

Obesity: epidemiological aspects and prevention

Obesidade: aspectos epidemiológicos e prevenção

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ABSTRACT

An alarming growth on the prevalence of childhood obesity has been observed in the last decades. Exogenous obesity (attributed to environmental factors such as diet, life habits, family and school environment) is responsible for approximately 95% of cases of obesity, while the remaining 5% are due to endogenous factors. The implications can be severe, with cardiovascular, anatomical and psychological repercussions. This article aims to review the literature on the epidemiology, etiology and prevention of childhood obesity, using the following scientific databases: PubMed, Scientific Electronic Library Online (SciELO), National Library Of Medicine (MedLine) and LILACS, in the last twelve years. Interventions for the prevention of obesity are widely known and include mainly food education and physical activity. It is essential that pediatricians address these subjects with children and their families during routine visits, aiming for prevention and treatment of this important morbidity. Moreover, prevention measures associated with multidisciplinary care should be incorporated into public policies.

Key words: *Obesity; Risk Factors; Child Health; Adolescent; Epidemiology.*

RESUMO

Observa-se, nas últimas décadas, crescimento alarmante de obesidade na população infantil. A obesidade exógena (atribuída a fatores ambientais, como alimentação, hábitos, ambiente familiar e escolar) é responsável por aproximadamente 95%, enquanto os 5% restantes decorrem de fatores endógenos. As consequências podem ser graves, com repercussões cardiovasculares, anatômicas e psicológicas. Este artigo objetiva revisar a literatura acerca da epidemiologia, etiogênese e prevenção da obesidade infantil, a partir das bases de dados científicas PubMed, Scientific Electronic Library Online (SciELO), National Library Of Medicine (MedLine) e LILACS, nos últimos 12 anos. As formas de prevenção da obesidade são amplamente conhecidas e englobam, principalmente, educação alimentar e prática de atividades físicas. É fundamental a abordagem, pelo pediatra, deste tema com a criança e familiares nas consultas de puericultura visando à prevenção e ao tratamento dessa importante morbidade. Além disso, faz-se necessário implantar políticas públicas associadas ao trabalho multiprofissional na prevenção da obesidade.

Palavras-chave: *Obesidade; Fatores de Risco; Saúde da Criança; Adolescente; Epidemiologia.*

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INTRODUCTION

Childhood obesity has shown an alarming increase in the last three decades and has become a major public health concern. The International Obesity Task Force (IOTF, 2005) estimates that there are currently 155 million children with excess weight (overweight/

obesity) worldwide, led by the industrialized countries, with the highest prevalence of childhood obesity.¹

These indices are alarming not only because obesity put individuals' at an increased risk of chronic-degenerative diseases but also because its treatment or control incurs in high financial costs.²

For these reasons, establishing measures to prevent childhood obesity is essential. Some measures can be initiated as early as the intrauterine life, by promoting maternal health, identifying risk factors for the mother's and the child's health and by providing guidance on lifestyle and habits that promote healthy weight.³ During the first years of life, caregivers must receive proper and specific dietary guidance not only on the types of food to be served to infants but also on forms of preparation, quantity and the age they should be introduced.⁴ Furthermore, families, schools and the community as a whole must be engaged in a collective project to improve child health.

The increased prevalence of obesity in Brazil and the desire to show both its risks factors and prevention, important measures for the child population, motivated this literature review on the epidemiology, etiology, consequences and prevention of childhood obesity in the PubMed, Scientific Electronic Library Online (SciELO), National Library of Medicine (MedLine) and LILACS scientific databases, in Portuguese and English. We used the descriptors "prevention of childhood obesity," "childhood obesity" and "child health" for articles published between 2000 and 2012. Recent textbooks, 34 articles, publications of the World Health Organization (WHO), the Brazilian Society of Pediatrics (SBP) and the Ministry of Health of Brazil (MS) were selected based on relevance and information value, including some key texts cited in other articles.

