REVIEW / SYNTHÈSE

Childhood obesity: food, nutrient, and eating-habit trends and influences

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Abstract: The need has never been greater to support healthy eating and physical activity in children and youth; the numbers of overweight and obese children have doubled and tripled, respectively, over the past 3 decades. Poor eating habits, including inadequate intake of vegetables, fruit, and milk, and eating too many high-calorie snacks, play a role in childhood obesity. Grain products provide the highest percentage (31%) of daily calories, followed by "other foods," which have limited nutritional value (22% of daily calories). Snacks account for 27% of total daily calories, which is more than the calories consumed at breakfast (18%) and lunch (24%), but not dinner (31%). For Canadians older than 4 years of age, more than 41% of daily snack calories come from other foods, such as chips, chocolate bars, soft drinks, fruit drinks, sugars, syrup, preserves, fats, and oils. Habits that protect against childhood obesity include eating more vegetables and fruit, eating meals with family, and being physically active. Children's food habits and choices are influenced by family, caregivers, friends, schools, marketing, and the media. Successful interventions for preventing childhood obesity combine family- and school-based programs, nutrition education, dietary change, physical activity, family participation, and counseling.

Key words: obesity, overweight, children, nutrition, eating habits.

Résumé : Au cours des trente dernières années, le taux d'embonpoint et d'obésité a respectivement doublé et triplé; le temps est venu d'encourager les jeunes à adopter de saines habitudes de vie en matière d'alimentation et de pratique d'activité physique. De mauvaises habitudes alimentaires dont des collations hypercaloriques combinées à un apport insuffisant de lait, de fruits et de légumes jouent un rôle dans la manifestation de l'obésité infantile. Les produits céréaliers fournissent la plus grande part de l'énergie journalière (31 %), puis ce sont les « autres aliments » qui contribuent pour 22 % mais leur valeur nutritive est limitée. Les collations apportent 27 % des calories de la journée, soit plus que ne le fait le déjeuner (18 %) et le dîner (24 %), mais moins que le souper (31 %). Chez les Canadiens de plus de 4 ans, plus de 41 % des calories comprises dans les collations proviennent des « autres aliments » tels les croustilles, tablettes de chocolat, boissons gazeuses, boissons fruitées, friandises, sirop et agents de conservation, graisses et huiles. Certains comportements protègent les jeunes contre l'obésité : manger plus de fruits et légumes, prendre ses repas en famille et être physiquement actif. Les habitudes alimentaires et le choix des aliments sont influencés par la famille, les soignants, les amis, l'école, le marketing et les médias. Les interventions favorables à la prévention de l'obésité infantile combinent les programmes famille-école, l'éducation alimentaire, les régimes alimentaires, l'activité physique, la participation de la famille et le counseling.

Mots-clés : obésité, surpoids, enfants, nutrition, habitudes alimentaires.

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Introduction

Childhood obesity is top of mind for health professionals and the public as a result of heightened media attention about this issue. The increase in childhood obesity in Canada results from the combined impact of children's food and activity habits from a young age and the eating influences and environmental supports or deterrents at home, at school, and in the media.

This article addresses childhood obesity trends and potential causes, food and nutrient trends in children, and eating habits associated with being overweight. It also reviews how children's eating is influenced by the family and home environment. It reviews how schools influence children's eating through education and role modeling, and through the school culture and eating environment. Marketing and the media also influence children's food choices, and the food industry is expected to become more responsible when marketing to children. Reversing childhood obesity trends will only be possible with multifaceted interventions, and the types of interventions that are required are discussed.

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Childhood obesity: trends and potential causes

Childhood obesity: trends

The prevalence of overweight and obese children has in-

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creased remarkably since the early 1980s, and continues to be a major public health concern in Canada (Tremblay and Willms 2000; Tremblay et al. 2002; Willms et al. 2003). Children who are overweight or obese are at greater risk for adult health problems, such as high blood pressure, diabetes, and heart disease (Freedman et al. 2007), as well as psychosocial issues (Daniels 2006).

According to the latest Canadian Community Health Survey (2004*a*), which measured the height and weight of children, 26% of 2 to 17 year olds were overweight and, of these, 8% were considered obese. The overweight/obesity rate of adolescents aged 12 to 17 more than doubled, from 14% to 29%, and their obesity rate tripled, from 3% to 9%, between 1978/79 and 2004 (Canadian Community Health Survey 2004*a*). The percentage of children aged 2 to 5 who were overweight remained virtually unchanged, and was reported to be 21% in 1978/79 and 2004 (Canadian Community Health Survey 2004*a*).

Body mass index (BMI) cutoffs of 25 and 30 are used to classify adults as overweight and obese, respectively. The Canadian Community Health Survey (2004*b*) used the International Obesity Task Force approach to measure overweight and obesity among children and adolescents that are sensitive to the timing of puberty. This involved extrapolating the adult cutoffs of 25 and 30 to create sex- and age-specific values. These BMI cutsoffs are lower than those used for adults (Canadian Community Health Survey 2004*b*).

