabetes. Diabetes 2004;53(1):119–24. [CrossRef]
24. Wallace TM, Levy JC, Matthews DR. Use and abuse of HOMA modeling. Diabetes Care 2004;27(6):1487–95. [CrossRef]
25. Baneu P, Văcărescu C, Drăgan SR. The triglyceride/HDL ratio as a surrogate biomarker for insulin resistance. Biomedicines 2024;12(7):1493. [CrossRef]
26. Calle EE, Thun MJ, Petrelli JM, Rodriguez C, Heath CW, Jr. Body-mass index and mortality in a prospective cohort of U.S. adults. N Engl J Med 1999;341(15):1097–105. [CrossRef]
27. Ferrannini E, Natali A, Bell P, Cavallo-Perin P, Lalic N, Mingrone G. Insulin resistance and hypersecretion in obesity. European Group for the Study of Insulin Resistance (EGIR). J Clin Invest 1997;100(5):1166–73. [CrossRef]
28. DeFronzo RA, Tobin JD, Andres R. Glucose clamp technique: A method for quantifying insulin secretion and resistance. Am J Physiol 1979;237(3):E214–23. [CrossRef]
29. Ferrannini E, Mari A. How to measure insulin sensitivity. J Hypertens 1998;16(7):895–906. [CrossRef]
30. Standards of medical care in diabetes-2017 Abridged for primary care providers. Clin Diabetes 2017;35(1):5–26. [CrossRef]
31. Variji A, Shokri Y, Fallahpour S, Zargari M, Bagheri B, Abediankenari S, et al. The combined utility of myeloperoxidase (MPO) and paraoxonase 1 (PON1) as two important HDL-associated enzymes in coronary artery disease: Which has a stronger predictive role? Atherosclerosis 2019;280:7–13. [CrossRef]
32. Gedikli MA, Kalın BS, Aktaş A. Relationship between HbA1c level and triglyceride/HDL cholesterol ratio and triglyceride glucose index in diabetes patients. Bagcilar Med Bull 2022;7(1):27–31. [CrossRef]
33. McLaughlin T, Reaven G, Abbasi F, Lamendola C, Saad M, Waters D, et al. Is there a simple way to identify insulin-resistant individuals at increased risk of cardiovascular disease? Am J Cardiol 2005;96(3):399–404. [CrossRef]
34. Bovet P, Faeh D, Gabriel A, Tappy L. The prediction of insulin resistance with serum triglyceride and high-density lipoprotein cholesterol levels in an East African population. Arch Intern Med 2006;166(11):1236–7. [CrossRef]
35. Quijada Z, Paoli M, Zerpa Y, Camacho N, Cichetti R, Villarroel V, et al. The triglyceride/HDL-cholesterol ratio as a marker of cardiovascular risk in obese children; association with traditional and emergent risk factors. Pediatr Diabetes 2008;9(5):464–71. [CrossRef]
36. Li C, Ford ES, Meng YX, Mokdad AH, Reaven GM. Does the association of the triglyceride to high-density lipoprotein cholesterol ratio with fasting serum insulin differ by race/ethnicity? Cardiovasc Diabetol 2008;7:4. [CrossRef]