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Childhood obesity – Towards effectiveness

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Abstract

Objective: To review therapeutic approaches to childhood obesity and also its diagnosis and prevention.

Sources of data: Searches were performed of scientific papers held on the MEDLINE, Ovid, Highwire and Scielo databases. Keywords utilized were: "childhood obesity" and a variety of combinations of this term with "treatment", "prevention" and "consequence". The search returned papers including review articles, observational studies, clinical trials and consensus statements. Bibliographical references in these articles were also investigated if it was perceived that they were relevant. Data was collected from 1998 to 2003.

Summary of the findings: While a number of different Brazilian prevalence studies were found, few gave details of the results of educational programs in our country.

Conclusions: Childhood obesity must be prevented through prescriptive diets from birth throughout childhood. Educational programs that might be applicable to primary health care or schools should receive further study.

J Pediatr (Rio J). 2004;80(3):173-82: Obesity, overweight, eating habits.

There is consensus that childhood obesity is increasing at a significant rate and that it is responsible for a number of different complications both during childhood and adulthood. During childhood, obesity management can be even more difficult than with adults because it is dependent on both changing habits and availability of parents and is further complicated by the child's lack of understanding of the damage caused by obesity.

The objective of this paper is to present the general characteristics of obesity and especially to highlight the practical aspects of broad coverage childhood obesity treatments, in addition to the importance of prevention together with how, in practical terms, this can be achieved.

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Obesity prevalence in Brazil

According to World Health Organization reports, the prevalence of childhood obesity has risen by between 10 and 40% in the majority of European countries during the last 10 years. Obesity is most common during the first year of life, between five and six and during adolescence.[1,2]

Studies[3-7] have been performed in Brazil to verify the increase in childhood obesity, as shown in Table 1.

Figure 1 shows the frequency of elevated obesity and malnutrition rates in two regions of the country over three decades.[8]

Obesity affects all economic classes. In Brazil it is more often present in the higher social classes. Higher socioeconomic status impacts on obesity by means of education, income and profession, which result in specific behavioral patterns that affect the number of calories ingested, energy expended and metabolic rate. In contrast, the extent to which healthier foodstuffs, such as fish, lean meat and fresh fruit and vegetables are generally less available for individuals living under more restricted conditions and as such obesity and low socio-economic class are observed to be related in developing countries.[2,9]

Table 1 - Prevalence of malnutrition, overweight and obesity in children and adolescents in Brazil

Author	City or region	Age group	n	Criterion	Results
Monteiro & Conde, 2000[3]	São Paulo	0 to 59 months	1973/74: 756 1984/85: 999 1995/96: 1,266	index weight/height and z score*	1973/74 - malnutrition: 5.5%; obesity: 3.2% 1984/85 - malnutrition: 1.7%; obesity: 4.0% 1995/96 - malnutrition: 0.6%; obesity: 3.8%
Leão et al., 2003[4]	Salvador	5 to 10 years	387	BMI †	obesity - public school: 8%; private school: 30%
Anjos et al., 2003[5]	Rio de Janeiro	< 10 years	3,387	IOTF ‡	obesity: 5%
Balaban & Silva, 2003[6]	Recife	Children and adolescents	762	BMI	overweight - high income: 34.3%; low income: 8.7% obesity - high income: 15.1%; low income: 4.4%
Abrantes et al., 2002[7]	Southeast and Northeast	Children and adolescents	7,260	BMI	obesity - female: 10.3%; male: 9.2%

* The 1978 National Center for Health Statistics (NCHS) curves were used as reference standard.
† BMI = body mass index.
‡ IOTF = International Obesity Task Force.