Childhood obesity: potential causes

The increase in childhood obesity over the past several decades has no single contributing factor. Some of the key contributing factors are eating more energy-dense high-calorie foods, eating more food away from home, eating more preprepared foods, walking less to school and other destinations, and spending more time watching television and using computers (Anderson and Butcher 2006).

The Canadian Community Health Survey (2004*a*) reported that 59% of Canadian children and adolescents consumed fruit and vegetables fewer than 5 times a day. These young people were significantly more likely to be overweight/obese or obese than were those who ate fruit and vegetables more frequently (Canadian Community Health Survey 2004*a*).

Analysis of the Canadian Community Health Survey (2004*a*) data shows that physical activity levels were not associated with being overweight or obese at ages 6 to 11, but by ages 12 to 17, associations were significant, although only for boys. Among children aged 6 to 17, the likelihood of being overweight or obese tends to rise with time spent watching television, playing video games, or using the computer (Canadian Community Health Survey 2004*a*).

According to the Active Healthy Kids Canada (2006) report card on physical activity for children and youth, fewer than half of Canadian children meet the minimum daily physical activity requirements for healthy growth and development. Canada's physical activity guides for children and youth recommend that children get 60 minutes of moderate physical activity and 30 minutes of vigorous activity each day (Health Canada 2002).

A number of studies have found that physical activity is protective against childhood obesity. Janssen et al. (2005) studied children in 34 developed countries and found that physical activity levels were lower and television viewing times were higher in overweight than in normal weight youth. Tremblay and Willms (2003) found physical activity in children to be negatively associated with being overweight, and television watching and video-game use to be risk factors for being overweight. A long-term cohort study in Britain found that television viewing in early childhood predicts a higher BMI in adulthood (Viner and Cole 2005).

Investigators in the Framingham Children's Study in Boston, Mass. found that the average habits of preschoolers predict their future weight status in adolescence, particularly physical activity (Moore et al. 2003). The critical time to instill healthy eating and activity habits to prevent unnecessary weight gain is when children are young.

Food and nutrient intake trends in children

There are limited data regarding trends in food and nutrient intake in Canadian children because of a lack of consistent data gathered at the national level. The most recent Canadian Community Health Survey (2004*c*) is the first national survey of eating habits to be released in Canada since the early 1970s. However, continuing nutrition surveys conducted by the Department of Agriculture in the United States (Enns et al. 2002, 2003) provides some insight.

Food choices

The dietary changes observed in school-aged children are reflective of the overall trends in the types of food currently favoured by North Americans (Dietitians of Canada 2003). Both Canadian and American studies undertaken since the early 1990s suggest a trend toward a decreasing consumption of milk, vegetables, whole-grain breads, and eggs, and increasing intake of fruit and fruit juices, carbonated beverages, salty snacks, poultry, and cheese (King et al. 1999; Cavadini et al. 2000; Enns et al. 2002, 2003; Nicklas et al. 2004; Agriculture and Agri-Food Canada 2005). These shifts in food choices affect the nutrient intake of children.

Macronutrients

In Canada, macronutrient intake is in line with the acceptable ranges set by the Institute of Medicine (2005) for fat, protein, and carbohydrates. The recommended levels for children aged 4 to 18 are 25% to 35% of energy from fat, 10% to 30% from protein, and 45% to 65% from carbohydrates. Canadian children and adolescents, on average, get 30.7% of their calories from fat, 14.7% from protein, and 55.4% from carbohydrates (Canadian Community Health Survey 2004*c*).

Fat has been the focus of many efforts to reduce unnecessary weight gain. That is because high-fat foods also tend to be high in calories. In Canada, meat and alternatives, milk products, and "other foods" all contribute about the same proportion of fat to a child's diet (Canadian Community Health Survey 2004*c*). Most of the fat in the Canadian diet comes from foods classified as sandwiches (which includes pizza, sandwiches, submarines, hamburgers, and hot dogs), followed by sweet baked goods (such as cake, cookies, and doughnuts); milk and milk-based beverages; salads with

dressing; cheese; pasta dishes; french fries; egg dishes; and margarine (Canadian Community Health Survey 2004*c*).

In the United States, research suggests that macronutrient distribution within the diet has shifted, particularly where carbohydrates are concerned. American trends data show that the percent of energy from carbohydrates increased, but the percent of energy from protein and fat (including saturated fat) decreased (Enns et al. 2002, 2003). The lower percentage of energy from fat is partly due to increased carbohydrate intake rather than lower fat intake. Higher carbohydrate intake did not result in a higher intake of dietary fibre (Enns et al. 2002).

