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Is the metabolic syndrome associated to childhood obesity and lifestyle?

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Abstract

Although the metabolic syndrome (MS) has usually been associated to adult health diseases, nowadays it also observed in overweight-obese (OW/OB) children. The aim of this study was to determine the incidence of metabolic syndrome in OW/OB children in Lleida. The study is an observational study, where 46 OW/OB children between 10-12 years old have participated. Anthropometric and MS related parameters in children population were measured in accordance with the IDFcriteria. Free movement was assessed by accelerometry. Participants that presented at least two risk factors for metabolic syndrome showed lower overall physical activity (effect size (ES): -1.0) and spent more time in sedentary behavior (ES:0.9) and less time in MVPA (ES:-1.1) than participants with only one. Having in mind this situation, we think it is essential to carry out urgent actions to prevent and treat overweight and obese children as well as to avoid suffering from MS at an early age.

Keywords: Metabolic syndrome, overweight-obese, children, accelerometry, physical activity.

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1. Introduction

Metabolic syndrome in the pediatric population is defined as a set of anthropometric, clinical and biochemical alterations that predispose throughout life to the development of atherosclerotic cardiovascular disease and type 2 diabetes mellitus. With the increasing prevalence of overweight and obesity in children and adolescents, it has increased interest in the study of metabolic syndrome. The main measure to prevent and to treat these patients is lifestyle intervention: healthy eating, increased physical activity and decreased sedentary. The aim of this study was to determine the incidence of metabolic risk factors and metabolic syndrome in OW/OB children in Lleida.

2. Method

2.1 Participants

This is a cross-sectional study, where baseline data from 46 overweight/obese low active boys and girls with a mean age of 10.99 years (standard deviation=1.08) recruited for a clinical trial (registration number: NCT01878994) for the assessment of a familial intervention for the treatment of the childhood obesity have been analyzed (Serra-Paya, Ensenyat, Real, Castro-Viñuales, Zapata, Galindo & Teixidó, 2013). The study protocol was approved by the Clinical Research Ethics Committee (CEIC) of the Primary Care Research Institute IDIAP-Jordi Gol (Registration number: P12/040) Before proceeding with the measures, informed parental and children consent was obtained. All procedures were conducted in accordance with the Declaration of Helsinki and its subsequent revisions (World Medical Association, 2008).

2.2 Procedures

Body mass, height and triceps and subscapular skin folds were measured following standard procedures (ALPHA study, 2009). Body mass index (BMI) was calculated dividing the body mass (kg) by the height (m^2). BMI Z punctuation (IMC-SD) as an indicator of overweight/obesity was determined according to the LMS (Pan & Cole, 2012). Body fat percentage was estimated from triceps and subscapular skinfolds according the equation proposed by Slaughter et al. (ALPHA study, 2009).

Metabolic syndrome criteria related parameters in children population were measured in accordance with the International Diabetes Federation (IDF) criteria (Zimmet, Alberti, Kaufman, Tajima, Silink, Arslanian & Caprio, 2007). Waist circumference percentile norms developed for Spanish children were used (Moreno, Fleta, Rodríguez, Sarría & Bueno, 1999) to determine high waist circumference. Blood pressure assessment was performed at the level of the brachial artery of the dominant arm using an automated device (Omrom M, Omron Healthcare Europe B.V. Hoofddorp, The Nederland) with children in a relaxed sitting position. Measurements were taken in duplicate and the last of them was recorded. Blood samples for the determination of plasma triglycerides, high density lipoproteins (HDL) and glucose were drawn after an overnight fast with participants in a sitting position. Blood samples were analyzed with automated methods at the laboratory of the Hospital Universitari Arnau de Vilanova, in Lleida. Tanner staging was performed by their pediatrician.