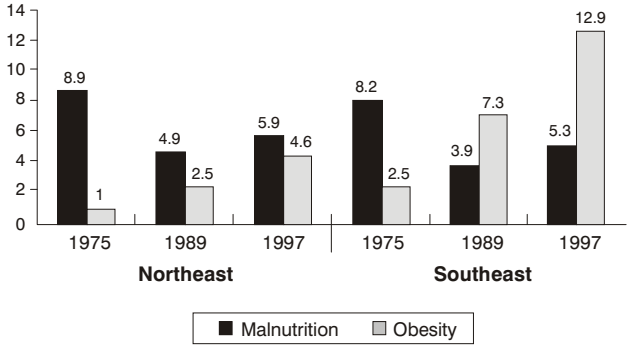

Figure 1 - Frequency of elevated obesity and malnutrition rates in two regions of the country over three decades[8]

Wang et al.[10] compared the prevalence of obesity according to family income across a number of different countries during the seventies, eighties and nineties. Figure 2 shows how Brazil and the United States compare in terms of these factors. In Brazil, in common with the United States and Europe, there is an observed increase in the prevalence of obesity that is strictly related to lifestyle changes (different types of toys, more time in front of the television and computer games and greater difficulty playing outside because of the lack of public safety) and modified eating habits (the greater appeal to consumers of products that are rich in simple carbohydrates and fat and high in calories, the greater ease of preparation of meals that contain high levels of fat and calories, and the lower cost of bakery products).[10]

In Brazil, two large-scale inquiries have been performed, in 1989 and in 1996. They were later critically analyzed by Taddei et al.[11] During these seven years, changes were observed in the prevalence of obesity among children under 5 years old. Increased prevalence was observed in less developed regions and reduced prevalence was observed in more developed regions. Both increases and reductions occurred more intensely among the children of mothers with

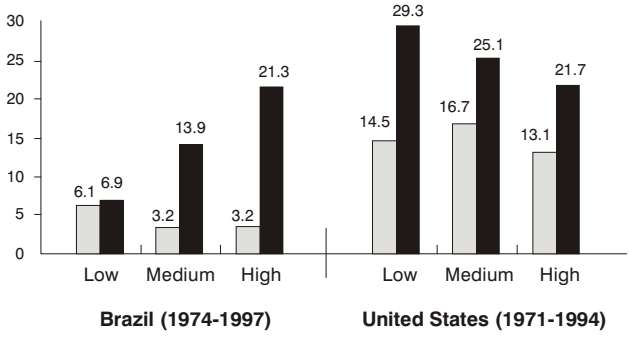

Figure 2 - Comparison of the prevalence of obesity according to family income between Brazil and the United States in the 70s and 90s[10]

greater degrees of education and among children less than two years old (Figure 3).

Definition and assessment of obesity

The definition of obesity is very simple when one is not a prisoner to scientific or methodological formalities. The appearance of the patient's body is the major element. As children gain weight there is accompanying increase in stature and bone aging accelerates. Later, weight continues and stature and bone age remain constant. Puberty can begin earlier which results in reduced final height because the cartilage growth plates close earlier.[12]

There are a number of different diagnostic methods for classifying obese and overweight individuals. Body mass index (BMI, weight/height or length^2) and tricipital skin folds (TSF) are often used in clinical and epidemiological studies. The 85th and 95th BMI and TSF percentiles are often used to detect overweight and obesity, respectively.[13] More recently, Cole et al.[14] have produced a table of world standards for overweight and obesity in childhood. Another commonly used indicator is the obesity index (OI, current weight/weight at 50th percentile, current stature/stature at 50th percentile x 100), which shows us if the patient's weight exceeds that to be expected for their weight, corrected for height/length. According to this scale, obesity is mild if the OI is between 120 and 130%, moderate when between 130 and 150%, and severe when over 150%. A major problem with this method is that it assumes any weight gain over normal body weight represents increase in fat. In fact, not all children with an OI over 120% are actually obese. Even so, this method can be of use when screening for obese children.[15,16]

The choice of one or a number of different methods must be made carefully, taking into consideration sex, age and sexual maturity in order to obtain reference values and classifications of obesity.[17,18] Among females, skin folds can be larger because of the larger proportion of fat.[13] In children and adolescents, BMI is related to age and sexual maturity.[19] There are differences in the proportion of fat and its regional distribution which may be or genetic origin.[20]