Energy intake

The average daily intake of calories by Canadian children is shown in Fig. 1. Results from the Canadian Community Health Survey (2004*c*) indicate that calorie consumption is highest during adolescence, and declines with age. Because of different assessment techniques, the 2004 data could not be statistically compared with the 1970–1972 Nutrition Canada data; however, results from these 2 surveys suggest that calorie consumption by Canadian children has not increased (Canadian Community Health Survey 2004*c*).

Grain products were the top energy provider, supplying 31% of calories (Fig. 2.). The other foods category ranked second, providing, on average, 22.3% of daily calories for children aged 4 to 18 years. Vegetables and fruit provided the lowest percentage of calories (13.9%) for children.

The other foods category consists of foods and beverages not part of a food group in Canada's food guide, and includes foods that are mostly fats, oils, or sugar; high-fat and (or) high-salt snack foods; beverages; and herbs, spices, and condiments. The top 10 other foods contributing extra calories to the diet of adults and children were soft drinks, salad dressing, sugars/syrups/preserves, beer, fruit drinks, oils/fats, margarine, chocolate bars, potato chips, and butter (Canadian Community Health Survey 2004*c*).

Children consumed more calories from snacks than from breakfast. Food and beverages consumed by 4 to 18 year olds as snacks accounted for 27% of total daily calories. This is more calories than consumed at breakfast (18%) or lunch (24%), but fewer than the total calories consumed at dinner (31%) (Canadian Community Health Survey 2004*c*). The proportion of calories from snacks peaked, among 14 to 18 year olds, at 30% for males and 28% for females, and then decreased with age (Canadian Community Health Survey 2004*c*).

For Canadians 4 years and older, more than 41% of snack calories were from the "other foods" category, followed by "grain products" (21.2%), "milk products", (15.8%), "vegetables and fruit", (13.0%), and "meat and alternatives" (8.5%) (Canadian Community Health Survey 2004*c*).

Earlier studies support the findings of the Canadian Community Health Survey. A study of the food habits of Canadians (1543 adults aged 18–65 and 178 adolescents) found that food choices from the other foods group contributed more than 25% of energy and fat intake for all age and sex groups (Starkey et al. 2001).

In the United States, the Institute of Medicine reported that at least 30% of the calories in the average child's diet are derived from sweets, soft drinks, salty snacks, and fast food (McGinnis et al. 2006). They also reported that soft drinks accounted for more than 10% of caloric intake, double the number in 1980.

Fig. 1. Average daily calories consumed by Canadian children 4 years and older (Canadian Community Health Survey 2004*c*).

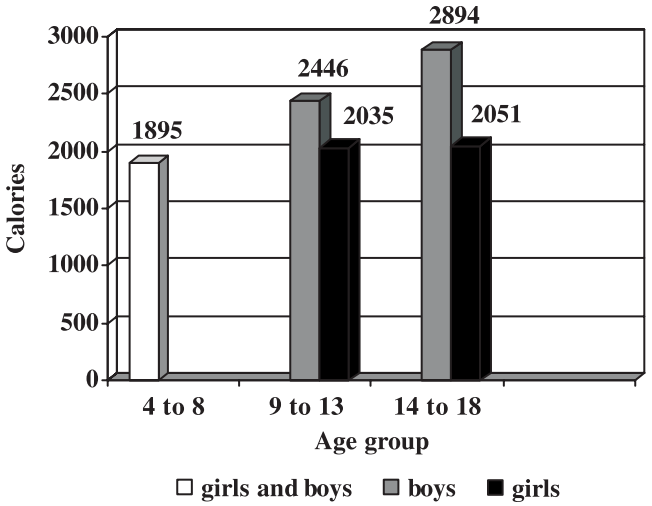
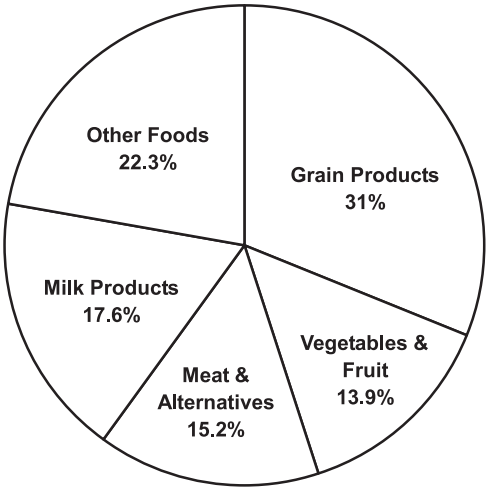


Fig. 2. Percentage distribution of sources of calories, by food group, for 4 to 18 year olds (Canadian Community Health Survey 2004*c*).



Also in the United States, the energy and proportion of energy from fat consumed during snacking was higher than that from food consumed during nonsnacking eating occasions; calcium, however, was lower. (Jahns et al. 2001). Jahns et al. (2001) also found that the average size of snacks and energy per snack remained relatively constant, but the number of snacking occasions increased significantly, increasing the average daily energy from snacks.

