

NUTRITION, PHYSICAL ACTIVITY AND LIFESTYLE FACTORS IN CHILDHOOD OBESITY PREVENTION

Oana-Raluca MUNTEANU, Emilia RUSU, Diana Simona STEFAN and Gabriela RADULIAN

“Carol Davila” University of Medicine and Pharmacy, Bucharest, Romania

National Institute of Diabetes, Nutrition and Metabolic Diseases “Prof. N. C. Paulescu”, Bucharest, Romania

Corresponding author: Emilia RUSU, E-mail emiliarusumd@yahoo.com

Accepted November 16, 2015

Obesity among children and adolescents affects, in varying degrees, countries of all economic levels. Although obesity affects all ages, the most dramatic increase has been among children. WHO estimates that there are 250 million obese people in the world, among which approximately 22 million are children aged less than 5 years. The medical consequences of childhood obesity extend into adulthood. Obesity during the teen years is associated with many adverse health consequences, which include greater risks of mortality as young adults. It can have a range of negative health consequences, including diabetes, heart disease, non-alcoholic steatohepatitis, obstructive sleep apnea, asthma, orthopedic complications as well as psychosocial problems such as depressive symptoms, poor body image and low self-concept. Strong prevention efforts are needed in order to decrease the obesity epidemic. Appropriate nutrition, physical activity and behavioral modification represent important strategies for prevention of obesity.

Key words: child obesity, nutrition, exercise, prevention.

INTRODUCTION

Obesity among children and adolescents affects, in varying degrees, countries of all economic levels. WHO estimates that there are 250 million obese people in the world, among which approximately 22 million are children aged less than 5 years¹. According to Onis et al.², worldwide, the prevalence of childhood overweight and obesity increased from 4.2% in 1990 to 6.7% in 2010. The expected prevalence for 2020 is 9.1%. The highest prevalence for obesity and overweight is cited in the Pacific Isles and Saudi Arabia³. The prevalence of childhood overweight and obesity continues to be high and of public health concern in Europe^{4, 5, 29, 30}.

In Romania, according to a study carried out in Bucharest in 2011, there were identified, among children and adolescents aged between 6 and 18 years, 11.4% (WHO) obese children, the obesity prevalence being significantly higher among the boys versus girls⁶. Another study in western Romania⁷ found that the prevalence of overweight was 18.2% and for obesity was 7.2% among children aged 7 – 18 years, with a higher prevalence in boys versus girls and rural versus urban.

The medical consequences of childhood obesity extend into adulthood. Obesity during the teen years is associated with many adverse health consequences, which include greater risks of mortality as young adults²²

Obesity can have a range of negative health consequences, including diabetes, heart disease, non-alcoholic steatohepatitis, obstructive sleep apnea, asthma, orthopedic complications as well as psychosocial problems such as depressive symptoms, poor body image and low-self concept²³⁻²⁷.

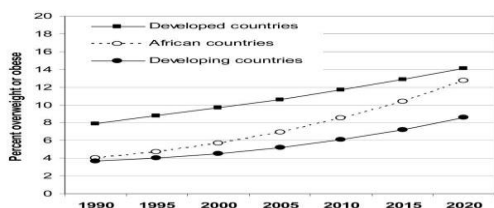


Figure 1 Trends between 1990-2010 and predicted ongoing rise 2010-2020 in the prevalence of BMI > +2 SD (equivalent to the 98th centile) in preschool children in developed and developing countries (adapted after²).

MATERIALS AND METHODS

Three databases were searched (Scopus, Web of Science and Pubmed) for reviews and meta-analyses published 2010-2015 that focused on the effects of interventions targeting nutrition, physical activity as well as other lifestyle factors on childhood obesity prevention.