LITERATURE REVIEW

Epidemiology

An important study in Brazil recently carried out by the Brazilian Institute of Geography and Statistics (IBGE) in partnership with the Ministry of Health, the 2008-2009 Brazilian Household Budget Survey (POF, in Portuguese) analyzed the nutritional and anthropometric characteristics of Brazilians, revealing changes in the profile of population in the last four decades. The results showed that height deficit (an important

indicator of malnutrition) sank from 29.3% (1974-75) to 7.2% (2008-09) for boys and from 26.7% to 6.3% for girls in the five to nine year age group (Figure 1). In contrast, excess weight (including obesity) showed high indices of prevalence in 2008-09: 51.4% for boys and 43.8% for girls in the same age group of five to nine years (Figure 1), which clearly demonstrates the relevance of this problem for public health in Brazil.⁵

Overweight and obesity have high prevalence rates, which have increased over time, as shown in Figure 1. Data analysis reveals that in 2008-09, among children aged five to nine years, 32% of girls were overweight and 11.8% were obese. As for boys, rates were even higher, 34.8 and 16.6%, respectively.⁵

According to the IBGE 2008-09 data, for the same period obesity and overweight rates in the 10 to 19 year age group were lower than in the five to nine age group. Among boys, 21.7% were overweight and 5.9% were obese, while for girls, overweight and obesity rates were 19.4 and 4%, respectively (Figure 2). Despite being lower than the five to nine years age group, these rates are still high, especially when compared to the much lower rates of 1974-75.⁵

Etiology

The etiology of childhood obesity involves external environmental factors ("exogenous obesity") and neuroendocrine or genetic factors ("endogenous obesity"). Only about 5% of cases of obesity in children and adolescents are caused by endogenous factors, with the remaining 95% corresponding to exogenous obesity.⁶

Exogenous obesity is a multifactor nutritional disorder. Early weaning, history of overweight in the family, overeating and disruptions in family dynamics, as well as reduced physical activity, are factors commonly associated with the etiology of obesity. The social environment in which the individual finds him or herself, access to healthy food, and physical activity are important in genesis of exogenous obesity, especially physical activity.⁷

In Brazil, the prevalence of this type of obesity among children and adolescents has increased rapidly in recent years, mainly due to the inadequate lifestyles adopted by most of the population. Over the past 30 years, there have been considerable changes in the families' eating patterns, with increased consumption of fast food and foods high in fat, salt and sugar. At the same time, the consumption of organic and high-fiber foods has decreased.⁸