Complications of childhood obesity

The total quantity of fat, excessive fat in the torso or abdominal region and excessive visceral fat are aspects of body composition that are associated with chronic-degenerative diseases. Increased serum cholesterol is a risk factor for coronary disease and the risk is increased when associated with obesity. Being overweight triples the risk of developing diabetes mellitus.[21] Obesity, elevated cholesterol levels, smoking, the presence of systemic arterial hypertension, diabetes mellitus and a sedentary lifestyle are all independent risk factors for coronary disease. Obesity

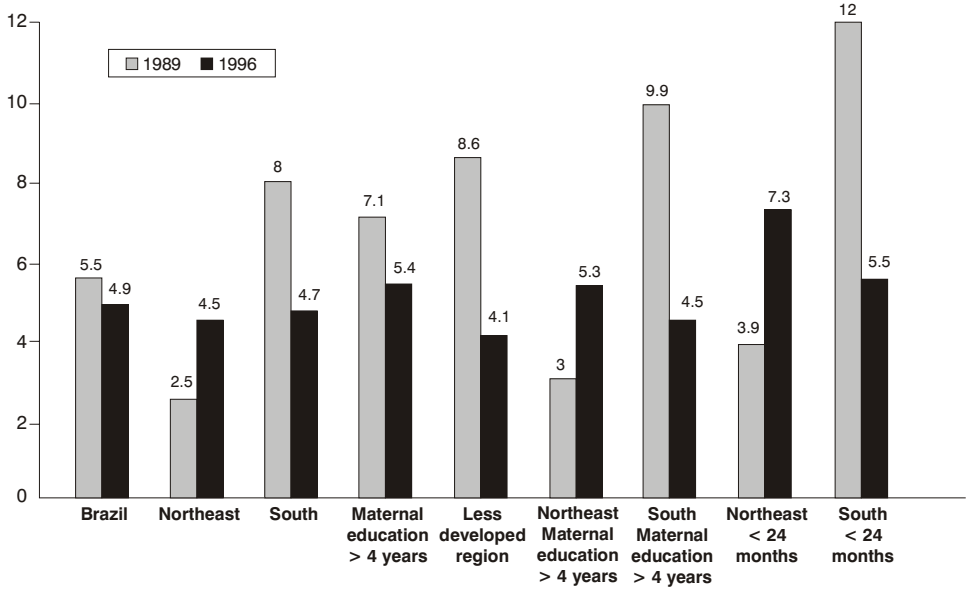

Figure 3 - Prevalences of overweight and obesity in two inquiries performed in Brazil[11]

is a risk factor for dyslipidemia, which in turn encourages increased cholesterol and triglycerides and a reduction in the HDL cholesterol fraction. Wight loss improves the lipid profile and reduces the risk of cardiovascular diseases.[22] Oliveira et al.[23] state that the quality of ingestion is a risk factor for coronary disease and that children's ingestion is intimately related with that of their parents.

Atherosclerosis onset is during childhood, with cholesterol deposited on the tunica intima of muscular arteries, forming fatty streaks. These streaks forming in the coronary arteries of children can, in some cases, progress to advanced atherosclerotic lesions in a few decades. This process is reversible during the start of its development. It is important to point out that the rhythm of progression is variable.[24-26] Systematic lipid profiling during childhood and adolescence is not to be recommended. It should, however, be performed for high-risk patients aged between 2 and 19. Borderline and elevated lipid values are listed in Table 2. If dyslipidemia is confirmed, dietary treatment should be started, for children over two, taking care to give priority to the vitamin and energy requirements that are appropriate for the patient's age and allowing a certain degree of flexibility with relation to, in specific situations, permit the ingestion of fat levels greater than 25%. Patients should be encouraged to ingest fiber and discouraged from foods that are rich in cholesterol and saturated fat and also from the excessive use of salt and refined sugar. When it proves necessary to increase fat levels, this should preferably be done through monounsaturated fats.[26]

