LETTERS TO THE EDITOR

TyG in insulin resistance prediction☆

TyG na predição da resistência à insulina

Dear Editor,

We read with interest the article ''The TyG index cutoff point and its association with body adiposity and lifestyle in children'' by Vieira-Ribeiro et al.,[1] published in the *Jornal de Pediatria,* which proposes TyG (triglyceride-glucose índex) cutoff points for the prediction of insulin resistance (IR) in school-aged children and preschoolers. The study makes an important contribution to the topic, considering the need to establish cutoff points to use this tool in the Brazilian pediatric population.

From this perspective, we believe it is very important to warn the authors about a probable mistake in the calculation of TyG. Although the calculation error does not impair the predictive capacity of this method, the proposed cutoff points are significantly altered. This method was proposed by Guerrero-Romero in an article published in 2010,[2] and the calculation is described as follows: [ln(fasting triglycerides) (mg/dL) × fasting glucose (mg/dL)/2], and the values found by the authors was 3.7 (values for healthy adults). However, in another publication by the same authors in 2016,[3] we can verify that the indicated calculation is as follows:[ln(fasting triglycerides (mg/dL) × fasting glucose (mg/dL)]/2, and the values shown by the authors in this article was 4.5 (values for healthy adult men and women).

The chart below shows that, according to the formula used, different TyG values will be obtained, since the first formula divides by 2 before performing the logarithmic operation and the second formula divides by 2 after the logarithmic operation of the serum triglyceride and glucose product.

Formula	TG	Glucose	TyG
1st [ln(fasting triglycerides) (mg/dL) × fasting glucose (mg/dL)/2]	168.3	88.3	8.91
2nd [ln(fasting triglycerides (mg/dL) × fasting glucose (mg/dL)]/2	168.3	88.3	4.80

Therefore, it is likely that the formula used by the authors who proposed the method is the latter of the two, since the values presented in both articles are between 3.7 and 4.5.

This error in the formula presentation led other authors,[4–6] including Vieira-Ribeiro et al.,[1] to use the first formula to obtain the TyG, achieving much higher values than those shown by the method's proponents.

Therefore, we suggest to the authors Vieira-Ribeiro et al.[1] that they recalculate the values of TyG based on the second formula, aiming to present more appropriate cutoffs to the original proposal and to allow an appropriate comparison with future studies, which also must adhere to the proper calculation of this index.

Conflicts of interest

The authors declare no conflicts of interest.

References

1. Vieira-Ribeiro SA, Fonseca PC, Andreoli CS, Ribeiro AQ, Hermsdorff HH, Pereira PF, et al. The TyG index cutoff point and its association with body adiposity and lifestyle in children. J Pediatr (Rio J). 2019;95:217–23.
2. Guerrero-Romero F, Simental-Mendía LE, González-Ortiz M, Martínez-Abundis E, Ramos-Zavala MG, Hernández-González SO, et al. The product of triglycerides and glucose, a simple measure of insulin sensitivity. Comparison with the euglycemic-hyperinsulinemic clamp. J Clin Endocrinol Metab. 2010;95:3347–51.
3. Guerrero-Romero F, Villalobos-Molina R, Jiménez-Flores, Simental-Mendía LE, Méndez-Cruz R, Murguía-Romero M, et al. Fasting triglycerides and glucose index as a diagnostic test for insulin resistance in young adults. Arch Med Res. 2016;47:382–7.
4. Kang B, Yang Y, Lee EY, Yang HK, Kim HS, Lim SY, et al. Triglycerides/glucose index is a useful surrogate marker of insulin resistance among adolescents. Int J Obes. 2017;41:789–92.
5. Moon S, Park JS, Ahn Y. The cut-off values of triglycerides and glucose index for metabolic syndrome in American and Korean adolescents. J Korean Med Sci. 2017;32:427–33.

6. Angoorani P, Heshmat R, Ejtahed HS, Motlagh ME, Ziaodini H, Taheri M, et al. Validity of triglyceride–glucose index as an indicator for metabolic syndrome in children and adolescents: the CASPIAN-V study. Eat Weight Disord. 2018;23:877–83.