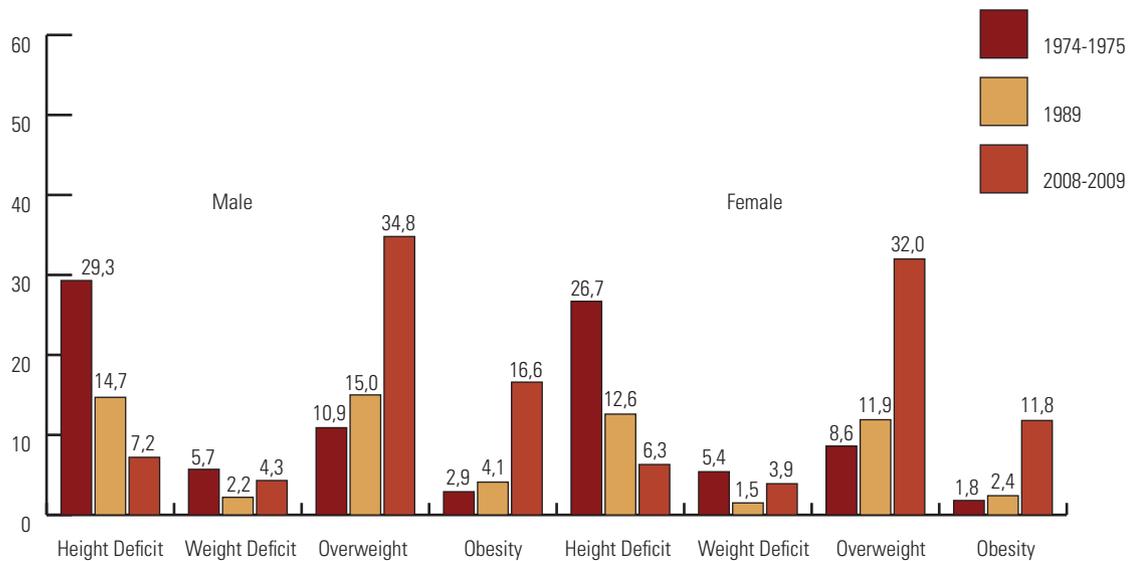


Figure 1 - Evolution of anthropometric indicators in the population from five to nine years of age, by sex - Brazil – in 1974-75, 1989 and 2008-2009.

Source: IBGE. Instituto Nacional de Despesa Familiar. 1974-1975. Instituto Nacional de Alimentação e Nutrição. Pesquisa Nacional sobre Saúde e Nutrição 1989. IBGE. Diretoria de pesquisas. Coordenação de Trabalho e Rendimento. Pesquisa de orçamento familiares 2008-2009.

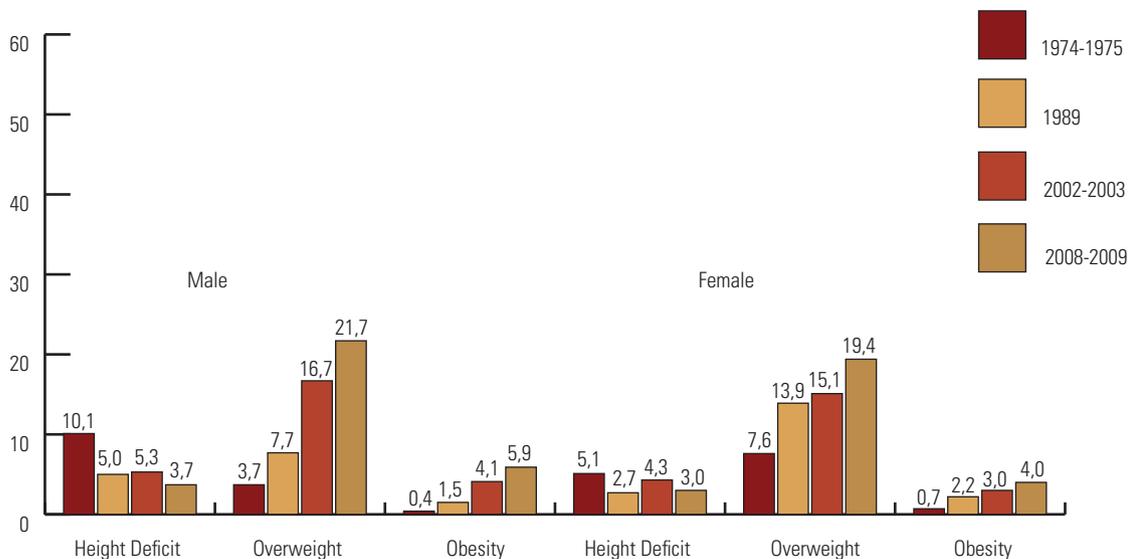


Figure 2 - Evolution of anthropometric indicators at ages 10 to 19, by sex – Brazil – in 1974-75, 1989 and 2008-2009.

Source: IBGE. Instituto Nacional de Despesa Familiar. 1974-1975. Instituto Nacional de Alimentação e Nutrição. Pesquisa Nacional sobre Saúde e Nutrição 1989. IBGE. Diretoria de pesquisas. Coordenação de Trabalho e Rendimento. Pesquisa de orçamento familiares 2008-2009.