Wright et al. present a study aimed at investigating whether childhood obesity increases the risk of obesity in adult life and the risk factors associated with it. They concluded that this risk does exist, but that being slim during childhood is not a protective factor against adult obesity. Thus, they state that childhood BMI has a positive correlation with adult BMI and that obese children have a greater risk of death compared to adults. Notwithstanding, BMI does not reflect fat percentages, and only children obese at thirteen years really have a greater chance of becoming an obese adult.[27]

Table 2 - Reference values of total cholesterol, LDL cholesterol fraction, HDL cholesterol fraction and triglycerides in children from 2 to 19 years old[26]

Lipid	Age (years)	Value (mg/dl) Normal	Borderline	Elevated
Total Colesterol	2 - 19	< 170	170 - 199	≥ 200
LDLc	2 - 19	< 110	110 - 129	≥ 130
HDLc	< 10	≥ 40	–	–
	10 - 19	≥ 35	–	–
Triglycerides	< 10	≤ 100	–	>100
	10 - 19	≤ 130	–	>130

LDL = low-density lipoprotein; HDL = high-density lipoprotein ;
LDLc = LDL cholesterol fraction; HDLc =HDL cholesterol fraction.

The relationship between low birth weight and insulin resistance is uncertain. A recent study showed that there was no significant correlation. However, current weight continues top be a contributing factor to this outcome. This being the case, it is important to manage and prevent childhood obesity, since it is more easily remedied or avoided than low gestational weight, in addition to resulting in consequences that more significant to health.[28]

Childhood obesity is related to a number of different complications in addition to an increased mortality rate. Furthermore, the longer the period for which a person remains obese, the greater the chances that complications will occur, and the earlier they will occur.[29] Table 3 lists the possible complications of obesity.[22,24,30-33]

The scale of weight loss to be recommended and the timescale over which it should be lost can vary depending on the degree of obesity and the nature and severity of complications. Children suffering complications that potentially involve a risk of death are candidates for more rapid weight loss. Available research data is limited to suggesting a safe rate at which children and adolescents can lose weight with no deceleration in the speed of their development. In general, the greater the number and severity of complications, the greater the probability that

Table 3 - Complications of obesity

Articular diseases	Higher risk of arthrosis, osteoarthritis Femoral head epiphysiolysis *Genu valgum*, coxavara
Cardiovascular diseases	Systemic arterial hypertension Cardiac hypertrophy
Surgical risk	Elevated surgical risk
Growth disorders	Advanced bone age, height increase Early first menstruation
Skin diseases	Higher risk of mycosis, dermatitis and pyodermitis
Endocrine-metabolic disorders	Insulin resistance and higher risk of diabetes Hypertriglyceridemia and hypercholesterolemia
Gastrointestinal disorders	Higher frequency of biliary lithiasis Hepatic steatosis and steatohepatitis
Mortality	Higher risk of mortality
Neoplasia	Higher risk of endometrial cancer, breast cancer, vesicle cancer, colon/retum cancer, prostate cancer
Psychosocial disorders	Social prejudice and isolation Withdrawal from the social activities Difficulties to express feelings
Respiratory diseases	Predisposition to hypoxia due to increase in the ventilatory demand, increase in the respiratory effort, reduction in the muscle efficiency, reduction in the functional reserve, microectasias, sleep apnea, Pickwicky syndrome Infections Asthma

this child will require assessment and treatment, perhaps drug-based, at a specialized pediatric obesity control center.[25,26,34]

Obesity and physical activity

Exercise is defined as a type of physical activity that is planned, structured and repetitive. Physical aptitude is an attribute of the individual that includes aerobic potential, strength and flexibility. Studying these parameters can be of assistance for the identification of children and adolescents at risk of obesity. Children and adolescents tend to become obese when they are sedentary and obesity itself can make them more sedentary still.[35] Physical activity, even when spontaneous, is important for body composition, to increase bone mass and prevent osteoporosis and obesity.[36]