RESULTS AND DISCUSSION

Interventions for childhood overweight/obesity generally focus on dietary restriction and physical exercise¹². Some studies evaluated and compared the effects of different types of diets on weight loss and metabolic outcomes^{17,31-34}. Casazza K et al³³ compared a moderately restricted carbohydrate versus a standard carbohydrate diet on weight/fat loss in obese peripubertal African American girls. Both diets determined significant weight/fat loss but the restricted carbohydrate diet showed improved glucose/insulin homeostasis. Megan L Gow et al¹⁷ examined the effectiveness of weight management interventions comparing diets with varying macronutrient distributions on BMI and cardiometabolic risk factors in overweight or obese children and adolescents. This review included a search of seven databases for the period 1975-2013 and identified 14 randomized controlled trials conducted with 6-18 year old subjects; 7 trials compared low-carbohydrate diet versus conventional low-fat approach, 6 increased-protein diet versus isocaloric standard-protein diet, 1 increased-fat versus isocaloric standard-fat diet. All studies reported improvements in weight-related outcomes irrespective of the macronutrient distribution. A low-carbohydrate diet may lead to greater short-term weight loss, greater improvements in triglyceride and insulin levels¹⁷.

Nazrat M Mirza et al³ showed that both low-glycemic load diet and low-fat diet determined significant reduction of BMI z-score and improved some aspects of metabolic syndrome in obese Hispanic youth. The ketogenic diet determined greater improvements in weight loss and metabolic parameters than the hypocaloric diet³². Hypocaloric low-glycemic-index diets have beneficial metabolic effects³⁴, contribute to an amelioration of insulin sensitivity in obese children^{35,36}.

According to a review conducted by Kelley A et al¹³, exercise improves the percent body fat (%BF) but there is insufficient evidence that exercise improves BMI-related measures, body weight and central obesity in overweight and obese children and adolescents. The dose-response effects of exercise in the treatment of overweight/obese children and

adolescents have not been elucidated, therefore it is recommended that practitioners follow the general recommendations for exercise in children and adolescents, that is, at least 60 minutes of physical activity each day¹³.

Another review suggests that exercise improves BMI z-score as well as other body composition (body weight, BMI, BMI percentile, fat mass, %BF) and cardiovascular disease risk factors (triglycerides, fasting insulin) variables¹⁴. Some reviews indicate that there should be included other outcome measures of adiposity, such as %BF^{13,15}, lean body mass (LBM)¹⁵, BMI z-score¹⁴. Dias KA et al showed that exercise training improves vascular function in overweight and obese children³⁷.

Mandy Ho et al¹⁵ compared the effects of dietary and exercise interventions and showed that children involved in 20-60 minutes of resistance training per week for 6 weeks achieved greater %BF loss than the diet-only group. The diet-only intervention led to greater reductions in levels of triglycerides and low-density lipoprotein cholesterol. At a subgroup analysis, the addition of aerobic exercise to dietary intervention led to greater improvements in high density lipoprotein cholesterol levels compared with diet and resistance training¹⁵. Multi-component interventions seem to have superiority over single component interventions in adiposity reduction (greater BMI loss and %BF loss than diet-only group at 1 year from baseline)¹⁵.

A 2011 systematic review including publications up to May 2010¹⁶ focused on the effectiveness of school-based nutrition education in reducing or preventing overweight and obesity in children and adolescents; most of the interventions with duration varying from 1 to 3 years demonstrated a reduction in the prevalence of overweight and obesity. Characteristics of the interventions that demonstrated effectiveness are: duration >1 year, introduction into the regular activities of the school, parental involvement, introduction of nutrition education into the regular curriculum, and provision of fruits and vegetables by school food services¹⁶. The setting in which these interventions are implemented is considered to impact this global epidemic. Schools represent an important setting for implementing preventive strategies targeting childhood obesity⁸. School-based nutrition education is effective in reducing children's and adolescents' BMI, the most significant effects are seen in interventions that lasted between 1-2 years⁹.

Beneficial effects of childhood obesity prevention programmes on BMI (strategies that focused on dietary or physical activity related factors) are found in most of the reviews, some of them targeting children aged 6 to 12 years¹⁰.

Interventions that utilize both a physical activity and nutrition component may increase the effectiveness of school-based childhood obesity prevention programs⁸. A recent systematic review¹¹ that included 139 studies suggest that multi-setting studies demonstrate significant and beneficial results compared with single-setting interventions. Physical activity-only interventions delivered in schools with home involvement and diet-physical activity combined interventions delivered in schools with both home and community components to prevent obesity have a high SOE- strength of evidence¹¹.