Consequences

The clinical effects of childhood obesity include mild to moderate morbidity and even life-threatening conditions in the long term. The consequences of obesity have metabolic, anatomic, psychological and behavioral implications.^{9,10}

Metabolic disorders related to obesity can manifest as singular findings on clinical or laboratory exams, while the combination of insulin resistance, hyperglycemia, systemic hypertension, increased triglycerides and decreased HDL constitute a diagnosis of a metabolic syndrome, with serious repercussions for the development of cardiovascular problems in adulthood.^{9,11}

Insulin resistance seems to arise from changes in peripheral cell receptors in which the hormone acts, with hyperinsulinemia being the finding that suggests this diagnostic hypothesis.⁶ It is also associated with the development of type 2 diabetes mellitus and other disorders, such as hypertension and dyslipidemia.⁹ According to the American Diabetes Association, 20 to 25% obese pediatric patients exhibit changes in glucose metabolism.⁹ Despite the compensatory elevation of insulin levels, glycemia levels can remain high and lead to the patient developing diabetes mellitus type 2.¹²

The pathophysiology of systemic hypertension associated with obesity has not been completely elucidated. The literature reports increased cardiac output in the obese,⁶ insulin resistance and vascular changes related to systemic hypertension⁹ and increased blood pressure proportional to increase in body mass index (BMI).⁹ Approximately 20-30% of obese children have high levels of systemic blood pressure and are 2.4 times more likely to develop systemic hypertension than eutrophic children.¹³ While the incidence of secondary systemic hypertension is significant among children, the last decade revealed an increase in the incidence of the basic form, especially in adolescence.¹⁴ The most important factor implied in the genesis of high blood pressure among children is obesity, thus making systematic investigation of this disease in all obese patients a necessity.¹⁴

Changes in lipid profile includes increased triglycerides, decreased HDL levels and in the structure of LDL, important risk factors for atherosclerosis and all associated cardiovascular disorders.^{9,12} In obese adolescents, a significant increase in LDL and triglycerides and reduced HDL levels are observed.¹³ Dyslipidemia in childhood and adolescence is been showed to be the main risk factor for developing cardiovascular disease in adult life.¹²

The common anatomical implications of obesity include weight gain leading to joint and bone overload, especially on the knees; trauma in joints, fractures, growth disorders;^{9,6,9} sleep apnea⁹, and anatomical changes in the larynx, thorax and abdomen. Moreover, childhood obesity affects neural activity and can lead to drowsiness and learning disorders.¹¹ Less common changes, such as polycystic ovary syndrome and non-alcoholic fatty liver disease, become more prevalent in adult life.⁹

Skin changes are observed with increased risk of developing candidiasis (in skin folds), acanthosis nigricans, striae and hirsutism.^{6,9}

There is no consensus in literature regarding the connection between obesity and depression. Depression symptoms in pediatric patients are common and constitute a differential diagnosis for sleep disorders and endocrine disorders. The most commonly observed symptoms are sadness, learning problems and family problems. Relationships with classmates can also become troubled. In adolescence, concerns about body image and resource to weight loss diets can be risk factors for developing anxiety disorders or even anorexia.¹⁰ Behavioral issues, especially among adolescents, such as social acceptance, difficulty in establishing romantic relationships and dissatisfaction with body image can have serious repercussions and impact quality of life and adaptation to treatment, possibly leading to severe depression and anxiety.¹⁰ Therefore, the psychological aspect of obesity must be addressed in the pediatric appointments, as much as other biological aspects.

OBESITY PREVENTION

Given the prevalence of obesity and its serious consequences, prevention measures and health promotion must be implemented as early as childhood. Health policies should be expanded to include food education as well as the creation of appropriate infrastructures for developing recreational practices and physical activity, specific legislation to standardize food labels and regulate advertising and marketing of food. Pediatrician actions are also essential in giving individualized care, especially if the child or adolescent is already overweight.