Sedentary habits, such as watching television and playing video games, contribute to reduced daily calorific expenditure. Klesges et al. observed a significant reduction in resting metabolic rate while children watched a specific television program. The reduction was greater among obese children.[37] Therefore, in addition to the metabolic expenditure involved in daily activity, resting metabolism can also affect the occurrence of obesity. Increased physical activity, therefore, is an objective to be aimed at[38,39] in conjunction with a reduction in the ingestion of food.[40] Physical activity also results in an individual tending to choose less calorific food.[41]

There are studies that relate the amount of time spent watching television with obesity prevalence. The proportion of children that watch less than one hour daily and are obese is 10%[42] whereas, if the habit is maintained for 3, 4 or 5 or more hours watching television per day it is associated with prevalence of 25%, 27% and 35%, respectively.[43] Television fills free time that children could be using to perform other activities. Children often eat in front of the television and a large proportion of television commercials offer food that is not nutritional and is high in calories.[40,44,45] Grazini & Amâncio analyzed the content of commercials aired during programs aimed at adolescents, finding that a majority of them (53%) were for snacks and soft drinks.[46]

Obesity is difficult to treat because base metabolic rates vary from person to person and for any given person under changing circumstances. Thus, at a given level of calorie consumption, one person may fatten and another not. Furthermore, obese people generally perform less physical activity than those who are not obese. It is difficult to decide whether a sedentary lifestyle is the cause o obesity or its consequence.[47]

In terms of physical activity, obese children generally have little sporting ability and do not stand out. Before starting systematic physical activity a careful clinical evaluation should be performed.[48] Notwithstanding, formal gymnastics, carried out at a gym, unless particularly enjoyed by the patient, are unlikely to be tolerated for long periods. This is because the processes are repetitive, lack any element of play and are artificial in the sense that the movements performed do not form part of the day-to-day lives of the majority of people. Additionally, parents and/or guardians may encounter problems with taking children to systematic activities, both because of cost and transportation considerations. Creative ideas for increasing the level of physical activity are therefore required, such as using the stairs if living in an apartment block, playing with balloons, skipping, walking around the block and helping with domestic chores.[49,50] Even changing between sedentary activities results in an increase in energy expenditure and in behavioral changes, avoiding remaining inert for hours performing a single, sedentary activity, as though it was an addiction.[42]

Bar-Or discusses aspects of obesity and physical activity, pointing out that programs should stimulate spontaneous physical activity and that, at the end of a program of intense sporting participation an assessment should be made of whether the child's lifestyle has changed. The child should be motivated to remain active and the activity should preferably be taken up by the whole family.[51]

Obesity and eating habits

A number of different have an influence of eating behavior. These include external factors (the family unit and its characteristics, the attitudes of parents and friends, social and cultural values, the media, fast food, nutritional knowledge and food fads), internal factors (psychological needs and characteristics, body self-image, personal values and experience, self-esteem, eating preferences, health and psychological development).

Problems attaining good control of satiety are a risk factor for the development of obesity, both during childhood and adulthood. When children are obliged to eat everything that is served to them, they may lose the point of satiety. Satiety originates after the consumption of food and suppresses hunger maintaining this inhibition for a determined period of time. The cephalic phase of appetite begins even before food is brought to the mouth, consisting of physiological signals, generated by vision, hearing and smell. These physiological stimuli involve a large number of neurotransmitters, neuromodulators, channels and receptors. Stomach distension is an important signal of satiety. In addition to mechanical stimuli, neurotransmitters and peptides such as cholecystokinin, glucagon, bombesin and somatostatin are involved. Cholecystokinin is considered a satiation-mediating hormone. Within the central nervous system, principally in the hypothalamus, seratonin-based appetite control systems are found. Other peptides, such as beta-endorphin, dynorphin and galanin, are active within the central nervous system affecting ingestion and/or satiety. Neuropeptide Y is the most potent known appetite stimulator. Leptin, produced within adipose tissues, has both a central and peripheral role, participating in energy control and probably interacts with neuropeptide Y in appetite and satiety control. Thus, the size of a plate or portion does not determine satiety; the child may be sated earlier or want to eat more.[52,53]