Some reviews found that most interventions for childhood overweight/obesity have been found ineffective¹². Amini et al²⁸ indicated that implementation of multi-component interventions did not necessarily improve the anthropometric outcomes.

Not involving parents in the attempts to prevent or reduce childhood overweight, focusing solely on weight reduction with little emphasis on psychosocial influences, often failing to address the manner in which overweight children perceive their own weight are considered the factors that lead to these negative results¹². Behaviorally based interventions are considered the first line of treatment for overweight and obesity in children and adolescents¹⁸.

The most effective interventions for pediatric obesity incorporate multiple components and hinge upon parental involvement. Social cognitive theory represents an important argument for parental inclusion in treatment¹⁹. Martin et al.²⁰ “found six behavior change techniques that are effective in obesity management interventions provide information on the consequences of behavior to the individual, environmental restructuring, prompt practice, prompt identification as role model/position advocate, stress management/ emotional control training and general communication skills training) and one behavior change technique for obesity prevention interventions (prompting generalization of a target behavior)”.

Resnikow K et al³⁸ highlights that motivational interviewing delivered by providers and RDs to parents of overweight children led to significant reductions in BMI percentile. Berge et al²¹ conducted a meta-analysis of family-based interventions targeting childhood obesity in the last decade. The majority of the studies included showed statistically significant changes in child BMI, after participating in a family-based intervention for weight loss. This meta-analysis suggests that the opposite sex parent may play a unique role in influencing child weight loss and sustainability of weight loss.

CONCLUSION

Appropriate nutrition, physical activity and behavioral modification represent important strategies for prevention of childhood obesity.

Acknowledgment This paper was co-financed from the European Social Fund through Sectoral Operational Programme – Human Resources Development 2007-2013, project number POSDRU/1871.5/S/155631, entitled “Doctoral programs at the forefront of research excellence in priority domains: health, materials, products and innovative processes”, Beneficiary- “Carol Davila” University of Medicine and Pharmacy, Bucharest.

REFERENCES

1. www.who.int/child-adolescent-health. Obesity: preventing and managing the global epidemic, Report of a WHO Consultation, Geneva, 2004.
2. Mercedes de Onis. Global prevalence and trends of overweight and obesity among preschool children Am J Clin Nutr 2010; 92: 1257-64.
3. James Philip. IOTF Childhood Obesity Report, 2004.
4. W Ahrens et al. Prevalence of overweight and obesity in European children below the age of ten. Int J of OB (2014)
5. Wijnhoven et al. WHO European Childhood Obesity Surveillance Initiative: BMI and level of overweight among 6-9 year-old children from school year 2007/2008 to school year 2009/2010. BMC Public Health 2014.
6. Barbu et al. Obesity and eating behaviors in school children and adolescents – data from a cross sectional study from Bucharest, Romania. BMC Public Health (2015)15: 206.
7. Emandi AC. Overweight and obesity in school age children in western Romania. Rev Med Chir Soc Med Nat. 2013
8. Melinda J Ickes et al. School-based childhood obesity interventions : a review. Int J Environ Res Public Health 2014
9. Cardoso da Silveira et al. The effect of participation in school-based nutrition education interventions on BMI: a meta-analysis of randomized controlled trials. Preventive Medicine 2013.
10. Waters E et al. Interventions for preventing obesity in children (Review) (A reprint of a Cochrane review, prepared and maintained by the Cochrane Collaboration – published in “The Cochrane Library 2011”)
11. Y Wang et al. What childhood obesity prevention programmes work? A systematic review and meta-analysis. Obesity Reviews 2015;16/7:547-565

