



Relationship Between Triglycerides and Glucose Index (TyG) And Lipid Profile in Patients with Dyslipidemia Treated with Bay Leaf Extract [*Syzygium Polyanthum* (Wight) Walp]

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Abstract. Background: Insulin Resistance (IR) causes a metabolic disorder including hyperglycemia, high blood pressure, and dyslipidemia. The purpose of the study was to assess the relationship of Triglycerides and Glucose Index (TyG) decline relationship with lipid profile after bay leaf extract treatment in dyslipidemia patients. Method: Fifteen dyslipidemia patients were administered 2x200 mg salam leaf extract capsules for 30 days. Criteria dyslipidemia is defined as one of the following: total cholesterol level ≥ 240 mg/dL, triglyceride levels ≥ 150 mg/dL, LDL cholesterol levels ≥ 140 mg/dL, HDL cholesterol levels < 40 mg/dL, or the use of lipid-lowering drugs. Blood samples lipid profile for biochemical tests were drawn in the morning after fasting 12 h. Anthropometric BMI and waist circumference measures were taken using standard procedures. The TG/HDL-C ratio was calculated by dividing the serum concentration of TG by HDL-C measured in mg/dL. TyG index was calculated based on formula: $\ln [TG (mg/dL) \times FG (mg/dL)]$. Result: After 30 days of salam leaf extract treatment, there was a significant correlation of TyG reduction with parameters TC, LDL-C, TG, TG/HD ratio ($p: 0.025^*$, $p: 0.001^*$, $p: 0.013^*$, sequentially) Conclusion: There is a significant correlation between Tyg reduction with TC, TG, and TG/HDL, which leads to a decrease in cardiovascular risk in dyslipidemia patients.

Keyword: TyG, Dyslipidemia, *Syzygium Polyanthum* (Wight) Walp

Abstrak. Latar belakang: Resistensi insulin (RI) menyebabkan gangguan metabolisme termasuk hiperglikemia, tekanan darah tinggi, dan dislipidemia. Tujuan penelitian adalah menilai hubungan penurunan index TyG dengan profil lipid setelah pengobatan ekstrak daun salam pada pasien dislipidemia. Metode: Lima belas pasien dislipidemia diberikan 2x200 mg kapsul ekstrak daun salam selama 30 hari. Dan Kriteria dislipidemia didefinisikan sebagai salah satu dari yang berikut: tingkat kolesterol total ≥ 240 mg/dL, kadar trigliserida ≥ 150 mg/dL, kadar kolesterol LDL ≥ 140 mg/dL, kadar kolesterol HDL < 40 mg/dL, atau penggunaan obat penurun lipid. Sampel darah profil lipid untuk uji biokimia diambil pada pagi hari setelah puasa 12 jam. Pengukuran IMT antropometri dan lingkaran pinggang menggunakan prosedur standar. Rasio TG / HDL-C dihitung dengan membagi konsentrasi serum TG dengan HDL-C diukur dalam mg / dL. Indeks TyG dihitung berdasarkan rumus:

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Ln [TG (mg / dL) x FG (mg / dL)]. Hasil: Setelah pengobatan ekstrak daun salam selama 30 hari, terdapat korelasi signifikan penurunan TyG dengan parameter TC, LDL-C, TG, rasio TG/HD (p: 0.025, p: 0.001*, p: 0.013*, secara berurutan). Kesimpulan: Terdapat korelasi yang signifikan antara penurunan TyG dengan TC, TG dan TG/HDL, yang menunjukkan penurunan risiko kardiovaskular pada pasien dislipidemia*