Aspects of those eating habits that are most related with obesity have been very well studied. Maternal

breastfeeding is preached as a protective factor against obesity.[54,55] Notwithstanding, habits such as not eating breakfast, eating large quantities of calories late in the day, ingesting a limited range of foods and preparations, and in large quantities, consuming high-calorie, lightweight liquids in excess, and having inappropriate feeding practices at an early age are all prejudicial and induce obesity.[56,57] A prospective study, 19 months in duration, involving 548 children from the fifth and sixth grades, found that BMI and obesity frequency increased for each additional portion of drinks containing refined sugar.[58] Snacking habits, analyzed for individuals between 2 and 18 years of age, has also altered over the last few decades. Nowadays, more children eat snacks than in the past, with the largest increase occurring during the last decade. Average ingestion of calories in the form of snacks has increased from 450 to 600 calories a day and nowadays makes up 25% of daily energy intake. The calorific density of children's snacks has also increased from 1.35 to 1.54 kcal/g.[59] This finding is important since small increases in calorific density of food consumed can lead to large increases in total calorie consumption. This being so, the tendency towards consuming snacks could be contributing to increased childhood obesity. Added sugar can reach a third or all calories ingested by the American population.[60]

Parents exercise a strong influence over the foods their children ingest. However, the more parents insist that a child consumes a certain foodstuff, the lower the probability that the child will do so. Similarly, restrictions made by parents can have deleterious effects. During early childhood, parents are recommended to provide their children with snacks and meals that are health, balance, with sufficient nutritional levels and allow the children themselves to choose the quality and quantity they want to eat of these healthy foods.[21,23]

Management of childhood obesity

Obesity can be divided into obesity of exogenous origins – the most common – and obesity of endogenous origins. In endogenous cases, the underlying disease should be identified and treated. Exogenous obesity starts with an imbalance between calorific intake and expenditure and should be managed with dietary guidance, in particular changing habits and optimizing physical activity.[61]

It is essential that the following be assessed: the availability of food, preferences and refusals, prepared foods habitually consumed, the location where meals are taken, who prepares and serves them, the child's habitual activities, liquid consumed with and between meals and beliefs and taboos about food. Reducing the consumption of hypercalorific foodstuffs alone is enough to reduce weight.[62]

It is also important to point out that children and adolescents follow paternal patterns and, if these are not modified or managed in conjunction, an unsuccessful treatment outcome can be expected[63,64] (Figure 4).

It is important that dietary guidance defines a controlled rate of weight loss, normal growth and development, the consumption of micro and macronutrients in adequate quantities for sex and age, a reduction in appetite or voracity, the maintenance of muscle mass, the absence of negative psychological consequences along with the maintenance of correct eating habits and the modification of unsuitable ones.[65] Smaller children should maintain their weight or gain a little in order to avoid compromising their development.[15,61,62]

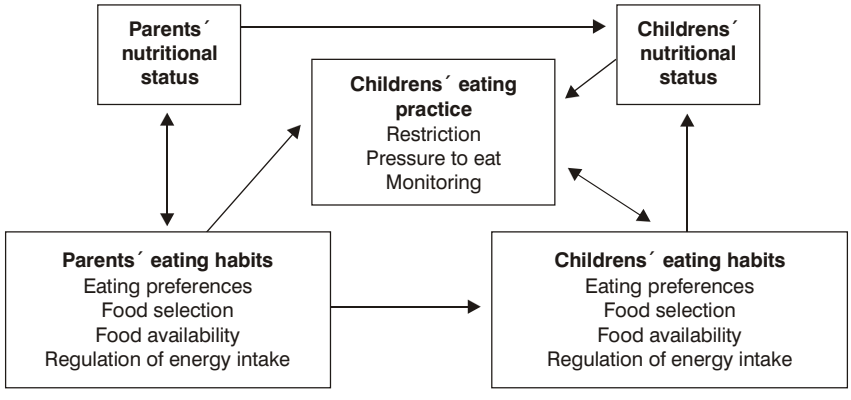

Figure 4 - Behavioral measurement of family similarities regarding eating habits and nutritional status[64]