Food groups

According to the latest Canadian Community Health Survey (2004*c*), many children were not consuming a balanced diet . The food choices of children were compared to the 1992 *Canada's Food Guide to Healthy Eating* (Health Canada 1992). This food guide recommended a daily intake of at least 5 servings of vegetables and fruit and grain products. For milk products, children 4 to 9 years of age were to have

2 to 3 servings per day; children 10 to 16 years of age, 3 to 4 servings per day; and those over 17 years of age, 2 to 4 servings per day. The recommendation for meat and alternatives was 2 to 3 servings per day. Other foods were to be consumed in moderation.

Seven of 10 children aged 4 to 8, and more than 60% of children aged 9 to 13 (62% of girls, 69% of boys) had fewer than 5 servings of vegetables and fruit each day. The average intake of vegetables and fruit was 4.5 servings per day for children and adolescents in all age groups (Table 1).

On average, children aged 4 to 18 years consumed 6.5 servings of grain products each day (Table 1). More than a quarter of children aged 4 to 8 and 33% of girls aged 14 to 18 did not consume the minimum 5 servings of grain products per day (Canadian Community Health Survey 2004*c*).

The milk products group includes milk, cheese, and yogurt. On average, children aged 4 to 18 years consumed 2 servings of milk products each day (Table 1). However, more than one third of 4 to 9 year olds did not have the minimum recommended 2 daily servings of milk products (Canadian Community Health Survey 2004*c*). By ages 10 to 16, 61% of boys and 83% of girls did not meet the recommended minimum of 3 daily servings (Canadian Community Health Survey 2004*c*).

The meat and alternatives group includes meat, fish, poultry, eggs, and alternatives, such as beans, lentils, tofu, peanut butter, nuts, and seeds. In the 1992 food guide, 2 to 3 servings of meat and alternatives was equivalent to 100 to 300 g. Meat and alternatives intake, on average. was,above 100 g per day. There was a gradual increase in meat and alternatives from ages 4 to 18 years, with boys consuming more meat and alternatives than girls after the age of 9 (Canadian Community Health Survey 2004*c*).

As reported earlier, other foods provided 22.3% of calories for children 4 to 18 years of age. For teens aged 14 to 18, other foods provided 25% of calories (Canadian Community Health Survey 2004*c*).

The new *Eating Well with Canada's Food Guide* (Health Canada 2007) makes more specific recommendations for the number of servings children should have from each food group each day (see Table 2). It also provides specific advice about eating 1 dark green and 1 orange vegetable each day, making half of grain choices whole grain, and having 2 cups (500 mL) of fluid milk each day. More studies are needed to see whether children are meeting these recommendations.

The Canadian Living Foundation – Breakfast for Learning (2006) *Report Card on Nutrition for School Children* found that 59% of children aged 6 to 17 years (n = 499) had 4 or more servings of vegetables or fruit per day (excluding fruit juice and french fries), 60% had 2 or more servings of whole grains or cereals per day, and 63% had 3 or more servings of milk products or calcium-fortified orange juice or soy products per day. One quarter of children consumed 2 or more servings of french fries per week, 37% consumed 2 or more servings of fruit juice per day, and 37% consumed 1 or more serving of regular soft drinks per day.

A web-based study of Ontario children in grades 6, 7, and 8, conducted by the University of Waterloo (Hanning et al. 2007), looked at nutrient intake and food consumption patterns of 651 children. They found that median intake for all food groups, except meat and alternatives, was below the levels recommended by *Canada's Food Guide to Healthy Eating* (Health Canada 1992). Participants also consumed 25% of total energy from foods from the other foods category.

An earlier web-based study by the same group examined the food behaviour of Ontario students in grades 6 to 10 (n = 3255). Researchers found low median intakes of most of the food groups in *Canada's Food Guide to Healthy Eating* (Health Canada 1992) for both sexes and across several grade levels (R. Hanning, personal communication, 2002). The vegetables and fruit and milk products groups were most likely to be consumed in inadequate amounts. The intake of more than half the students was below the minimum recommended 5 servings of vegetables and fruit each day. More girls than boys did not meet the 3 to 4 servings recommended for the milk products group. About half the students did not consume the minimum recommended 5 servings of grain products each day. Intake by boys and girls of meat and alternatives met the minimum *Canada's Food Guide to Healthy Eating* recommendation.

Beverages

Soft drinks are the single greatest beverage of choice in Canada, and are predicted to remain so (Agriculture and Agri-Food Canada 2005). Innovation continues to offer many new beverage choices aimed at the youth market. Hot and cold beverages, such as soft drinks, fruit drinks, iced coffees, smoothies, milk shakes, and sports and energy drinks, are all popular choices, and can provide significant extra calories to a child's daily diet.