Free movement was assessed objectively by accelerometry using the ActiGraph GT3X+ accelerometer (ActiGraph LLC, Pensacola, FL, USA) for eight consecutive days. Accelerometers were positioned laterally on the waist and attached with an elastic belt. The children and their families were instructed to wear the accelerometer all day, including during sleep. Accelerometers were programmed to register the movement in 60-seconds epochs and data were downloaded and analyzed with ActiLife 6.0 software (ActiGraph, Pensacola, FL, USA). Sleeping hours and bouts of 20 minutes of consecutive zero counts were excluded from the analysis. Data from accelerometers were

analyzed as overall physical activity index (expressed as vector magnitude in mean counts per minute (CPM)) and as the percentage of registered time spent in different levels of sedentary or physical activity (PA) behavior. The cut-off points for the categorization movement were based on the American Thoracic Society (2002).

2.3 Statistical analyses

Descriptive parameters are expressed as mean and standard deviation (SD) for quantitative variables and as frequency and percentage for qualitative variables. Normality was assessed by means of Shapiro-Wilks in all participants and in each grouping. Parametric (T-test for independent samples, Anova) or non-parametric test (U-Man Whitney, Chi-square test) were used to determine significant differences between groups. The significance level was set at $p \leq 0.05$ for all analyses. Effect size was estimated as the mean standardized difference between the mean of each group (gender; session category) divided by the pooled standard deviation. Values of 0.2–0.5 represent small differences, 0.5–0.8 moderate differences, and >0.8 large differences according Cohen's (Cohen, 1992). Statistical data analysis has been conducted using SPSS (Statistical Package for the Social Sciences, v17.0, SPSS Institute Inc., Chicago, IL, EEUU) software.

3. Results

The main anthropometric and clinical data are presented in table 1. Although no differences were observed in age, height, weight or BMI-SD between genders, boys showed a greater waist circumference (effect size: 0.7) and a greater fat mass (effect size: 0.6) than girls. Girls showed a significant but small (effect size: 0.3) greater level of plasma HDL than boys. Seventy-two percent of participants (n= 33) were prepuberal (Tanner's stage I) (20 boys and 13 girls) the rest (5 boys and 8 girls) were in any other Tanner's stage. Twenty-two percent (n=10) of the participants were overweight (4 boys and 6 girls) and the rest (78%) were obese (21 boys and 15 girls). No significant differences in Tanner stages or obesity categories distribution between genders were observed.

Table 1. Anthropometric and clinical data

	All (n=46)	Boys (n=25)	Girls (n=21)	P Value
	Mean (SD)	Mean (SD)	Mean (SD)	Boys versus girls
Age (years	10.99 (1.08)	11.13 (1.24)	10.81 (0.85)	0.31
Height (cm)	147.83 (7.74)	148.87 (8.7)	146.6 (6.42)	0.33
Weight (kg)	56.27 (10.68)	58.22 (12.13)	53.95 (8.36)	0.18
BMI (kg/m2)	25.52 (2.86)	26 (3.17)	24.95 (2.39)	0.22
BMI-SD[a]	2.28 (0.45)	2.37 (0.45)	2.17 (0.43)	0.14
WHtR (unit)	0.6 (0.04)	0.61 (0.04)	0.58 (0.04)*	0.03
WC (cm)	88.03 (8.24)	90.46 (8.29)	85.13 (7.36)*	0.03
Fat mass (%)[b]	39.61 (7.66)	41.64 (7.91)	37.2 (6.75)*	0.05
SBP (mmHg)	112.87 (13.12)	113 (13.98)	112.71 (12.35)	0.94
DBP (mmHg)	67.76 (9.82)	67.16 (8.84)	68.48 (11.04)	0.66
TG (mmg/dL)	81.8 (38.91)	88 (48.6)	74.43 (21.62)	0.62
HDL (mg/dL)	53.96 (14.42)	52.29 (18)	55.86 (8.83)*	0.04
Glucose (mg/dL)	84.59 (7.9)	85.84 (9.67)	83.1 (4.89)	0.45

BMI, body mass index(weight (kg)/height(m)2); BMI-SD, standard deviation of body mass index; DBP, diastolic blood pressure; HDL, high density lipoprotein; SBP, systolic blood pressure; TG, triglycerides; WC, waist circumference; WHtR, waist-to-height ratio.

