

# Determinants of Healthy Eating in Children and Youth

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## ABSTRACT

This review outlines the state of knowledge and research gaps in the area of determinants of healthy eating among children and youth. The article is structured around individual and collective determinants that affect healthy eating in children and youth. We defined healthy eating as “eating practices and behaviours that are consistent with improving, maintaining and/or enhancing health.” Relevant databases were searched for papers published between January 1992 and March 2003 that focussed on children or youth and reported at least one factor relevant to healthy eating. Among collective factors, familial factors and the nature of foods available in the physical environment, including at home, schools and in fast-food establishments, stand out as significant influences on healthy eating in children and youth. The media, particularly television, also have an enormous potential influence and can overshadow familial influences. Individual factors identified include knowledge, attitudes and food preferences; only the latter have been identified as a strong determinant of healthy eating in both children and adolescents. The results of the review identified a significant body of literature in the area of determinants of healthy eating in children and youth; however, very little of this research has taken place in Canada. Only a few determinants, such as economic factors and food security, the content of media nutritional messages, and the issue of flavours, neophobia and food preferences, have undergone some examination by Canadian researchers. Research priorities for Canada in the area of determinants of healthy eating and surveillance of eating behaviours are identified.

**MeSH terms:** Eating; child; adolescent; factors

There is mounting evidence that Canadian children may be making unhealthy food choices, leading to both dietary excesses and inadequacies. Most information comes from nutritional surveillance in the United States (US), which suggests that few children meet dietary recommendations. They have low intakes of fruits, vegetables and milk products; high intakes of less healthy choices, such as soft drinks and high-fat, high-sugar snack foods; and consumption of too much fat and saturated fat, and too little folate and calcium.<sup>1-7</sup> Overall dietary quality declines with age, and the rate of breakfast skipping increases. Although there are no comparable national data available on children’s eating behaviours in Canada, limited information from a national study,<sup>8</sup> and some provincial data,<sup>9,10</sup> suggest that similar concerns exist about Canadian children, including low fruit and vegetable consumption and high consumption of candy, chocolate bars and soft drinks.

Unhealthy eating habits during childhood may interfere with optimal growth and development while setting the stage for poor eating habits during adolescence and adulthood.<sup>11,12</sup> Moreover, poor diet and inactivity during childhood have been implicated in the worrisome increase in childhood overweight,<sup>13</sup> which is considered to be at epidemic proportions in Canada and in other developed nations.<sup>14-16</sup> Increases in other nutrition-related risk factors for chronic disease in children such as hypertension, hypercholesterolemia and Type 2 diabetes have also been observed.<sup>17,18</sup>

A range of health promotion strategies are required in order to support healthy eating during childhood and adolescence and promote optimal growth and development while reducing risk for obesity as well as chronic disease rates in the adult population.<sup>11,19</sup> However, in order to design effective interventions, an understanding of the complexity of factors that influence the eating behaviours of children and adolescents is needed.

This review outlines the state of knowledge and research gaps in the area of determinants of healthy eating among children and youth. The paper is structured around *individual* and *collective* determinants, as described in the Framework for Population Health,<sup>20</sup> that affect healthy eating in chil-

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dren and youth. *Individual* determinants include biological factors (sex, age), food preferences, knowledge and attitudes pertaining to health and food, and skill level or capacities. *Collective* determinants include the economic, social and physical environments. We defined **healthy eating**, as “eating practices and behaviours that are consistent with improving maintaining and/or enhancing health.”

## METHODS AND LITERATURE SEARCH

All primary data-based papers and review papers published between January 1992 and March 2003 that focussed on children and/or youth (age 2-18 years) and reported at least one behaviour or determinant relevant to healthy eating were included. Databases searched included MEDLINE, CINAHL, PsycINFO, ERIC and Social Science Index, and the key words used were: *children, toddlers, youth, adolescents, school children, factors/influences, eating, diet, food, eating behaviours* and *nutrition*. Six journals were also hand searched from 1997 to 2003 inclusive (*Appetite, Canadian Journal of Dietetic Practice and Research, Canadian Journal of Public Health, Journal of the American Dietetic Association, Journal of Nutrition Education and Behaviour* and *Obesity Research*). Key sources in French were also identified and translated.

## RESULTS

### Individual determinants

These include *biological factors* (age, sex), *food preferences, nutrition knowledge* and *attitudes*. Most studies focussed on differences in eating behaviours, such as snacking or breakfast consumption, rather than differences in determinants of eating behaviours such as *age and sex*.