Wendell Arthur Lopes [ID] *,
Gustavo Henrique de Oliveira [ID], João Carlos Locateli [ID], Caroline Ferraz Simões [ID]

Universidade Estadual de Maringá (UEM), Centro de Ciências da Saúde, Departamento de Educação Física, Curitiba, PR, Brazil

* Corresponding author.
E-mail: warthurlopes@gmail.com (W.A. Lopes).

Answer to the letter ''TyG in insulin resistance prediction''☆

Resposta à carta ''TyG na predição da resistência à insulina''

Dear Editor,

We carefully evaluated with great interest the comments made by the authors of the Letter to the Editor and we appreciate the opportunity to answer them.

To calculate the TyG (triglyceride-glucose índex) in our study[1], we used the formula proposed by Simental-Mendía et al.[2] in 2008 and Guerrero-Romero et al.[3] in 2010, described as follows:Ln[fasting triglycerides (mg/dL) × fasting glucose (mg/dL)/2].Moreover, the same formula was also used in other studies[4–7] that evaluated the TyG index in predicting insulin resistance in children and adolescents, with similar cutoffs to those identified in our study.

As our main objective was to evaluate the factors associated with the TyG index (dependent variable), linear regression analysis was used (the index was included in the analyses as a quantitative variable). Therefore, regardless of the formula used in the calculation of TyG, there is no change in the observed associations.

Additionally, we redid the TyG index calculation using the following formula: ln[fasting triglycerides (mg/dL) × fasting glucose (mg/dL)]/2, which was used by the same authors in another study in 2016[8]. As shown below, the cutoff point identified for the index was lower, as expected. However, the sensitivity and specificity values are similar.

Formula	Cutoff point	Sensitivity (%)	Specificity (%)
ln[fasting triglycerides (mg/dL) × fasting glucose (mg/dL)/2]	7.88	80.0	53.2
ln[fasting triglycerides (mg/dL) × fasting glucose (mg/dL)]/2	4.29	80.0	53.9

In response to the email sent by a researcher from our institution inquiring about the correct formula for calculating TyG, Fernando Guerrero-Romero points out that: ''Both procedures appropriately identify the presence of insulin resistance; however, using the procedure [ln(glucose × triglycerides/2)] gives higher cutoff values for the TyG.''

We believe in the importance of the standardized formula use for the index calculation;however,to the best of our knowledge, there is no opinion from the authors who validated itregarding which one would be better.

Finally, we would like to highlight the importance of the observations made by the authors of the Letter, as they will greatly contribute to other studies that adopt the TyG index.

Conflicts of interest

The authors declare no conflicts of interest.

References

1. Vieira-Ribeiro SA, Fonseca PC, Andreoli CS, Ribeiro AQ, Hermsdorff HH, Pereira PF, et al. The TyG index cutoff point and its association with body adiposity and lifestyle in children. J Pediatr (Rio J). 2019;95:217–23.

2. Simental-Mendía LE, Rodríguez-Moraan M, Guerrero-Romero F. The product of fasting glucose and triglycerides as surrogate for identifying insulin resistance in apparently healthy subjects. Metab Syndr Relat Disord. 2008;6:299–304.

3. Guerrero-Romero F, Simental-Mendía LE, González-Ortiz M, Martínez-Abundis E, Ramos-Zavala MG, Hernández-González SO, et al. The product of triglycerides and glucose, a simple measure of insulin sensitivity.Comparison with the euglycemic-hyperinsulinemic clamp. J Clin Endocrinol Metab. 2010;95:3347–51.

4. Kim JH, Park SH, Kim Y, Im M, Han HS. The cutoff values of indirect indices formeasuring insulin resistance for metabolic syndrome in Korean children andadolescents. Ann Pediatr Endocrinol Metab. 2016;21:143–8.

5. Kang B, Yang Y, Lee EY, Yang HK, Kim HS, Lim SY, et al. Triglycerides/glucose index is a useful surrogate marker of insulin resistance among adolescents. Int J Obes (Lond). 2017;41:789–92.

6. Moon S, Park JS, Ahn Y. The cut-off values of triglycerides and glucose index for metabolic syndrome in American and Korean adolescents. J Korean Med Sci. 2017;32:427–33.

7. Angoorani P, Heshmat R, Ejtahed HS, Motlagh ME, Ziaodini H, Taheri M, et al. Validity of triglyceride–glucose index as an