[a] BMI-SD according the LMS method (Pan & Cole, 2012).

[b] percentage of adipose tissue estimated according Slaughter et al (ALPHA study, 2009) equation.

Data are mean (standard deviation).

[*] P <0.05 gender differences. Independent samples *t* test.

[*] P <0.05 gender differences. Non-parametric U-Mann-Whitney test for TG, HDL and glucose. Independent samples *t* test for the others.

Participants wore accelerometers for six to seven days, for more than 12 hours a day. Data show that children devoted a large percentage of their waking hours to SB and LPA, and only a minor percentage to MVPA (Table 2). Girls spent more time in LPA (effect size: 0.62) and less time in MVPA (effect size: -0.62) than boys.

No differences were observed between boys and girls for cardiorespiratory fitness analyzed as the meters achieved during the 6MWT.

Table 2. Physical activity and sedentary behavior and cardiorespiratory fitness.

	All (n=46) Mean (SD)	Boys (n=25) Mean (SD)	Girls (n=21) Mean (SD)	P Value Boys versus girls
Days (n)	7.9 (0.3)	7.9 (0.3)	7.9 (0.2)	0.40
Minutes/day	759.2 (35.7)	761.8 (40.1)	755.8 (30.2)	0.59
VM (CPM)	911.7 (212.5)	951.9 (232.1)	863.9 (180.4)	0.16
SED (%)[a]	33.8 (9.7)	34.7 (10.8)	32.8 (8.4)	0.52
LPA (%)[a]	52.1 (7.5)	50.1 (8.1)	54.5 (6.2)*	0.04
MVPA (%)[a]	14.1 (4.5)	15.3 (4.7)	12.6 (4.0)*	0.04
6MWT (m)	597.27 (98.9)	614.14 (100.75)	577.19 (95.13)	0.21

CPM, counts per minute; LPA, light intensity physical activity; MVPA, moderate-to-vigorous physical activity; SED, sedentary behavior; VM, vector magnitude; 6MWT, six-minute walking test.

[a]Expressed as the percentatge of recorded time.

Data are mean (standard deviation).

[*] P <0.05 gender differences. Non-parametric U-Mann-Whitney test for Days. Independent samples *t* test for the others.

A great number of participants presented risk factors (RF) for the metabolic syndrome (Table 3). Clearly the most frequent risk factor was a high waist circumference while the others were substantially less frequent. No significant differences were observed in the distribution of risk factors, either considered individually or in combination, between genders or Tanner stage. Nonetheless, participants that presented at least two risk factors for metabolic syndrome showed lower overall physical activity (effect size: -1.0) and spent more time in sedentary behavior (effect size: 0.9) and less time in MVPA (effect size: -1.1) than participants with only one. No differences were observed in cardiorespiratory fitness between these groups (Table 4).

Table 3. Incidence of metabolic risk factors among participants.

	All (n=46)		Boys (n=25)		Girls (n=21)	
Metabolic risk factors[a]	n	%	n	%	n	%
WC > percentile 90	41	89.1	22	88.0	19	90.5
SBP > 130 mmHg	4	8.7	2	8.0	2	9.5
DBP > 85 mmHg	1	2.2	0	0.0	1	4.8
TG > 150 mg/dL	3	6.5	3	12.0	0	0.0
HDL < 40 mg/dL	3	6.7	3	12.5	0	0.0
Glucose >100 mg/dL)	1	2.3	1	4.0	0	0.0
Combination of risk factors (number per participant)						

None	4	9.3	3	12.5	1	5.3
One	32	74.4	16	66.7	16	84.2
Two	5	11.6	3	12.5	2	10.5
Three	1	2.3	1	4.2	0	0.0
Four	1	2.3	1	4.2	0	0.0

DBP, diastolic blood pressure; HDL, high density lipoprotein; SBP, systolic blood pressure; TG, triglycerides; WC, waist circumference.