Dietary Habits

Dietary factors that contribute to childhood obesity begin in intrauterine life through maternal diet and even as early as the mother's nutritional status before pregnancy, both of which influence the newborn's nutritional status, and later, that of the child and adolescent. In the first trimester the health of embryo depends on the condition of the mother before pregnancy. It is important for pregnant women to have adequate food intake in relation to energy balance and nutrients as early as the second trimester. Appropriate weight gain during pregnancy also affects the fetus's nutritional status.^{15,16}

According to Mello *et al.*¹⁷, dietary habits are influenced by many internal and external factors. Internal factors include emotional and psychological considerations, self-esteem and confidence, as well as body image, life experience, preferences, and comorbidities. Environmental factors, attitudes, and specific characteristics of family and friends, cultural values and beliefs, education level, knowledge about nutrition, and media appeal have a strong influence on eating behavior of individuals, especially children and adolescents, and can increase their risk of becoming overweight or obese.¹⁷

Dietary habits that can lead to excess weight are related to the quantity and quality of food consumed.¹⁸ Dietary patterns have changed in recent years, which partly explains the increased obesity rates. Among these changes, the increased consumption of sweetened beverages, foods with high energetic density but low in micronutrients, and low consumption of vegetables and fruit stand out.¹⁹

In a study conducted in England with children between seven and 11 years of age, showed that reducing consumption of carbonated drinks was a protection factor against excessive weight gain. After a 12 month follow up, the percentage of overweight and obese children increased 7.5% in the control group (who freely consumed carbonated drinks) and decreased 0.2% in the intervention group.²⁰ Another study followed 548 children from the sixth and seventh grades for 19 months and showed higher BMI and obesity related to increased consumption of sugary drinks.

One of the most well studied factors in relation to the risk of obesity is breastfeeding.¹⁷ Several authors have found that children who were exclusively breastfed until six months of age were less affected by obesity and overweight in preschool. They have also shown an inverse correlation between waist circumference and the length of time children were breastfed.^{21,22} Increased waist circumference is a high risk factor for developing chronic diseases, hypertension, dyslipidemia, metabolic syndrome and diabetes mellitus type 2.²²

The WHO recommends exclusive breastfeeding for infants up to six months of life.²³ Breastfeeding has many benefits, including protection against infections of the respiratory and gastrointestinal tracts²⁴; improvements in neurological, visual and psychosocial developments, protection against various morbidities²⁵, in addition to being a protective factor against the development of excess weight and obesity.^{26,27} Nevertheless, many mothers abandon breastfeeding, and many variables contribute to early abandonment, in-

cluding the use of pacifiers², the mother's low education²⁹, low socioeconomic status³⁰ and primiparity³¹.

During childhood, individuals go through different phases of eating behavior, and approaches must be different according to these phases. The preschool phase is characterized by increased variety of foods consumed. Generally, children make food choices according to taste, and avoid food that they feel tastes bad. The family has a strong influence in this phase, so adopting a proper diet for the whole family can help in the adequate development and growth of preschool children.¹⁸ Parents or guardians, however, should not impose or restrict what the child eats, merely provide healthy foods and encourage consumption.¹⁷

Schoolchildren are even more intensely affected by the media, which plays an important role in determining patterns of purchase and attitudes, which includes people's diets.¹⁸ The food industry, through aggressive advertising, stimulates consumption of highly processed, high-calorie, high-fat, high-sugar, and high-salt foods. In the school phase, this influence is extremely relevant since it happens when children gain some autonomy in the streets, in the supermarket, at the mall. In those places, they find various colorful, tasty, cheap foods, sometimes bundled with toys as gifts, all features that attract children, but may not always be nutritious or healthy.

Adolescence is another distinct period, in which the group can determine customs and habits. In this phase, the dietary behavior is characterized by the ingestion of snacks, sandwiches, cookies, sweets, chips, soft drinks and other high-calorie, low-micronutrient foods. Furthermore, replacing main meals with snacks or even skipping meals, especially breakfast, becomes a common habit,¹⁸ which have caused recent increases in calorie value of snacks, from 450 to 600 calories, representing 25% of the total calories consumed on average daily. The energetic density of snacks increased from 1.35 to 1.54 kcal/g.¹⁷

Prevention in the school environment

In Brazil, the value of food education for students in school is gradually becoming established as important measures for preventing and combating obesity and excess weight. Improved awareness in this regard has already been reached in the U.S. and parents and students believe in the crucial role schools play in obesity prevention, making school interventions common.

