Exploring interactions among clustered components of Metabolic Syndrome with diabetes in The Study of Cardiovascular Risk Factors in Adolescents – ERICA Study

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ERICA ESTUDO DE RISCOS CARDIOVASCULARES EM ADOLESCENTES

BACKGROUND

- Whether Metabolic syndrome (MetS) components interact with regard to diabetes mellitus or cardiovascular disease is controversial[1,2].
- Aim: Assessment of interactions of metabolic syndrome components with regard to diabetes in adolescents.

METHODS

- 2013-2014 population-wide school-based survey of 37,815 Brazilian adolescents aged 12 to 17 years from whom blood samples were collected[3,4];
- MetS components (International Diabetes Federation)[5]: see table 1;
- Diabetes: self-reported diabetes or medications (pills), glucose≥126md/dL or HbA1C ≥6.5%. Exclusion: insulin use;
- 6 possible joint associations of three or more components. The glucose component was excluded;
- We estimated unadjusted and sex-, age-, body mass index (BMI)- and socioeconomic status-adjusted prevalence ratios (PR) using the Poisson regression model.
- Approach: Assessment of homogeneity of associations and comparison between observed and expected Joint associations.

RESULTS

- Median age: 15 years. Less than 3% of adolescents met the MetS criteria, 4% had diabetes and the majority was diagnosed by self-reported diabetes (table 1).
- PRs of high TG in the presence vs absence of low HDL (4.53 vs 1.23), and elevated WC in the presence vs absence of high TG (3.23 vs 0.73) were heterogeneous, suggesting qualitative interactions (Tables 2 and 3). These findings were consistent with the strategy of comparing observed vs joint expected associations (not shown).

RESULTS

Table 1. Characteristics of 37,815 adolescents enrolled in the Study of Cardiovascular Risk Factors in Adolescents (ERICA, 2013-2014)

Variables	n	Median	IQR	
			1ºQ	3ºQ
Age (years)	37,815	15	13	16
Female (%)	37,815	50.2		
Public Schools (%)	37,815	77.8	72.4	82.3
MetS * (%)	861	2.6	2.3	2.9
MetS components				
Elevated WC*** (%)	4,386	12.6	11.6	13.7
High BP (≥130/85mmHg) (%)	2,677	8.2	7.6	8.9
High glucose (≥100mg/dl) (%)	1,147	4.1	3.5	4.8
High TG (≥ 150mg/dl) (%)	1,712	4.6	4.1	5.1
Low HDL-c** (%)	13,076	32.7	30.3	35.2
Obesity (%)	3,097	9.2	8.5	10.0
Diabetes[Γ]	1,552	3.9	3.5	4.3
Self-report Diabetes[θ]	1,244	3.3	2.9	3.7
Self-report diabetes treatment	155	0.5	0.3	0.8
Fasting glucose (≥126mg/dL)	205	0.5	0.4	0.8
Hb1Ac (≥6.5%)	112	0.3	9.2	15.3

*Definition of metabolic syndrome: elevated waist circumference (values ≥ 90th percentile aged for those aged 10 to 16 years old; for those aged 16 years or older, ≥ 90cm for males and ≥ 80 cm for females) and the presence of two or more risk factors high triglycerides ≥ 150mg/dl, and/or high glucose ≥100mg/dl, and/or low HDL-c <40mg/dl or hdl<50mg/dl in girls aged 16 and 17 and/or high blood pressure ≥130/85mmHg
***values ≥ 90th percentile aged for those aged 10 to 16 years old; for those aged 16 years or older, ≥ 90cm for males and ≥ 80 cm for females
**<40mg/dl or hdl<50mg/dl in girls aged 16 and 17

Table 2. Adjusted* prevalence ratio to assess interaction of High TG and Elevated WC with diabetes[Γ], stratified by HDL and BP in the 37,815 adolescents included in the Study of Cardiovascular Risk Factors (ERICA, 2013-2014)

Stratified by Low HDL[δ] or High BP[ξ]

TG[λ]	WC**	Adjusted PR	Homogeneity test
Normal	Normal	1 (Ref. category)	P-value=0.02
Normal	High	0.73 (0.38, 1.41)	(n=12,578)
High	Normal	1 (Ref. category)	
High	High	3.23 (0.94, 11.13)	(n=861)

Table 3. Adjusted* prevalence ratio to assess interaction of High TG and Low HDL-c with diabetes[Γ], according to WC and Blood pressure in the 37,815 adolescents included in the Study of Cardiovascular Risk Factors (ERICA, 2013-2014)

Stratified by Elevated WC** and/or High BP[ξ]

HDL[δ]	TG[λ]	Adjusted PR	Homogeneity test
Normal	Normal	1 (Ref. category)	P-value=0.02
Normal	High	1.23 (0.50, 3.03)	(n=2,061)
Low[δ]	Normal	1 (Ref. category)	
Low	High	4.53 (1.99, 10.31)	(n=2,311)

*Adjusted by sex, age, obesity and socioeconomic status
[λ] High triglycerides: ≥ 150mg/dl
**Waist circumference: values ≥ 90th percentile aged for those aged 10 to 16 years old; for those aged 16 years or older, ≥ 90cm for males and ≥ 80 cm for females
[δ]Low HDL-c: <40mg/dl or hdl<50mg/dl in girls aged 16 and 17
[ξ] High blood pressure: ≥130/85mmHg
[Γ]defined by self-report, glucose≥126md/dL or Glycosylated haemoglobin≥6.5%

CONCLUSIONS

- Although interaction was not present in all possible combinations, high TG and low HDL or elevated interacted with regard to the prevalence of type 2 diabetes mellitus.

REFERENCES
1- Vaidya D, Szklo M, Liu K, Schreiner PJ, Bertoni AG, Ouyang P. Defining the metabolic syndrome construct: Multi-Ethnic Study of Atherosclerosis (MESA) cross-sectional analysis. Diabetes Care. 2007 Aug 1;30(8):2086–90. : 2- Kahn R, Buse J, Ferrannini E, Stern M. The metabolic syndrome: Time for a critical appraisal - Joint statement from the American Diabetes Association and the European Association for the Study of Diabetes [Internet]. Vol. 28, Diabetes Care. American Diabetes Association; 2005. p. 2289–304; 3-Vasconcellos MT Le, Silva PL do N, Szklo M, Kuschnir MCC, Klein CH, Abreu G de A, et al. Sampling design for the Study of Cardiovascular Risks in Adolescents (ERICA). Cad Saude Publica [Internet]. 2015 May [cited 2016 Apr 24];31(5):921–30; 4-Bloch KV, Szklo M, Kuschnir MCC, Abreu G de A, Barufaldi LA, Klein CH, et al. The study of cardiovascular risk in adolescents – ERICA: rationale, design and sample characteristics of a national survey examining cardiovascular risk factor profile in Brazilian adolescents. BMC Public Health [Internet]. 2015 Dec 7 [cited 2016 Apr 24];15(1):94; 5-Alberti KGMM, Zimmet P, Shaw J. Metabolic syndrome - A new world-wide definition. A consensus statement from the International Diabetes Federation [Internet]. Vol. 23, Diabetic Medicine. Diabet Med; 2006. p. 469–80;