The American Academy of Pediatrics' 2003 guidelines for the treatment of childhood obesity are as follows:[33]

Health supervision: identify at-risk patients by means of family history, birth weight or socioeconomic, ethnic, cultural or behavioral factors, calculate and record BMI once a year for all children and adolescents, use change in BMI to identify excessive rates of weight gain to linear growth, encourage maternal breastfeeding, direct parents to encourage healthy eating patterns offering healthy snacks, encourage children to achieve autonomy in controlling their food intake, establish appropriate limits at schools, routinely promote physical activity including unstructured play at home, set limits to time spent watching television and video to a maximum of 2 hours per day, recognize and monitor changes in risk factors associated with obesity for adults with chronic diseases such as systemic arterial hypertension, dyslipidemia, hyperinsulinemia, glucose intolerance and obstructive sleep apnea symptoms.

General support: help parents, teachers, coaches and other professionals who have an influence of youth to discuss healthy habits and not body-beautiful culture as part of the effort to control overweight and obesity, encourage the management at local, state and national organizations and schools to provide the necessary conditions for all children to have a healthy lifestyle including suitable nutrition and adequate opportunities for regular physical activity, encourage the organs that are responsible for health finance and care to promote effective strategies for the prevention and treatment of obesity, encourage public and private entities to channel funds into research into effective strategies for preventing overweight and obesity and to maximize limited family and community resources to achieve results that are healthy for youth, promote support and defend by social marketing with the intention of promoting healthy nutritional schools and more physical activity.

Treatment programs that involve overweight children and adolescents in rigorous physical activities and gymnastics demonstrate significant benefits in terms of weight loss and in terms of physical condition. However, a majority of the programs described extend for periods of up to 10 months, involving continuous and intensive treatment and requiring incentives to ensure that participants adhere, which cannot be applied in daily practice.[62,66] The results of these programs are not so encouraging, although when applied to children the results are better.[62,67]

A majority of dietary intervention techniques focus on reducing the consumption of fats, even when dietary fat may not be a significant cause of obesity. Many studies of techniques based on physical activity have prescribed conventional exercise programs, even though encouraging an active lifestyle or reducing sedentary behavior may be more effective at controlling weight over the long term.[2,62,65]

Innovative programs have been developed that are designed to widen children's nutritional knowledge and also to have a positive influence on diet, level of physical activity and inactivity.[67-70] Campell et al. performed a review of childhood obesity management programs, concluding that there are yet too few studies for effective conclusions to be established, but that strategies aimed at reducing sedentary habits are useful.[71] Protocols for a number of different childhood obesity management programs were also studied by Summerbell et al., who found that their orientation varies greatly. Some are group interventions others are for individuals, there are programs with and without medical supervision, family, behavioral and cognitive therapy and pharmaceutical treatment. In the face of this, greater consensus is required in terms of effectiveness conclusions, since intervention techniques vary significantly.[72]

Currently, school-based health-education programs are the most effective strategy for reducing chronic public health problems related to sedentary lifestyle and incorrect eating patterns, although more studies are necessary.[73]

Preventing childhood obesity

As intervention programs continue to enjoy little consensus, prevention remains the best approach. Efforts at preventing childhood obesity are probably more effective when directed at primordial, primary and secondary targets simultaneously, with appropriately objectives for each. Primordial prevention aims at preventing children from being "at risk" of becoming overweight, primary aims at preventing "at risk" children from becoming overweight and secondary prevention aims at opposing the growing severity of obesity and reducing its co-morbidity among overweight and obese children. Against this background basic action priorities can be identified, prioritized and linked to potentially satisfactory intervention strategies.[34]

Primordial and primary prevention strategies are most effective, probably if begun before school age and continued throughout childhood and adolescence. Significant effort should be made in order to aim them towards the prevention of obesity during the first ten years of life. Scholl policy can either promote or discourage healthy diet and physical activity.[67,74,75] It is highly important that, at all grades, the study of nutrition and healthy living habits are incorporated into schools' formal curricula, since it is at this point and in this place that interest and understanding may begin and even adults' habits can be changed through children and adolescents.

