Triglyceride glucose index is a superior biomarker for predicting type 2 diabetes mellitus in children and adolescents

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INTRODUCTION

The triglyceride-glucose (TyG) index has been associated with predicting type 2 diabetes mellitus (T2DM); however, its relationship with the homeostatic model assessment of insulin resistance (HOMA-IR) in T2DM has not been established.

AIM

We investigated the role of the TyG index for detecting T2DM in children and adolescents and compared it with the HOMA-IR index.

RESULTS

Table 1. Clinical characteristics of the study population (*n*=176)

	Non-T2DM n=122	T2DM n=54	*P*
Age (years)	9.92 ± 2.56	14.25 ± 2.29	<0.001
Height SDS	0.99 ± 1.17	1.49 ± 1.39	0.016
Weight SDS	2.60 ± 0.84	2.42 ± 1.51	0.414
BMI SDS (kg/m²)	3.01 ± 0.93	2.19 ± 1.63	0.001
TC (mg/dL)	179.51 ± 31.46	181.63 ± 44.22	0.718
HDL-C (mg/dL)	48.43 ± 10.10	44.15 ± 10.86	0.013
TG (mg/dL)	130.90 ± 90.30	147.80 ± 79.50	0.237
LDL-C (mg/dL)	112.37 ± 25.00	115.19 ± 32.30	0.477
Glucose (mg/dL)	93.60 ± 10.18	195.44 ± 83.72	<0.001
Insulin (µU/mL)	18.66 ± 14.04	17.38 ± 15.20	0.586
HbA1c (%)	5.41 ± 0.38	9.92 ± 2.63	<0.001
HOMA-IR	4.44 ± 3.57	7.30 ± 5.64	0.001
TyG index	8.56 ± 0.55	9.36 ± 0.64	<0.001

SDS, standard deviation score; BMI, body mass index; TC, total cholesterol; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; TG, triglyceride; TyG index, triglyceride and glucose index; HOMA-IR, homeostatic model assessment of insulin resistance.

Table 2. The unadjusted and adjusted correlation between TyG index and clinical parameters in type 2 diabetes mellitus (*n*=176)

	Unadjusted model		Adjusted model 1		Adjusted model 2	
	r	P	r	P	r	P
Sex (girls)	-0.058	0.441	-	-	-	-
Age (years)	0.487	<0.001	-	-	-	-
BMI SDS (kg/m²)	-0.134	0.076	0.004	0.958	-	-
TC (mg/dL)	0.245	0.001	0.271	0.001	0.272	<0.001
HDL-C (mg/dL)	-0.447	<0.001	-0.369	<0.001	-0.370	<0.001
TG (mg/dL)	0.740	<0.001	0.753	<0.001	0.756	<0.001
LDL-C (mg/dL)	0.278	<0.001	0.289	<0.001	0.289	<0.001
HbA1c (%)	0.590	<0.001	0.412	<0.001	0.425	<0.001
Insulin (µU/mL)	0.111	0.144	0.028	0.720	0.029	0.716
FSG	0.632	<0.001	0.509	<0.001	0.518	<0.001
HOMA-IR	0.338	<0.001	0.209	0.007	0.220	0.005

SDS, standard deviation score; BMI, body mass index; TC, total cholesterol; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; TG, triglyceride; FSG, fasting serum glucose; TyG index, triglyceride and glucose index; HOMA-IR, homeostatic model assessment of insulin resistance

Model 1 was adjusted by controlling for sex and age.

Model 2 was adjusted by controlling for sex, age, and BMI SDS.

Table 3. The association between TyG index and clinical parameters in T2DM using multiple linear regression analysis in the study population (*n*=176)

Variables	Multivariate (adjusted R² 0.919, P<0.001)	
	Standarized β	P
Age (years)	0.057	0.036
Glucose (mg/dL)	0.530	<0.001
TG (mg/dL)	0.617	<0.001
LDL-C (mg/dL)	0.150	<0.001
HDL-C (mg/dL)	-0.104	<0.001
HOMA-IR	0.053	0.029

Figure 1. ROC curves comparing the AUC for the TyG index (red line) and HOMA-IR (blue line) for detection of T2DM

ROC, receiver operating characteristic; AUC, area under the curve; TyG, triglyceride-glucose; HOMA-IR, homeostatic model assessment of insulin resistance; T2DM, type 2 diabetes mellitus.

METHOD

Subjects
- Cross-sectional study analyzed clinical data from 176 children and adolescents (January 2000 ~ June 2020)
- Inclusion criteria
- Patients diagnosed with overweight, obese, acanthosis nigricans, or type 2 diabetes mellitus
- Exclusion criteria
-History of type 1 diabetes mellitus, microalbuminuria, retinopathy, neuropathy, and other endocrine diseases

Measurements
- The TyG index was calculated as follows: ln(fasting TG [mg/dL] × fasting glucose [mg/dL]/2).
- HOMA-IR was calculated as fasting insulin (mIU/L) × fasting glucose (mg/dL) /405).

CONCLUSIONS

The TyG index was significantly associated with insulin resistance in T2DM and could be superior to HOMA-IR in predicting T2DM in children and adolescents.

REFERENCES

1. Mohd Nor NS, Lee S, Bacha F, Tfayli H, Arslanian S. Triglyceride glucose index as a surrogate measure of insulin sensitivity in obese adolescents with normoglycemia, prediabetes, and type 2 diabetes mellitus: comparison with the hyperinsulinemic euglycemic clamp. Pediatr Diabetes. 2016;17(6):458-65.

2. Low S, Khoo KCJ, Irwan B, Sum CF, Subramaniam T, Lim SC, et al. The role of triglyceride glucose index in development of Type 2 diabetes mellitus. Diabetes Res Clin Pract. 2018;143:43-9.
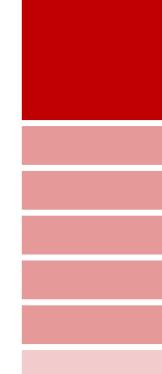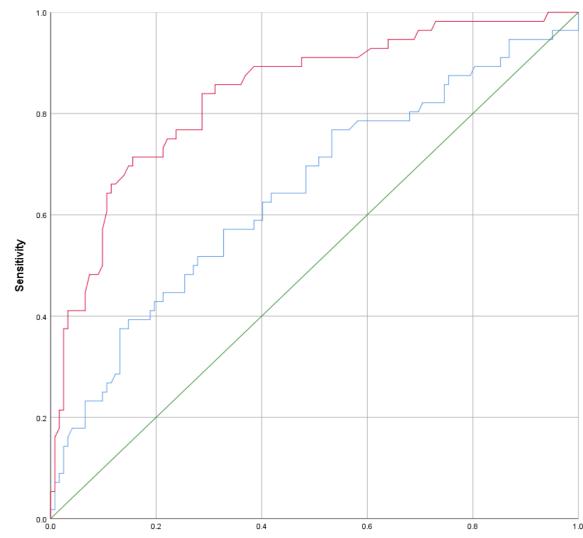
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