Studies show that short-term intervention programs are not efficient in promoting significant changes in student weight and lifestyle but may bring punctual benefits to the health of students. Interventions can promote isolated increase in physical activity, intake of healthier foods instead of high-fat food and carbonated drinks, as well as stimulate students to spend less time in sedentary activities like watching television.³²

There are few Brazilian studies on school interventions. A study in the city of Niterói-RJ included two schools, one of which was submitted to an intervention while the other remained as control, and included 331 students of the fifth and sixth grades between August and November 2005. The study established that interventions may be important in changing dietary habits, and fewer students skipped main meals to eat snacks and consumed less soft drinks and *fast food*. However, at the end of the survey, no difference was found in terms of weight. The intervention included basically nutrition education activities and encouraged physical activity.³³ A similar study was conducted in São Paulo in eight public schools, three of which received interventions and five constituted the control groups. At the end, an improvement in the student's eating choices was noticeable, and there were also positive changes in knowledge and attitudes of teachers relative to obesity prevention. The intervention was in this case, mainly by nutrition education.³⁴

It is known that the home environment directly influences children's weight. However, programs in the U.S. that directly included the family were not proven to be considerably more effective than those that did not.³² A study conducted in northern Germany showed that intervention can reduce the rates of excess weight. The effects of interventions appear to be higher when children come from high-income families and if the mother has normal weight. While promoting small but beneficial changes in lifestyle and helping in control and remission of excess weight, the intervention studied was not successful in effectively decreasing obesity rates.³⁵

The analysis of different interventions in the U.S. shows that boys and girls have different results, according to the approach. Girls seem to respond better to programs that involve educational components based on social learning, while boys respond better to social and environmental changes that facilitate increased physical activity and improved diet. Children aged seven to 10 years are less affected by interventions than the older ones, which suggests that different intervention programs should be targeted at children aged 10 to 14 years in order to reduce BMI and the prevalence of obesity.³²

A common criticism to studies on interventions in the U.S. regards duration, since behavioral changes are not usually in the short term.³³ The already mentioned study in Niterói, in turn, stressed that despite no significant weight loss being registered among children in the schools where interventions took place, there was a short-term beneficial effect on eating habits.³³ Finally, the research in São Paulo revealed lack of support by the institutions studied. These facts highlight the need for more assistance and greater awareness of the seriousness of the problem by the education and health sectors, which must help overcome barriers in the attempts to combat and prevent overweight and obesity in schools.³⁴

In 2007, two years after the study in São Paulo, the Ministry of Health and the Ministry of Education established the Health in School Program (PSE, in Portuguese) by the Presidential Decree No. 6286. The Program is an attempt to contribute to students' education as a whole in public institutions through preventive actions and health care activities.³⁶

The PSE consists of five components:

1. it assesses of the health of children, adolescents and young adults in public schools;
2. it promotes health and prevention activities;
3. It stimulates continued education and training for education professionals and childcare staff;
4. it monitors and reassesses students' health;
5. it monitors and evaluates itself.³⁶

The various proposals highlight the need to address obesity and its comorbidities. Even in the most basic textbooks the topic of obesity features prominently, as a priority project, along with sex education and drug use prevention.³⁶ There are no publications reporting experiences with the program, most likely because it is new and has not yet been properly assessed.

The study of interventions in schools and their results is important to assist in guiding and planning new interventions, whether performed within the PSE or independently. Such studies can make future interventions more successful.