American surveys indicate that there is a decline in diet quality and breakfast consumption with age and an increase in snacking from elementary to higher grades.<sup>1,3,7</sup> Smaller Canadian studies confirm these trends.<sup>9,10</sup> This is a concern, since children who eat breakfast regularly are more likely to have more nutritious diets than those who do not.<sup>9,21</sup> Females, particularly adolescents, tend to be at greater nutritional risk than males.<sup>7</sup>

Children's *food preferences* are often guided by taste or liking alone.<sup>22,23</sup> Preference for specific food items (e.g., fruits and vegetables) is a strong positive indicator of the consumption of that food in both children and adolescents.<sup>24-30</sup> Taste can lead to poor choices: for example, “dislike for vegetables” is one of the three most important predictors of fruit and vegetable intake in children.<sup>30,31</sup> Personal preferences for eating fast food<sup>32</sup> or vending machine snacks<sup>33</sup> have also been identified as a barrier to healthy eating in adolescents.

*Nutrition knowledge* levels are generally low among children and adolescents, who have a weak understanding of the connection between food choice, physical activity, and health.<sup>23,34-36</sup> While knowledge does not consistently influence dietary behaviour,<sup>37-44</sup> inconsistent findings may reflect past methodological problems<sup>45</sup> or the inter-relation between knowledge and other determinants, which may make independent effects difficult to assess. Relatively few studies have described *attitudes* toward food and the role of food in health.<sup>28,45,46</sup> Intervention<sup>47,48</sup> studies utilizing models such as Social Cognitive Theory<sup>49-53</sup> have been unable to explain a large variation in children's eating behaviours. Those using a qualitative approach to examine attitudes and meanings associated with foods suggest that determinants vary by sex and age.<sup>30,37,54,55</sup> Even fewer studies have examined the effect of food preparation *skill level* (perceived or actual) among children and adolescents.<sup>30,31</sup>

### Collective determinants

#### Economic Determinants

These include *income/socio-economic status, food pricing, education* and *employment*. Income and socio-economic factors are discussed more thoroughly elsewhere in this supplement. *Food price* becomes the most important consideration in food choice when income is restricted,<sup>56</sup> often leading to the selection of foods that are higher in sugar and fat because they are among the least expensive sources of dietary energy.<sup>57</sup> Further, reducing the price of foods and beverages that are high in sugar and/or fat increases the consumption of these foods.<sup>58,59</sup> Lower *educational status* of parents has been associated with lower dietary quality, including higher fat and lower micronutrient

intakes in children.<sup>60-63</sup> Finally, *maternal employment* has been found to be negatively associated with the frequency of family meals, which are, in turn, positively associated with diet quality.<sup>64</sup>

#### Social Determinants

These include *cultural factors, familial factors, peers* and *product marketing/mass media*. Although *culture* is considered one of the most important influences on healthy eating, increasing “globalization” of food habits<sup>65</sup> has led to a reduction in inter-cultural differences in food practices within society.<sup>66</sup> In Canada, there has been clear evidence of nutritional concerns about Aboriginal children.<sup>67-70</sup> However, there is a paucity of data comparing dietary behaviours of Canadian children and youth with those from other countries and cultures.

Children's dietary patterns evolve within the context of the *family*.<sup>71</sup> The intakes of parents and children are correlated for most nutrients,<sup>72</sup> with stronger correlations between mothers and children than fathers and children. According to Nicklas and coworkers,<sup>11,73</sup> *familial factors* include food exposure and availability, parental modelling, meal structure and family meals, parenting style, and food socialization practices. A strong positive association between the *availability* of fruits and vegetables in the home and consumption has been reported.<sup>27,30,31,45,73-75</sup> While the availability of healthy foods is necessary, it is not always a sufficient enabler of healthy eating: qualitative research indicates that although parents provide youth with healthy homemade foods, the youth do not always like them.<sup>32</sup> Few studies have examined the role of *parental modelling* as a predictor of healthy eating in children and youth.<sup>45,50,75,76</sup> *Family meals* have a positive influence on diet quality of children and youth,<sup>77-79</sup> with higher consumption of vegetables and fruit, milk products and improved nutrient intakes.

An authoritarian *parenting style*, characterized by controlling child feeding practices (using high-fat/high-sugar foods as rewards, restriction of “junk foods”) increases children's preferences for and intake of restricted foods once the restriction is removed.<sup>73,80-85</sup> Further, encouraging the consumption of a healthy food on the basis of its health benefits decreases children's preference for the food.<sup>86,87</sup>

Permissive parenting can lead to inappropriate snacking and consumption of inappropriate portions of energy-dense foods.<sup>88</sup> Parental attitudes and knowledge about nutrition, termed “*food socialization practices*”<sup>73,89</sup>, have also been correlated with nutrient intakes of children.<sup>90</sup> Parents’ nutritional *knowledge* may affect the nutritional quality of foods purchased, and therefore their availability, as well as the size of portions served to the child.<sup>71,90-92</sup> Positive nutritional *attitudes* in parents of pre-schoolers have been found to be associated with more pleasant mealtime experiences, fewer suboptimal mealtime practices and fewer eating problems.<sup>93</sup> Some early research<sup>94</sup> suggested that *peers* are an important and lasting influence on the food preferences of pre-schoolers (age 2-5). Enthusiastic peer modelling has been found to be the strongest predictor of younger children’s willingness to try new foods.<sup>95</sup>

