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MINIREVIEW

Metabolically obese normal-weight children

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Abstract

Non-obese children with elevated serum insulin levels and metabolic disorders such as, hyperglycemia, hypertension, and/or hypertriglyceridemia are a subset of children in high risk of developing cardiovascular disease later in life. Since usually the health policies for the prevention of the obesity associated disorders in children are based on the screening focused on the obese, frequently the metabolically obese normal-weight (MONW) children are not identified in primary care setting. Given that characterization of the MONW children is an important public health issue, and that a large amount of resources might be unnecessarily used in the screening of metabolic risk of nonobese children; we review data regarding criteria for the early recognition of this subset of children in high risk of developing cardiovascular disease. Results of our review suggests that the presence of family history of type 2 diabetes and/or hypertension, the elevated percentage of body fat, and the high birth-weight should be taken into account as criteria of high cardiovascular risk, irrespective of obesity.

Key words: Children; Normal-weight; Cardiovascular risk factors; Screening; Obesity

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INTRODUCTION

Non-obese individuals with elevated serum insulin levels and metabolic disorders such as hyperglycemia, hypertension, and/or hypertriglyceridemia have been named metabolically obese normal-weight (MONW) individuals[1], and characterize a subgroup who, irrespective of obesity, exhibited elevated cardiovascular risk.

Because usually the health policies for the prevention of obesity associated disorders in children are based on the screening focused on obese, characterization of the MONW children is an important public health issue. Nonetheless, reports about MONW children are scarce[2,3], and its characteristics and related factors are not well determined in childhood.

Given that a large amount of resources might be unnecessarily used in the screening of metabolic risk of nonobese children, the most important raised question in this regard is which could be the criteria for screening of cardiovascular risk in the non-obese children?

On this regard, it has been reported that non-obese prehypertensive children exhibited significant higher frequency of family history of hypertension and atherogenic lipid profile as compared with non-obese healthy children[4-7]. In addition, a positive family history of type 2 diabetes is common in all diabetes types, particularly

type 2 diabetes (83%)[8] and had significant effect on individuals with metabolic syndrome as compared with individuals having no family history of diabetes[9]. The presence of family history of diabetes is associated with hypertriglyceridemia, hyperinsulinemia, insulin resistance, and impaired fasting glucose, independently of body mass category[10,11]. Furthermore, non-obese children (according waist circumference criterion) with family history of hypertension in the maternal branch, show hyperinsulinemia, hypertension, hypertriglyceridemia, and low high-density lipoprotein cholesterol[12]. These finding strongly suggest that positive family history of diabetes and or hypertension could be the first clue for screening of cardiovascular risk factors in non-obese children.

In young women, the relative level of body fatness is related with the presence of abnormal lipid profile and metabolic syndrome irrespective of obesity according to standard body mass index or waist circumference criteria[13,14]. This finding strongly suggest that, in order to diagnosis of obesity, clinicians should include the measurement of body fatness as an adjuvant measure to body mass index and waist circumference. It has been shown that reduction of body fatness by lifestyle intervention programmes in the primary prevention of chronic diseases is beneficial at the population level and should not be limited to obese children[15,16]. So, it is rationale to consider that the elevated percentage of total body fat might be another criterion for the screening of MONW children.

A growing body of evidence show that the high birth-weight is a risk factor for cardiovascular disease later in life[17-21]. Furthermore, children exposed to maternal obesity are at increased risk of developing metabolic syndrome, irrespective of obesity, which suggests that obese mothers who do not fulfill the clinical criteria for gestational diabetes may still have metabolic factors that affect fetal growth and postnatal outcomes[18]. We have found that family history of diabetes in the maternal branch, in combination with the low or high birth-weight is strongly associated with the presence of metabolic syndrome in children and adolescents, irrespective of obesity[22].

Given that non-obese children could display a high prevalence of abnormalities in glucose, insulin levels, and lipid profile[23-25], the screening for cardiovascular risk based in the presence of obesity does not recognize a high proportion of children with atherogenic lipid profile and glucose metabolic disorders. In order to provide the benefits of screening to non-obese children, as part of the public health policies for prevention of cardiovascular disease, we propose that the presence of family history of type 2 diabetes and/or hypertension, the elevated percentage of body fat, and the high birth-weight should be taken into account as criteria of high risk for cardiovascular disease, irrespective of obesity.

The scarce of studies in the field should encourage the research in the field, to validate the criteria of screening for cardiovascular risk in non-obese children.

REFERENCES

1 **Ruderman NB**, Schneider SH, Berchtold P. The "metabolically-obese," normal-weight individual. *Am J Clin Nutr* 1981; **34**: 1617-1621

2 **Kelishadi R**, Cook SR, Motlagh ME, Gouya MM, Ardalan G, Motaghian M, Majdzadeh R, Ramezani MA. Metabolically obese normal weight and phenotypically obese metabolically normal youths: the CASPIAN Study. *J Am Diet Assoc* 2008; **108**: 82-90

3 **Pacifico L**, Poggiogalle E, Costantino F, Anania C, Ferraro F, Chiarelli F, Chiesa C. Acylated and nonacylated ghrelin levels and their associations with insulin resistance in obese and normal weight children with metabolic syndrome. *Eur J Endocrinol* 2009; **161**: 861-870

4 **Rodríguez-Morán M**, Guerrero-Romero F, Aradillas-García C, Bermudez-Peña C, Simental-Mendia LE, Vargas Morales JM, Torres Rodríguez ML, de la Cruz Mendoza E. Atherogenic indices and prehypertension in obese and non-obese children. *Diab Vasc Dis Res* 2012; Epub ahead of print