Canadian studies show that daily soft drink consumption has become the norm for many children. The Canadian Living Foundation – Breakfast for Learning (2006) *Report Card on Nutrition for School Children* found that 37% of children aged 6 to 17 years consumed 1 or more servings of regular soft drinks, and 37% of children had 2 or more servings of fruit juice per day. An earlier study by Evers et al. (2001) found that approximately one third of Ontario students in grades 4 to 8 consumed soft drinks daily.

High consumption of sugar-sweetened soft drinks, which provide excess calories and large amounts of rapidly absorbable sugars, is associated with an increased risk of obesity in children (Ludwig et al. 2001; Nicklas et al. 2003). Soft drink consumption can also reduce the intake of essential nutrients. An American study found that children with the highest soft drink consumption consumed less milk and fruit juice than those who drank fewer soft drinks (Harnack et al. 1999). Soft drinks can have a negative impact on bone health, especially in girls, because they displace milk and essential bone-building nutrients from the diet (Whiting et al. 2004).

Fast foods

About one fifth of children aged 4 to 13 years reported eating some fast foods the day before they were interviewed for the Canadian Community Health Survey (2004*c*). One third of 14 to 18 year olds reported eating some fast food. Children aged 4 to 8 and girls aged 9 to 13 were more likely to consume only food prepared at home (60%) than boys 9

Table 1. Average daily servings, from the 4 food groups, consumed by Canadians aged 4 to 18 y (Canadian Community Health Survey 2004*c*).

Age group (y), sex	Vegetables and fruit (servings)	Grain products (servings)	Milk products (servings)	Meat and alternatives (g)
4–18	4.45	6.41	2.29	153
4–8	4.18	5.76	2.31	118
9–13, male	4.53	7.09	2.55	176
9–13, female	4.40	5.92	2.08	130
14–18, male	4.87	7.98	2.64	229
14–18, female	4.45	5.74	1.82	136

to 13 (55%) and boys and girls aged 14 to 18 (44%) (Canadian Community Health Survey 2004*c*).

The portion or serving size of fast foods and beverages has been cited as a cause of obesity in the popular media. According to Young and Nestle (2002), marketplace food and beverage portion sizes began to grow in the 1970s, rose sharply in the 1980s, and have continued to increase in parallel with increasing body mass. The American Academy of Paediatrics (2004) found that a standard serving of carbonated beverage increased from 6.5 oz (192 mL) in the 1950s, to 12 oz (355 mL) in the 1960s, and to 20 oz (591 mL) by the late 1990s. The soft drinks and other sweetened beverages and sports drinks sold in stores and vending machines in schools and recreation centres are typically available in 500 mL bottles.

Children's eating habits associated with excess weight

Studies have shown that poor eating habits, eating at school, and eating in front of the television are associated with excess weight and obesity in children. Eating together as a family and being physically active are protective against obesity.

In Nova Scotia, 4298 grade 5 students were weighed, measured, and assessed for dietary habits (Veugelers and Fitzgerald 2005). Based on the results of that study, the estimated provincial prevalence of overweight children was 32.9% and of obese children was 9.9%. Children who bought lunch at school were at increased risk of being overweight. Children attending schools where lunches were provided by a foodservice company (onsite catering or fast food) were 12% more likely to be overweight than children who attended schools where no foodservice companies were used, but this difference was not statistically significant. Children who ate supper together with their family 3 or more times a week were at decreased risk of being overweight. Physical education classes 2 or more times a week at school were associated with a decreased risk of being overweight. Children who lived in high-income neighbourhoods were half as likely to be obese as their peers who lived in low-income neighbourhoods.

In another paper based on the same study (Veugelers et al. 2005), children reporting frequent consumption of meals in front of the television and less physical activity had poorer diets. Skipping meals and purchasing meals at school or fast-food restaurants were statistically significant determinants of poor diet.

Eating in front of the television has also been linked to children being overweight (Matheson et al. 2004). Studies show that children and teens who eat in front of the television have lower intakes of fruit and vegetables and higher intakes of pizza, snack foods, and soft drinks (Marquis et al. 2005; Boynton-Jarrett et al. 2003; Coon et al. 2001). Television viewing can also exert external cues to promote the consumption of certain foods, but not necessarily the healthiest choices (Halford et al. 2004).

Children's eating influences: family, school, marketing, and the media

Parents and other family members, childcare providers, friends/peers, and other role models, such as teachers and coaches, influence a child's food choices. Schools, food marketers, and the media also influence children's eating habits. Taylor et al. (2005) suggest that familial factors and the nature of foods available at home, schools, and fast-food establishments are the most significant influences on the eating habits of children and youth. They also suggest that the media, particularly television, has an enormous potential influence and can overshadow familial influences. For teenagers, a broad range of factors influence food choices, such as hunger, food cravings, appeal of food, time considerations of adolescents and parents, convenience, availability, parental influence on eating behavior (including the culture or religion of the family), benefits of foods (including health), situation-specific factors, mood, body image, habit, cost, media, and vegetarian beliefs (Neumark-Sztainer et al. 1999). A small American study (n = 108) of adolescents aged 11 to 18 years determined that the primary food-choice criteria were taste, familiarity/habit, health, dieting, and "fillingness" (Contento et al. 2006).

