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ORIGINAL ARTICLE

Triglycerides/High density lipoprotein cholesterol ratio as a cardiometabolic risk marker in children and adolescents from Mérida city, Venezuela☆

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KEYWORDS
Triglycerides/high density lipoprotein cholesterol ratio;
Obesity;
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Abstract
Objective: To determine the behavior of the triglycerides/HDL-cholesterol ratio (TG/HDL) as a cardiometabolic risk marker in children and adolescents from Mérida, Venezuela.
Methods: A total of 1292 children and adolescents aged 7–18 years who attended educational institutions in the Libertador Municipality were enrolled into this study. Anthropometric measurements and blood pressure values were recorded. Fasting blood glucose, insulin and lipid levels were measured. The TG/HDL ratio, HOMA-IR, and QUICKI indexes were calculated. Subjects were categorized as with and without cardiometabolic risk based on the presence or absence of 2 or more risk factors. Cut-off points for the TG/HDL ratio were determined by constructing ROC curves.
Results: Significantly higher mean TG/HDL ratios were found in pubertal (2.2 ± 1.7) as compared to prepubertal subjects (1.8 ± 1.5; $p = .001$), with no sex differences. Two or more risk factors were found in 14.7% (n = 192) of the participants, in whom TG/HDL ratios were significantly higher as compared to those with no risk (3.5 ± 2.9 versus 1.6 ± 0.8 in prepubertal and 4.1 ± 3.5 versus 1.8 ± 0.9 in pubertal subjects; $p = .0001$). According to cardiometabolic risk, cut-off points for the TG/HDL ratio of 1.8 and 2.5 were found for prepubertal and pubertal children respectively. These cut-off points showed risks (odds ratio) higher than 2.5 for

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conditions such as metabolic syndrome, elevated non-HDL-C, abdominal obesity, and elevated HOMA-IR.
Conclusion: In this sample of children and adolescents, an elevated TG/HDLc ratio was found to be a good marker for predicting cardiometabolic risk.

PALABRAS CLAVE
Relación triglicéridos/colesterol de la lipoproteína de alta densidad;
Obesidad;
Factores de riesgo cardiometabólico;
Resistencia a la insulina

Relación triglicéridos/colesterol de la lipoproteína de alta densidad como indicador de riesgo cardiometabólico en niños y adolescentes de la ciudad de Mérida, Venezuela

Resumen
Objetivo: Determinar el comportamiento de la relación triglicéridos/colesterol HDL (TG/cHDL) como indicador de riesgo cardiometabólico en niños y adolescentes escolarizados de la ciudad de Mérida.
Métodos: Se estudió a 1.292 niños y adolescentes entre 7 y 18 años de edad, de instituciones educativas del Municipio Libertador. Se registraron medidas antropométricas y la presión arterial. Se determinaron glucemia, insulina y lípidos en ayunas. Se calcularon la relación TG/cHDL y los índices HOMA-IR y QUICKI. Se realizó la clasificación de individuos con riesgo y sin riesgo cardiometabólico a partir de la presencia o no de 2 o más factores de riesgo. Se determinaron puntos de corte de la relación TG/cHDL a través de la construcción de curvas operador receptor (COR).
Resultados: La relación TG/cHDL presentó medias significativamente superiores en individuos púberes (2,2 $\pm$ 1,7) en comparación con prepúberes (1,8 $\pm$ 1,5; p = 0,001), sin diferencias según el género. El 14,7% (n = 192) de los participantes presentaba 2 o más factores de riesgo y los valores de la relación TG/cHDL fueron significativamente mayores en comparación con aquellos sin riesgo (3,5 $\pm$ 2,9 frente a 1,6 $\pm$ 0,8 en prepúberes y 4,1 $\pm$ 3,5 frente a 1,8 $\pm$ 0,9 en púberes; p = 0,0001). De acuerdo con el riesgo cardiometabólico, se obtuvieron puntos de corte para la relación TG/cHDL de 1,8 y 2,5 en prepúberes y púberes, respectivamente. Estos puntos de corte muestran riesgos (odds ratios) superiores a 2,5 para alteraciones como síndrome metabólico, colesterol no HDL elevado, obesidad abdominal y HOMA-IR elevado.
Conclusión: En esta muestra de niños y adolescentes, la relación TG/cHDL elevada demostró ser un buen marcador para predecir riesgo cardiometabólico.

Introduction

Alterations in lipid metabolism are a key element in atheroma plaque formation, representing up to 50% of cardiovascular risk.[1] Low density lipoprotein cholesterol (LDLc) currently constitutes the main management objective in the primary and secondary prevention of cardiovascular disease (CVD).[2] However, it is acknowledged that the measurement of coronary risk based only on LDLc is insufficient,[3,4] since approximately 40% of all patients who have suffered a coronary event exhibit normal LDLc levels.[5,6]

A small and dense LDL particle phenotype (pattern B) has been related to a three-fold greater cardiovascular risk than a large LDL particle phenotype,[7,8] and has been significantly correlated to so-called atherogenic dyslipidemia, characterized by elevated triglyceride (TG) concentrations and low high density lipoprotein cholesterol (HDLc) levels, which could explain 50–67% of the variance in LDL particle size.[9,10] The prevalence in adults of so-called LDL pattern B is 31–44% of the general population in the United States,[11,12] versus up to 34% in Japan.[13] In 2004, Shimabukuro et al.,[14] in 586 Japanese children between 7 and 12 years of age, found 10.8% of the boys and 4.4% of the girls to have small LDL particles, and the main determinants of this lipoprotein pattern were higher plasma concentrations of glucose, insulin and TGs, and lower HDLc levels.

The TG/HDLc ratio may reflect the balance between atherogenic and protective lipoproteins, and shows a positive correlation to the HDL esterification rate and an inverse correlation to LDL particle size.[15] In a classic study, McLaughlin et al.[16] found the TG/HDLc ratio to be the best predictor of insulin resistance (IR) and of LDL particle diameter. In this respect, a cut-off point of 3.5 showed high sensitivity and specificity in identifying individuals with LDL phenotype B and subjects with IR.

In a pediatric population involving 35 overweight adolescents, Hannon et al.[17] found those subjects with a TG/HDLc ratio $\geq$3 to have less insulin sensitivity as determined by the euglycemic-hyperinsulinemic clamp technique, and greater visceral fat, than those with values below this cut-off point.