The effects of *product marketing and mass media* on dietary behaviour are inter-related and include influences on food preferences, food purchases and children’s food requests, or they may affect knowledge and attitudes, and the development of dieting behaviours and body image problems. The *media*, particularly television, have an enormous potential influence on healthy eating in children and youth, and, in many instances, can overshadow familial influences. Food advertising promotes more frequent consumption of less healthy foods, including higher-fat, energy-dense snacks<sup>96,97</sup> and rarely features healthy choices such as fruits and vegetables.<sup>98-100</sup> This is a concern, since children are more likely to request, purchase and consume foods that they have seen advertised on television.<sup>96,101</sup> In addition to their effects on food consumption, food or beverage advertisements are persuasive and have been shown to often contain misleading information or incomplete disclosure, which can contribute to confusion among children.<sup>39</sup> Finally, mass media have been identified as important factors in the development of both overweight<sup>102,103</sup> and dieting behaviours,<sup>104</sup> particularly in young women.

#### *Physical Environment*

This includes *foods available/portion sizes* and the *school environment*. The negative influence of increased *availability* and

effective mass marketing of fast food, convenience foods and expanding portion sizes on healthy eating in children and youth has received considerable attention in recent years.<sup>105</sup> This is a concern, since children as young as five years eat more when they are served large portions.<sup>106</sup> Further, changes have been associated with a decline in dietary quality, including a reduction in the consumption of nutrient-dense foods and a concomitant increase in foods that are low in nutrients yet high in energy, fat, sugar and sodium.<sup>59,86,89,106,107</sup>

The *school environment* may influence healthy eating in children and youth through the foods that are available, nutritional policies, school nutrition and health curricula, and teacher and peer modelling. Schools are the ideal settings to establish and promote healthy eating practices in children and adolescents.<sup>108,109</sup> Recent surveys of food programs in Canadian schools have identified a number of concerns regarding the nutritional quality of foods in schools, including the ready availability of high-fat, high-sugar, low nutrient-dense foods and beverages, particularly in vending machines.<sup>110-114</sup> A national scan indicated that there are very few school nutritional policies in Canada,<sup>115</sup> which are critical in order to provide guidelines for the planning, development and implementation of comprehensive nutrition programs,<sup>12</sup> and which are associated with changes in students’ nutritional knowledge and behaviours.<sup>41,43,116</sup>

#### **KNOWLEDGE GAPS**

Although there is now a significant body of literature in the area of determinants of healthy eating in children and youth, very little of this research has taken place in Canada. Only a few determinants, such as economic factors and food security,<sup>117-121</sup> the issue of flavours, neophobia and food preferences<sup>122,123</sup> and the content of media nutritional messages<sup>96,99,100</sup> have undergone some examination by Canadian researchers. It may seem reasonable to build on research conducted elsewhere, given the common exposure to powerful forces such as the mass media and technology, an increasingly globally homogenous food supply, and common health problems, such as overweight. This is not appropriate, however, where there are significant national differ-

ences, for example, the role of the school environment or the effect of national dietary guidelines on healthy eating in children and youth. The following key research priorities have been identified:

#### *1. Research examining the nature of familial influences on healthy eating in children and youth, including family food practices, the frequency of family meals and the relative influence of peers and siblings on healthy eating.*

Among *collective* factors, familial factors and the nature of foods available in the physical environment, including at home, schools and in fast-food establishments, stand out as particularly significant influences on healthy eating in children and youth. Given the positive association between family meals and diet quality, future research should attempt to increase our understanding of how families with working parents living in a time crunch do manage to have family meals.<sup>64</sup> Because children have, in turn, influenced family food habits by pressuring food preparers to purchase and prepare food they like, research on the interaction between children and parents, which examines the complexity of this relationship, is needed. Although mothers are more motivated to change their children’s eating behaviours than fathers and are more knowledgeable about the nutrient content of foods, they are relatively unsuccessful in changing their children’s food habits on their own.<sup>124</sup> The reported incongruence between reported maternal motivations and the foods they select for their children<sup>125</sup> reflects the complex context in which eating takes place and the influence of other cognitions relating to mothers’ concerns about their own weight. The observed inter-relations among cultural, familial and societal influences in the formation of children’s eating habits serve to decrease the impact of family culture on food behaviours in children and youth. This, in addition to the clear decline in familial influences with age, including a decline in the frequency of family meals, underscores the importance of supporting healthy food socialization practices in parents. Since it is food use, portion sizes and food preparation methods that are often targeted in interventions, it would be useful to examine the influence of familial factors on these food-related

practices more closely and whether they predict eating behaviours and body weight.<sup>61,126</sup> Although the problem of escalating portion sizes in the fast-food industry and the grocery retail sector (muffins, bagels, soft drinks and confections) is well known, there has been little research on this phenomenon in the home environment. Research to clarify and confirm the potential influence of peers and siblings on dietary behaviour is needed.