5 **Mahoney LT**, Clarke WR, Burns TL, Lauer RM. Childhood predictors of high blood pressure. *Am J Hypertens* 1991; **4**: 608S-610S

6 **Lauer RM**, Burns TL, Clarke WR, Mahoney LT. Childhood predictors of future blood pressure. *Hypertension* 1991; **18**: I74-I81

7 **Burns TL**, Moll PP, Lauer RM. Increased familial cardiovascular mortality in obese schoolchildren: the Muscatine Ponderosity Family Study. *Pediatrics* 1992; **89**: 262-268

8 **Gilliam LK**, Liese AD, Bloch CA, Davis C, Snively BM, Curb D, Williams DE, Pihoker C. Family history of diabetes, autoimmunity, and risk factors for cardiovascular disease among children with diabetes in the SEARCH for Diabetes in Youth Study. *Pediatr Diabetes* 2007; **8**: 354-361

9 **Das M**, Pal S, Ghosh A. Family history of type 2 diabetes and prevalence of metabolic syndrome in adult Asian Indians. *J Cardiovasc Dis Res* 2012; **3**: 104-108

10 **Rodríguez-Morán M**, Guerrero-Romero F. Hyperinsulinemia in healthy children and adolescents with a positive family history for type 2 diabetes. *Pediatrics* 2006; **118**: e1516-e1522

11 **Rodríguez-Moran M**, Guerrero-Romero F, Aradillas-García C, Violante R, Simental-Mendia LE, Monreal-Escalante E, Mendoza Ede L. Obesity and family history of diabetes as risk factors of impaired fasting glucose: implications for the early detection of prediabetes. *Pediatr Diabetes* 2010; **11**: 331-336

12 **Rodríguez-Moran M**, Aradillas-García C, Simental-Mendia LE, Monreal-Escalante E, de la Cruz Mendoza E, Dávila Esqueda ME, Guerrero-Romero F. Family history of hypertension and cardiovascular risk factors in prepubertal children. *Am J Hypertens* 2010; **23**: 299-304

13 **Conus F**, Allison DB, Rabasa-Lhoret R, St-Onge M, St-Pierre DH, Tremblay-Lebeau A, Poehlman ET. Metabolic and behavioral characteristics of metabolically obese but normal-weight women. *J Clin Endocrinol Metab* 2004; **89**: 5013-5020

14 **Jennings CL**, Lambert EV, Collins M, Joffe Y, Levitt NS, Goedecke JH. Determinants of insulin-resistant phenotypes in normal-weight and obese Black African women. *Obesity* (Silver Spring) 2008; **16**: 1602-1609

15 **Kelishadi R**, Hashemipour M, Sarrafzadegan N, Mohammadifard N, Alikhasy H, Beizaei M, Sajjadi F, Poursafa P, Amin Z, Ghatreh-Samani S, Khavarian N, Siadat ZD. Effects of a lifestyle modification trial among phenotypically obese metabolically normal and phenotypically obese metabolically abnormal adolescents in comparison with phenotypically normal metabolically obese adolescents. *Matern Child Nutr* 2010; **6**: 275-286

16 **Park TG**, Hong HR, Lee J, Kang HS. Lifestyle plus exercise intervention improves metabolic syndrome markers without change in adiponectin in obese girls. *Ann Nutr Metab* 2007; **51**: 197-203

17 **Barker DJ**, Hales CN, Fall CH, Osmond C, Phipps K, Clark

PM. Type 2 (non-insulin-dependent) diabetes mellitus, hypertension and hyperlipidaemia (syndrome X): relation to reduced fetal growth. *Diabetologia* 1993; **36**: 62-67

18 **Boney CM**, Verma A, Tucker R, Vohr BR. Metabolic syndrome in childhood: association with birth weight, maternal obesity, and gestational diabetes mellitus. *Pediatrics* 2005; **115**: e290-e296

19 **Wang X**, Liang L, Junfen FU, Lizhong DU. Metabolic syndrome in obese children born large for gestational age. *Indian J Pediatr* 2007; **74**: 561-565

20 **Morley R**, McCalman J, Carlin JB. Birthweight and coronary heart disease in a cohort born 1857-1900 in Melbourne, Australia. *Int J Epidemiol* 2006; **35**: 880-885

21 **Phipps K**, Barker DJ, Hales CN, Fall CH, Osmond C, Clark PM. Fetal growth and impaired glucose tolerance in men and women. *Diabetologia* 1993; **36**: 225-228

22 **Guerrero-Romero F**, Aradillas-García C, Simental-Mendia LE, Monreal-Escalante E, de la Cruz Mendoza E, Rodríguez-Moran M. Birth weight, family history of diabetes, and metabolic syndrome in children and adolescents. *J Pediatr* 2010; **156**: 719-723, 723.e1

23 **Guerrero-Romero F**, Rodríguez-Morán M. Prevalence of dyslipidemia in non-obese prepubertal children and its association with family history of diabetes, high blood pressure, and obesity. *Arch Med Res* 2006; **37**: 1015-1021

24 **Salazar Vázquez B**, Rodríguez Morán M, Guerrero Romero F. [Biochemical factors associated to cardiovascular risk among children and adolescents]. *Rev Med Inst Mex Seguro Soc* 2005; **43**: 299-303

25 **Ruderman NB**, Berchtold P, Schneider S. Obesity-associated disorders in normal-weight individuals: some speculations. *Int J Obes* 1982; **6** Suppl 1: 151-157

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