Kata Kunci: TyG, Dislipidemia, *Syzygium Polyanthum* (Wight) Walp

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1 Introduction

Insulin resistance (IR) causes decreased cell sensitivity to insulin and is a central characteristic of metabolic syndrome (MS). IR tends to cause metabolic disorders including hyperglycemia, high blood pressure, and dyslipidemia all associated with diabetes, atherosclerosis, and cardiovascular disease. IR evaluation requires advanced methods and is not available in daily clinical practice. [2] Hyperinsulinemic-euglycemic clamp is a direct method of measuring IR and is considered a gold standard procedure, but difficult to perform in daily practice. Instead of IR examination includes the assessment of homeostatic IR (HOMA-IR) models i.e. measurement of fasting glucose and insulin levels. [3] Due to the difficulty of assessing the RI, sought other practical ways.[4] Other alternatives assess IR by measuring plasma TG and HDL cholesterol (TG/HDL-C),[5] and TG/plasma/glucose called triglyceride and glucose index (TyG).[6] TyG is associated with HOMA-IR, insulin suppression tests, and hyperinsulinemic-euglycemic clamps. [7]

Bay leaves contain tannin, galokatekin, flavonoids, saponins (triterpenoid), and essential oils (sesquiterpenes). Bay leaves also contain several vitamins, including vitamin A, vitamin C, vitamin E, thiamine, riboflavin, niacin, vitamin B6, vitamin B12, and folate. The results of in vitro studies showed that flavonoids work as inhibitors of the HMG-CoA reductase enzyme so that cholesterol synthesis decreases. An estimated 75 - 80% of people in developing countries and 25% in developed countries use traditional medicine as first-line treatment. The administration of bay leaf extract 400 mg per day for 30 days there was a significant decrease in TC, LDL, TG (p: 0.012, p: 0.035, p: 0.009, sequentially) in dyslipidemia patients.[8].

The purpose of the study was to assess the relationship of TyG index decline as a sign of RI with lipid profile after treatment of bay leaf extract in dyslipidemia patients

2 Method

Fifteen dyslipidemia patients were given 2x200 mg of bay leaf extract capsules for 30 days. Subject dyslipidemia with other inflammations, infections, use of anti-inflammatory drugs, and secondary dyslipidemia excluded from the study. Dyslipidemia criteria are defined as one of the following: total cholesterol levels ≥ 240 mg/dL, triglyceride levels ≥ 150 mg/dL, low-density lipoprotein (LDL) cholesterol levels ≥ 140 mg/dL, high-density lipoprotein (HDL) cholesterol levels < 40 mg/dL, or the use of lipid-lowering drugs. Blood samples lipid profile for biochemical

tests were drawn in the morning, after fasting 12 h. Anthropometric measures were taken using standard procedures. [9] Waist circumference (cm) was measured halfway between the lower lateral margin of the last rib and the anterior superior region of the iliac crest while standing, using a flexible, not distensible measuring tape. Body mass index was calculated as weight (kg)/height (m)². The TyG index was calculated as the natural logarithm (Ln) of the product of plasma glucose and TG using the formula: $\text{Ln} (\text{TG} [\text{mg/dL}] \times \text{glucose} [\text{mg/dL}]/2)$. [6] The TG/HDL-C ratio was calculated by dividing the serum concentration of TG by HDL-C measured in mg/dL. TyG index was calculated based on formula: $\text{Ln} [\text{TG} (\text{mg/dL}) \times \text{FG} (\text{mg/dL})/2]$, according to the previous studies. [10]

All statistical analyses were performed using the SPSS statistical package for Windows (version 16.0, SPSS). Kolmogorov–Smirnov test was used to test the normality of the distribution of variables. The differences within groups were analyzed by the dependent t-test where appropriate. Univariate correlation coefficients were determined by Spearman analysis.

3 Result

In table 1, all study patients were male, dyslipidemia and overweight/obese.

Table 1 Basic data of research subjects

Variable	(n =15) mean \pm SD
Age (years)	50.40 \pm 5.22
WC (cm)	88,33 \pm 7,18
BMI (kg/m ²)	27.54 \pm 3.22
FBS (mg/dL)	94,20 \pm 15,03
TC (mg/dL)	229,13 \pm 14,99
LDL-C (mg/dL)	155,00 \pm 22,55
HDL-C (mg/dL)	51,13 \pm 7,73
TG (mg/dL)	149,93 \pm 70,56
TG/HDL	3.10 \pm 1.84
TyG	4.80+0.41

Note: WC: waist circumference; BMI: body mass index; FBS: fasting blood sugar; TC: total cholesterol; LDL-C: low density lipoprotein; HDL-C: high density lipoprotein; TG: triglyceride; TyG: Triglycerides And Glucose Index

In table 2, there were significant differences in TC, LDL-C, TG, TG/HDL ratios, while TyG decreased but not significantly.