Physical Activity

A major focus in childhood obesity prevention programs should be ways to encourage physical activities among children. Research indicates that sed-

entary habits are related to obesity, and vice versa.¹⁷ According to Monasta et al., preschool children who did less than 30 minutes of exercise each day have increased risk of excess weight.³⁷ Conversely, high levels of physical activity in childhood protect against childhood obesity.³⁷ It is known that physical activity increases the individual's basal metabolic rate, which is assumed to reduce the risk of excess body weight. In addition to this benefit, the practice of physical activity can lead to better food choices¹⁷ and it is usually accompanied by a healthier lifestyle in adult life.³⁸

Physical inactivity and sedentary lifestyles are, however, part of our current reality. A Brazilian study published in 2012 with 265 children from private schools in Olinda, indicated that approximately 65% of children had low levels of physical activity, as defined by less than one hour of daily exercise outdoors.³⁹

In order to start a program of structured physical activity for children or adolescents, clinical evaluation by a trained doctor is paramount.¹⁷ In this stage of life, in particular, the level of physical and mental maturity must be respected, and guidelines established regarding for different types of physical activity according to age. Table 1, by Weffort *et al.*, summarizes these recommendations.⁵

Table 1 - Guidelines for adequate physical activities for each age group

Age (years)	Activity
0 a 1	Pick up objects, sit, roll, crawl, stand, walk, psychomotor stimulation, play in the water from 6 months of age.
2 a 6	Recreation, throw at a target, catch or kick ball, jump, explore the environment, cycle, run, jump obstacles or steps, climb stairs, dive
7 a 12	School sports, swimming, gymnastics, dance, basketball, soccer, volleyball, and other (non-competitive) sports
13 a 18	Competitive sports

Source: Weffort VRS, Lamounier JA. *Nutrição em Pediatria: Da neonatologia à adolescência*. São Paulo: Manole; 2009.

In addition to structured physical activity, and more importantly, the adoption of a more active lifestyle should be encouraged by reducing the time spent in activities of low energy expenditure, such as watching television, surfing the Internet or playing video games. Even preschool children spend much of their time involved in sedentary activities, also making them a target for incentives in change of habits.⁴⁰

Studies show that there is an association between risk of obesity and time spent watching television.^{17,37} The prevalence of obesity rises with time spent in front of the

television: 10% for one hour per day, 25% for three hours per day, 27% for four hours per day, reaching a 35% prevalence with five hours of television per day.¹⁷ According to Reilly *et al.*³⁷, watching television for over eight hours a week is an independent risk factor for developing obesity among 3 year-olds. The mechanism involved in the way this habit contributes to increase obesity rates depends, on the one hand, on its low caloric expenditure and on the other on the influence that advertisements have on personal food choices, especially for children and adolescents, by generally stimulating high calorie intake.¹⁷

In addition to weight problems, the habit of watching a lot television, especially in early childhood, is also related to sleep, cognitive, and language problems.⁴⁰ The high rate of extremely young children who habitually watch television demonstrates the seriousness of the situation; 40% of three-month old babies and 90% of two-year old children watch television regularly.⁴² These findings are even more disturbing when bearing in mind the expert recommendation that children under the age of two years avoid television altogether.⁴⁰

DISCUSSION

Obesity is a multifactor disorder, whose prevention requires a multidisciplinary and multisector approach involving the industry, public policies, schools and families. Brazil has experienced advances regarding schools involvement and in public policy-making, including work with the industry and in *marketing campaigns*. Nevertheless, these efforts are still limited considering the current situation and future prospects, which indicate an increase in the prevalence of childhood obesity.

CONCLUSION

This paper highlights the numerous risk factors and their consequences, as well as methods used for preventing childhood obesity. Intervention within the family environment starts very early in intrauterine life, and is followed by healthy eating since birth, complemented with incentives for the practice of physical activities as early as the first months of life. Moreover, environmental factors also interfere, especially in schools, where children spend most of their time, and the association of all factors should aim at reducing the prevalence of obesity, both in childhood and in adult life.

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