Family and home influences

During early and middle childhood, parents and the family environment are key influencers of the development of food preferences, patterns of food intake, eating styles, activity preferences, and patterns that shape children's developing weight status (Birch and Davison 2001).

Young children depend greatly on what their parents provide them to eat, and that influences what they actually eat. Parents also serve as role models and children will follow their lead, choosing foods that their parents like to eat because these are foods likely served most often. Parents who make healthy foods accessible and who serve these foods in positive mealtime situations help their children to develop healthy eating habits (Koivisto Hursti 1999). Because of the time spent with children, childcare providers are at least as

Table 2 . Recommended number of food-guide servings per day (Health Canada 2007).

Age group (y), sex	Vegetables and fruit	Grain products	Milk and alternatives	Meat and alternatives
4–8	5	6	2	1
9–13	6	6	3–4	1–2
14–18, female	7	6	3–4	2
14–18, male	8	7	3–4	3

important, and possibly more important, than family members in shaping the food preferences of young children (Nicklas et al. 2001). The foods served in the childcare environment, as well as the attitudes and behaviours of childcare providers, influence children's food choices and eating habits.

Family meals provide important opportunities for parents to be healthy-eating role models for their children. Family meals also provide structure to children's days, allow for communication between children and parents, and contribute to healthier eating and lifestyle habits. Gillman et al. (2000) found that families who eat together tend to have a better quality diet, and eat more fruits and vegetables, less fried food, fewer soft drinks, more fibre, more essential nutrients, and less saturated fat and trans fat. Numerous other studies have found diets to be better in families that share meals together (Neumark-Sztainer et al. 2003; Gillman et al. 2000; Taveras et al. 2005).

Children who ate supper with their families at least 3 times a week were reported, in a recent Canadian study (Veugelers and Fitzgerald 2005), to be at decreased risk of being overweight or obese. Eating together can also prevent eating while watching television, which helps prevent uncontrolled eating and higher energy intake (Veugelers et al. 2005).

Current trends show that eating at home is not always nutritious. Proprietary research from food companies indicates that breakfast is no longer balanced, and rarely includes the foods from at least 3 food groups recommended in Canada's food guide. Snacks often replace a meal, such as a small breakfast, or fill the gap between the afternoon and evening meal. Snacking often takes place at home, but typical snack choices are high in calories, fat, sugar or salt, and low in nutrients. As reported in the review of food and nutrient intakes of children, snacks now provide more calories than breakfast or lunch. Typical snack foods come predominantly from the other foods category (Canadian Community Health Survey 2004*c*).

Home-cooked meals are on the decline, and preprepared fresh and frozen meals are increasingly available. Grocery stores offer many meal selections that consumers can simply heat and eat. These choices include precooked meat, mashed potatoes, frozen vegetables, pasta dishes, stir fries, and frozen pizza. Although the majority (70%) of Canadians make and eat meals at home, 10% of meals are eaten at restaurants, 7% are eaten away from home, 5% are in-home meal replacements, and 4% are food sourced from a restaurant and brought home (NPD Group 2005). Eating out or bringing home fast food often provides more calories, fat, salt, and sugar than most children need. The portions of foods and beverages served in fast-food establishments can also be larger than needed, contributing extra calories. The average Canadian household spends 22.1% of its total food dollar on foodservice, compared with 41.4% in American households (Canadian Restaurant and Foodservices Association, Statistics Canada and the Bureau of Labour Statistics 2005).

Raising children with healthy eating habits means parents have to balance many factors, including taste, nutrition, time, convenience, and cost. They need practical information about choosing and preparing healthy foods for their children and more time to enjoy meals with their families.

Schools' influences and initiatives

After families and caregivers, schools are the most influential factors in a child's development. Schools have a responsibility, through the curriculum, to teach children about making healthy lifestyle choices, including what to eat. They also play an important role in supporting healthy food choices through the types of foods available. Schools support children who come to school without proper nourishment. School breakfast programs, for example, have helped improve the nutrient intake and performance of such children (Canadian Living Foundation – Breakfast for Learning 2000).