Table 2 Differences in TyG and lipid profile after treatment

Variabel	D ₀	D ₃₀	p _a
	Mean ± SD	Mean ± SD	
WC (cm)	91.46 ± 4.43	91.50 ± 4.37	0.109
BMI (kg/m ²)	27.54 ± 3.21	27.53 ± 3.19	1.000
FBS (mg/dL)	94.20 ± 15.03	89.06 ± 13.24	0.116
TC (mg/dL)	229,13 ± 14,99	217,53 ± 23,10	0,012*
LDL-C (mg/dL)	155,00 ± 22,55	145,67 ± 29,37	0,035*
HDL-C (mg/dL)	51,13 ± 7,73	50,07 ± 7,5	0,318
TG (mg/dL)	149,93 ± 70,56	112,13 ± 37,92	0,009*
TG/HDL	3.1 ± 1.84	2.40 ± 0.98	0.040*
TyG	4.80 ± 0.41	4.66 ± 0.48	0.317

Note: WC: waist circumference; BMI: body mass index; FBS: fasting blood sugar; TC: total cholesterol; LDL-C: low density lipoprotein; HDL-C: high density lipoprotein; TG: triglyceride; TyG: Triglycerides and Glucose Index.

In table 3. There is a significant correlation between TyG and TC, TG and TG/HDL

Table 3 Correlation between TyG and lipid profiles after treatment

Variabel	r	p
WC (cm)	0.297	0.283
BMI (kg/m ²)	0.246	0.377
FBS (mg/dL)	0.164	0.559
TC (mg/dL)	0.573	0.025*
LDL-C (mg/dL)	0.475	0.074
HDL-C (mg/dL)	-0.278	0.315
TG (mg/dL)	0.786	0.001*
TG/HDL	0.625	0.013*

Note: WC: waist circumference; BMI: body mass index; TC: total cholesterol; LDL-C: low density lipoprotein; HDL-C: high density lipoprotein; TG:triglyceride;

4 Discussion

Average Indeks TyG and TG/HDL-C ratio are very high in subjects with MS compared to those without MS. TyG index also increases as the number of MS components increases, and there is a good correlation between TyG index and TG/HDL-C ratio. This data is consistent with previous evidence that supports TyG index values and TG/HDL-C ratios as IR markers.[6] TyG can help to assess IR as it shows sensitivity (96.5%) and specificity (85.0%) when assessed compared to hyperinsulinemic-euglycemic clamp.[11]

The studies conducted in the non-diabetic population, that the TyG index and TC/HDL-C ratio have a moderate correlation just like the index that uses fasting insulin, assessing glucose absorption by insulin, then this indicates that alternative IR markers based on lipid measurements help detect IR. Due to the similarity of the cut-off index points of TyG to distinguish in men (8.8) and women (8.7) MS in research, sex stratification is considered unnecessary use in daily clinical practice.

However, more studies are needed to validate this index in other populations to generalize the cut-off value. TG/HDL-C ratio value, in the overall MS population, is 2.4, in contrast to TyG index which is different after sex stratification. The cut-off points reported in the study were 2.2 for women and 3.1 for men, similar to the values reported by Salazar et al in Argentina's population (2.5 for women and 3.5 for men).[12] The TG/HDL cholesterol ratio was positively associated with the prevalence of silent brain infarct (SBI) in a neurologically healthy population,[13] and an independent predictor of all-cause mortality and cardiovascular events,[14] The TyG index was significantly associated with the risk of incident diabetes and could be a valuable biomarker of developing diabetes,[15] a predictor of incident CKD,[16] and predictor of impaired glucose tolerance in overweight and obese adolescents.[17]

In this study, TyG was significantly correlated with TC, TG, and TG/HDL, leading to cardiovascular risk in dyslipidemia patients.

5 Conclusions

There is a significant correlation between tyg reduction with TC, TG and TG/HDL, this leads to cardiovascular risk in dyslipidemia patients.

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