Figure 5 presents the principal targets in childhood obesity prevention.[76]

The majority of these recommendations should be adhered to by the whole family, whether individual family members are obese or not.[25,61,64,77,78]

In our country childhood obesity is a serious public health problem which has been increasing in all social strata of the Brazilian population. It seriously affects current and future health. Preventing childhood obesity results in a reduction in chronic degenerative diseases by rational and little onerous means. School is an important site for this work since children eat at least one meal at school which makes nutritional education work possible and also allows

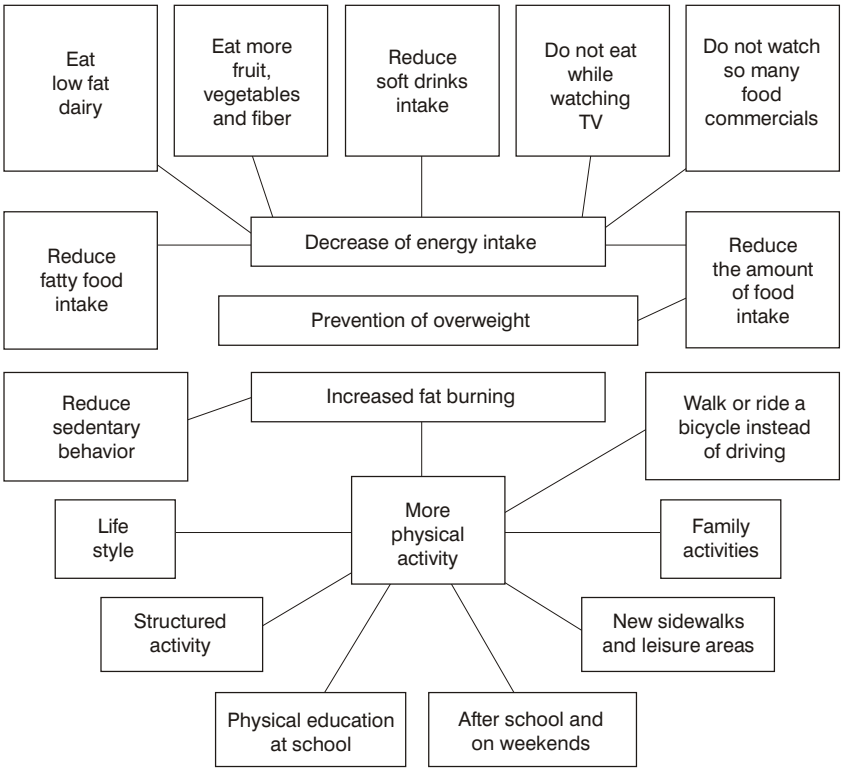

Figure 5 - Principal targets in childhood and adolescence obesity prevention[76]

for increased physical activity to be provided. School meals should meet the nutritional needs of its children, in both quality and quantity, and be an agent for the formation of healthy habits.[67]

To achieve healthy nutrition, in addition to providing the correct information on nutrition and health (promotion), it is also necessary to prevent incorrect and contradictory information from reaching individuals (protection) and, at the same time conditions must be created that make adoption of the guidance they receive practicable (support). This entails that a consistent obesity prevention policy should cover not just educative and informative activities (such as mass media campaigns), but legislative measures (such as controlling the advertisement of unhealthy foods, particularly aimed at children), tax measures (making healthy food tax exempt and increasing the prices of unhealthy ones), the training and refreshing of health professionals, measures to support the production and sale of healthy foods and even measures related to urban planning (for example, giving priority to pedestrians and not automobiles and providing grants for underprivileged areas that lack the minimum resources necessary to practice physical leisure activities).[32,33,78-80]

Knowing what is necessary to lose weight does not present any great difficulties after a certain amount of practice. To want, to need and to be able to lose weight are issues that are hugely more complex and demand great emotional, intellectual and physical investment.

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