12. Daniel Stein et al. Psychosocial perspectives and the issue of prevention in childhood obesity. *Frontiers in Public Health* 2014
13. Kelley A et al. Effects of exercise in the treatment of overweight and obese children and adolescents: a systematic review of meta-analysis. *Journal of Obesity* 2013
14. Kelley et al. Effects of exercise on BMI z-score in overweight and obese children and adolescents: a systematic review with meta-analysis. *BMC Pediatrics* 2014
15. Mandy Ho et al. Impact of dietary and exercise interventions on weight change and metabolic outcomes in obese children and adolescents. A systematic review and meta-analysis of randomized trials. *Jama Pediatr* 2013; 167(8): 759-768.
16. Jonas AC Silveira et al. Effectiveness of school-based nutrition education interventions to prevent and reduce excessive weight gain in children and adolescents: a systematic review. *J Pediatr (Rio J)* 2011. 87(5): 382-92.
17. Megan L Gow, Mandy Ho, Burrows TL. Impact of dietary macronutrient distribution on BMI and cardiometabolic outcomes in overweight and obese children and adolescents: a systematic review. *Nutr Rev* 2014; 72 (7): 453-70.
18. Whitlock EP et al. Effectiveness of weight management interventions in children: a targeted systematic review for the USPSTF. *Pediatrics* 2010; 125:e396-e418.
19. Denise E Wilfley et al. Counseling and behavior change in pediatric obesity. *Pediatr Clin North Am* 2011; 58 (6): 1403-1424
20. J Martin, A Chater. Effective behavior change techniques in the prevention and management of childhood obesity. *International Journal of Obesity* 2013, 37, 1287-1294.
21. Berge JM et al. Family-based interventions targeting childhood obesity: a meta-analysis. *Child Obesity* 2011, 7: 110-121.
22. Must A et al. Long-term morbidity and mortality of overweight adolescents; a follow-up of the Harvard Growth Study of 1922 to 1935. *N Engl J Med* 1992; 327: 1350-1355
23. American Diabetes Association. Type 2 diabetes in children and adolescents. *Diabetes Care* 2000; 23: 381-389.
24. David S Freedman et al. The relation of overweight to cardiovascular risk factors among children and adolescents: The Bogalusa Heart Study. *Pediatrics* 1999, 103 (106)
25. Redline S et al. Risk factors for sleep-disordered breathing in children. Associations with obesity, race, and respiratory problems. *Am J Respir Crit Care Med* 1999; 159: 1527-32.
26. Morishita R et al. BMI, adipokines and insulin resistance in asthmatic children and adolescents. *J Asthma* 2015, 2; 1-24.
27. Yung Seng Lee. Consequences of childhood obesity. *Annals Academy of Medicine* 2009, 38 (1).
28. Maryam Amini et al. Effect of school-based interventions to control childhood obesity: a review of reviews. *Int J Prev Med* 2015; 6: 68
29. Shamir R et al. Obesity prevention in children. *World Rev Nutr Diet. Basel*, 2013, 106, 119-126.
30. Lobstein T. Prevalence of overweight among children in Europe. *Obesity Reviews* 2003, 195-200.
31. Nazrat M Mirza et al. Effects of a low glycemic load or a low-fat dietary intervention on body weight in obese Hispanic American children and adolescents : a randomized controlled trial. *Am J Clin Nutr* 2013, 97: 276-85.
32. Partsalaki I et al. Metabolic impact of a ketogenic diet compared to a hypocaloric diet in obese children and adolescents. *J Pediatr Endocrinol Metab* 2012; 25 (7-8): 697-704.
33. Casazza K et al. Reduced carbohydrate diet to improve metabolic outcomes and decrease adiposity in obese peripubertal African American girls: does macronutrient profile matter? *J Pediatr Gastroenterol Nutr* 2012; 54(3): 336-42.
34. Parillo M et al. Metabolic changes after a hypocaloric, low-glycemic-index diet in obese children. *J Endocrinol Invest.* 2012; 35(7): 629-33.
35. Jannuzzi A et al. Comparison of two diets of varying glycemic index on carotid subclinical atherosclerosis in obese children. *Heart Vessels* 2009; 24(6): 419-24.
36. Visuthranukul C et al. Low-glycemic index diet may improve insulin sensitivity in obese children. *Pediatr Res* 2015; 78(5): 567-73.
37. Dias KA et al. Exercise and vascular function in child obesity: a meta-analysis. *Pediatrics* 2015; 136(3): e648-59.
38. Resnicow K et al. Motivational interviewing and dietary counseling for obesity in primary care: an RCT. *Pediatrics* 2015; 135(4): 649-57.