Data are frequency (n) and percentatge (%).

[a]Metabolic risk factors according to(Zimmet, Alberti, Kaufman, Tajima, Silink, Arslanian & Caprio, 2007).

Table 4. Physical activity, sedentary behavior and cardiorespiratory fitness among risk factor groups for the metabolic syndrome

	No RF (n=6)	1 RF (n=32)	≥2 RF (n=7)	P Value
	Mean (SD)	Mean (SD)	Mean (SD)	1 RF versus ≥2 RF
VM (CPM)	906,1 (137,3)	952,8 (198,2)	723 (249,7)*	0,03
SED (%)[a]	31,1 (7,6)	32,5 (7,7)	42,4 (15,5)*	0,04
LPA (%)[a]	55,6 (7,6)	52,5 (6)	47,3 (12,1)	0,28
MVPA (%)[a]	13,3 (3,3)	15 (4,5)	10,3 (3,7)*	0,04
6MWT (m)	666,7 (100,7)	581,8 (89,7)	610,6 (125,1)	0,91

CPM, counts per minute; LPA, light intensity physical activity; MVPA, moderate-to-vigorous physical activity; RF, risk factor; SED, sedentary behavior; VM, vector magnitude; 6MWT, six-minute walking test.

[a]Expressed as the percentatge of the recorded time.

Data are mean (standard deviation).

*P <0.05 differences between 1 risk factors group and ≥2 risk factors . Anova test.

4. Discussion

In the current study the prevalence of MS was lower than the observed in the study NAHNES (9.4% of boys and 9.7% of girls had MS), according IDF criteria (Jolliffe & Janssen, 2007). Having in mind this preoccupant situation, we think it is essential to carry out urgent health lifestyle actions to prevent and treat overweight and obese children as well as to avoid suffering from MS at an early age.

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References

ALPHA study (2009). The ALPHA health-related fitness test battery for children and adolescents. Test manual. *European Union DG SANCO*, 1-33.

American Thoracic Society (2002). ATS Statement: Guidelines for the Six-minute walk test. *American Journal of Respiratory and Critical Care Medicine, 166,* 111-117.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112,* 155-159.

Moreno, L. A., Fleta, J., Rodríguez, G., Sarría, A., & Bueno, M. (1999). Waist circumference values in Spanish children-Gender related differences. *European Journal of Clinical Nutrition, 53,* 429-433.

Pan, H., & Cole, T. J. (2012). LMS growth, a Microsoft Excel add-in to access growth references based on the LMS method. Retrieved from; http://www.healthforallchildren.co.uk

Serra-Paya, N., Ensenyat, A., Real, J., Castro-Viñuales, I., Zapata, A., Galindo, G., & Teixidó, C. (2013). Evaluation of a family intervention programme for the treatment of overweight and obese children (Nereu Programme): a randomized clinical trial study protocol. *BMC public health, 13*(1), 1000.

Jolliffe, C. J., & Janssen, I. (2007). Development of age-specific adolescent metabolic syndrome criteria that are linked to the Adult Treatment Panel III and International Diabetes Federation criteria. *Journal of the American College of Cardiology, 49*(8), 891-898.

World Medical Association. (2008). Declaration of Helsinki - Ethical principles for medical research involving human subjects. http://www.wma.net/en/30publications/10policies/b3/index.html . Seul. 1-4-2012.

Zimmet, P., Alberti, K. G. M., Kaufman, F., Tajima, N., Silink, M., Arslanian, S., & Caprio, S. (2007). The metabolic syndrome in children and adolescents–an IDF consensus report. *Pediatric diabetes, 8*(5), 299-306.