Schools provide food in many different venues, including breakfast, snack, or lunch programs; classroom celebrations; special food days; fundraising events; vending machines, cafes, stores, and tuck shops; and meetings. Even foods that staff and children bring to school can model and reinforce healthy eating (Dietitians of Canada 2004). It is recognized by public health nutritionists that promoting and reinforcing healthy eating at school is a challenge when nutritionally inadequate foods are available (Ontario Society of Nutrition Professional in Public Health – School Nutrition Workgroup Steering Committee 2004). Some key nutrition challenges at schools are the availability of low-cost high-fat foods and sugary treats (such as, french fries, chips, chocolate bars, candies, and soft drinks); the limited access to nutritious foods not available at school or not brought from home; the lack of milk programs; vending machines stocked with low-nutrient food and beverage choices; and fundraising with low-nutrient foods (Ontario Society of Nutrition Professionals in Public Health – School Nutrition Workgroup Steering Committee 2004; Dietitians of Canada and Dairy Farmers of Canada 2004). Ideally, all foods served and sold should be healthy choices that reinforce the messages taught in the health curriculum.

The Ontario Society of Nutrition Professional in Public Health – School Nutrition Workgroup Steering Committee (2004) released a *Call to Action* report, which provided examples of healthy food choices that should be available in schools, and strategies to support a healthy nutrition environment in schools. In October 2004, the Ontario Ministry of Education (2004) released a policy restricting the type of foods and beverages available in elementary school vending

machines. The focus was on reducing the availability of low-nutrient soft drinks, sugary beverages, sports drinks, and snacks. Refreshments Canada (2006) responded in 2004 by providing industry guidelines to control the type of beverages sold in elementary schools, and in 2006 announced that high schools signing new contracts with Coke or Pepsi would only get calorie-free or low-calorie drinks for their vending machines and cafeterias (Alphonso 2006). In June 2005, the Ontario Ministry of Children and Youth Services (2005) released *Student Nutrition Program Nutrition Guidelines* to help organizers select nutritious foods for breakfast, lunch, and snack programs. None of the Ontario Ministry guidelines directly deal with foods selected for fundraising events, special lunch days, or food served in high schools.

In Nova Scotia, the Department of Education, working in collaboration with Nova Scotia Health Promotion and other partners, developed a comprehensive food and nutrition policy for Nova Scotia public schools. This policy outlines the standards for foods and beverages served and sold in their public schools. The policy also promotes nutrition education in the curriculum, encourages community partnerships, and is supportive of a positive learning environment for students, staff, and the community (Nova Scotia Education and Nova Scotia Health Promotion 2006).

Dietitians of Canada worked closely with Ontario and Nova Scotia provincial education and health ministries to support the development of guidelines that promote healthy eating through access to nutritious foods provided in a safe and supportive eating environment. Other provincial initiatives that the Dietitians of Canada have collaborated on include *School Nutrition Handbook – Getting Started with Guidelines and Policies* (Manitoba Government 2006), *Foundation for School Nutrition Initiatives in Alberta* (Alberta Coalition for Healthy School Communities 2006), and *Guidelines for Food and Beverage Sales in BC Schools* (British Columbia Ministry of Education and Ministry of Health 2005). The resulting healthy-eating guidelines and policies for schools are a major attempt to ensure that healthy eating is supported in schools, along with regular physical activity to promote healthy growth, development, and weight in children.

Marketing and media influences on children

The marketing of foods has long been debated as a key cause of childhood obesity, and many organizations, including the Institute of Medicine and the Centre for Science in the Public Interest, have supported this idea. The notion that advertising to children affects obesity rates has been long debated, and confirmation is still being sought.

Institute of Medicine researchers (McGinnis et al. 2006) found strong evidence that television advertising influences the food and beverage preferences and purchase requests of children aged 2 to 11 years, and affects their consumption habits, at least over the short term. Most advertising geared toward children promotes high-calorie low-nutrient foods, beverages, and meals, which the Institute of Medicine committee concluded influences children to request and choose these products. There was not enough evidence to determine the extent to which marketing influences the preferences and consumption habits of 12 to 18 year olds, because too few studies focus on teens. The Institute of Medicine report concluded that the available studies were too limited to determine whether television advertising is a direct cause of obesity among children. However, the statistical association between advertising viewing and obesity is strong (McGinnis et al. 2006).

Restrictions or bans on the use of cartoon characters, celebrity endorsements, health claims on food packages, stealth marketing, and marketing in schools, along with federal actions that promote media literacy, better school meals, and the consumption of fruit and vegetables are some policy recommendations from the Institute of Medicine. These actions might not be enough to prevent childhood obesity, but should help make it easier for parents and healthcare providers to encourage children to eat more healthfully (Nestle 2006).

In the United States, the Children's Advertising Review Unit (2006), established the *Children's Food and Beverage Advertising Initiative*, a voluntary self-regulation program with 10 of the largest food and beverage companies as charter participants to "shift the mix of advertising messaging to children to encourage healthier dietary choices and healthy lifestyles." Participating companies committed to a number of activities, such as directing part of their advertising to children under 12 at encouraging good nutrition or healthy lifestyles, not advertising food or beverage products in elementary schools, avoiding food and beverage product placement in editorial and entertainment content, and reducing the use of third-party licensed characters in advertising that does not meet the Initiative's product or messaging criteria.

In the United Kingdom, the Office of Communication Regulator (Office of Communications 2006) released new restrictions on advertising to children in November 2006. The regulatory objectives focus on reducing significantly the exposure of children 16 years of age and under to the advertising of food and drink products that are high in fat, salt, and sugar. This was a result of extensive review and research, involving 2000 interviews with children, parents, and teachers, as well as details of family eating habits drawn from a panel of 11 000 people. It demonstrated that television advertising has a direct effect on children's dietary preferences; however, the impact of advertising is modest compared with that of other factors, such as parental influence, trends in family eating habits, school policy, public understanding of nutrition, food labelling, and exercise. Such advertising also has a large indirect effect on food and drink choices, although this could not be quantified (Office of Communications 2006).

In Canada, pressure for more responsible advertising will affect the food and beverage industry. Currently, Advertising Standards Canada's *Broadcast Code for Advertising to Children* restricts the use of cartoon characters and children's entertainers on ads, but not packaging (Canadian Association for Broadcasters 1993). Also, there are limits to the total length of commercial messages to Canadian children. Quebec's *Consumer Protection Act* prohibits advertising to children under 13 years of age entirely. Concerned Children's Advertisers (2005) provides public education programs for parents and children to understand what they see in the media and how to make healthy choices. In 2005, Concerned Children's Advertisers launched public service announcements and a comprehensive education program,

called Long Live Kids, to teach children (5–13 years old) how to "eat smart, move more, and be media wise."

Successful interventions to prevent obesity in children

A number of strategies to prevent obesity in children have already been discussed, specifically, eating more vegetables and fruit and fewer foods high in fat, salt, and sugar, and getting more physical activity. Parents as positive role models, family meals, healthy school nutrition policies, and positive healthy eating messages from marketers and the media are all key factors in preventing childhood obesity.

A synthesis research study was undertaken by Flynn et al. (2006) to develop best-practice recommendations that address the prevention and treatment of childhood obesity and the related risk of chronic diseases. The shortage of programs in community and home settings limited the understanding of the potential effectiveness of interventions in these environments. Schools were found to be a critical setting, and engagement in physical activity emerged as a key intervention in obesity prevention and reduction programs (Flynn et al. 2006).

Another paper identified common features of childhood obesity prevention programs in the United States and Canada (Caballero 2004). Most prevention programs used at least 1 of the following components: dietary changes, physical activity, behavior and social modifications, and family participation. They recognize that integrating all the activities of a multicomponent prevention intervention, and delivering and sustaining it in different environments, is a major challenge for health professionals, parents, educators, and children. The authors point out that progress has been made in several areas, and the increased awareness of childhood obesity by all concerned will continue to foster efforts in this area (Caballero 2004).

The American Dietetic Association (2006) released a position statement on interventions for "pediatric overweight" and recommended a combination of family- and school-based multicomponent programs. To be effective, programs should include the promotion of physical activity, parent training/modeling, behavioral counseling, and nutrition education. Their research showed positive effects of 2 specific kinds of excess weight interventions: multicomponent family-based programs for children between the ages of 5 and 12 years; and multicomponent school-based programs for adolescents.

The Intitute of Medicine's 2006 report, *Progress in Preventing Childhood Obesity: How do We Measure Up?* (Intitute of Medicine 2006), outlines specific strategies to prevent childhood obesity involving families, schools, communities, industry, and government. They call for a long-term commitment to create a healthy environment for children and youth. They emphasize that tackling childhood obesity is a broad-based issue involving many players and strategies.

Summary

Eating patterns that don't follow food guide recommendations to satisfy nutrient needs and consuming too many high-calorie low-nutrient foods and beverages are indicative of poor eating habits in children. Spending too much time on passive activities, such as watching television, playing video games, sitting in front of a computer, and not spending enough time in sports or other active pursuits contribute to excess weight and obesity in children.

Support for healthy food choices and regular physical activity are required at home, daycare, school, and in the community to help ensure that children adopt healthier eating and activity habits. Parents and caregivers can provide a supportive home environment by making sure nutritious foods are available, eating meals together, providing opportunities to be active, and providing positive role models for healthy eating and active living.

Schools must practice what they teach, through positive role modeling, the provision of low-cost nutritious foods and beverages for meals and snacks, the adoption of healthy food policies for fundraising and other events, and the provision of time for physical activity. Overall, schools need to adopt a school culture that supports healthy eating and active living in all of its activities.

Food marketing and the media influence the food choices of young children, but the impact is not clear for older children. Food companies and the media need to become more responsible in the way they market and promote food to children. Food marketers and the media can also play an important role in preventing overweight and obese children by using their marketing strategies to influence children to make healthier food and activity choices.

Combined strategies are required to prevent childhood obesity, and many players must be involved. To prevent children from becoming overweight or obese, more multicomponent programs, involving the family, school, community, media, and all levels of government, are required.

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