## 2. *Research regarding the impact of the school environment on healthy eating, particularly nutritional policy and modelling.*

Evidence suggests that, while school environmental change is occurring in Canada, many schools are failing to provide adequate environments to support healthy eating.<sup>110-114</sup> Thus, while students may be receiving some nutritional education in the classroom, confusing and counterproductive messages appear to be provided in cafeterias and other school settings.<sup>12,109</sup> It is encouraging that enthusiastic teacher and peer modelling has been found to increase acceptance of healthy food choices in pre-schoolers; this suggests important opportunities for day care centres and kindergarten settings to promote healthy eating. The characteristics of modelling activities, environments and children for whom modelling is effective<sup>89</sup> need to be documented. This would facilitate the design of effective interventions in both school and home settings. Recent findings that changing the economics of food choice in schools and other environments, such as grocery stores, can have positive effects on healthy eating<sup>58</sup> must be confirmed in a broader range of foods, settings and age groups. Finally, it is important to monitor the impact of school nutritional policies on improving the school food environment and eating behaviours. The possible effects of such policies on time allotted for physical activity in school should be assessed as part of this monitoring.

## 3. *Effects of mass media on healthy eating.*

Much of the evidence of the effectiveness of television food commercials in changing dietary behaviour comes from marketing research, which is not accessible to researchers or the public. Although the amount of money invested in food com-

mercials seems to provide clear testimony to the perceived effectiveness of influencing behaviours,<sup>98,127</sup> the effects of television on nutritional knowledge, children's perceptions and views, and, most important, food intake in children and youth, after exposure to food commercials<sup>128</sup> needs to be further investigated.

## 4. *Research regarding food preferences and nutritional knowledge/skills in children and youth and their impact on behaviour change.*

Among individual determinants, only food preferences or liking was consistently identified in both young children and adolescents as an important predictor of healthy eating.<sup>22-30</sup> Since food preferences are often not consistent with children's knowledge, educators should go beyond teaching children *what* to eat, and assist them in choosing healthy foods that are also seen as good tasting.<sup>129</sup> While there is evidence of an association between knowledge and behaviour, particularly in older children,<sup>32,34,35,44</sup> the ability of children to identify appropriate foods needed to meet dietary recommendations should be assessed. It is not sufficient to be able to "parrot" nutritional recommendations; children need to be able to identify and request healthy choices (e.g., lower-fat foods).<sup>129</sup> Longitudinal studies of the effects of knowledge on dietary behaviour and studies of children from diverse cultures and socio-economic backgrounds are necessary. Qualitative methods appear to have promise in terms of studies examining the effect of knowledge on healthy eating.<sup>129</sup> The relation between food-related skills (including food selection and preparation) and healthy eating in both children and their parents should also be examined. Given the decrease in emphasis on the development of food-related skills in school systems across Canada, changes in courses offering Home Economics/Family Studies,<sup>130</sup> and the increase in prepared and convenience foods in the home, it is important to identify means by which children will consistently acquire food-related skills and use them to make healthy choices.

## 5. *Methodological issues in the examination of multiple determinants of healthy eating in children and youth, and their interactions.*

Much of the research has been limited to an examination of bivariate relations<sup>71</sup> and the use of non-experimental designs, precluding the identification of causal relations between determinants and eating behaviours of children and youth. Many interventions have focussed on fruit and vegetable intake.<sup>131-133</sup> Although determinants of healthy eating appear to vary by food, it is impractical to develop predictive models for individual foods.<sup>45</sup> Examining groups of foods that are homogenous in terms of determinants of consumption is suggested as a possible approach.

The low predictability of psychosocial models to predict food intake in children and youth may be improved by considering the relatively stronger influence of factors such as food availability and accessibility, and their interactions.<sup>133</sup>

Quantitative methods predominate in the literature, and there is a paucity of Canadian studies exploring the determinants of healthy eating in children using a qualitative approach. The latter approach could help identify the reasons why children and youth make positive choices, so that supports for healthy eating can be strengthened.

## 6. *Monitoring eating behaviours and weight in children and youth.*

Canada must have its own nutritional monitoring system to identify unique national and regional dietary behaviours and nutritional concerns. Clearly, in order to choose interventions wisely and tailor them to specific regions, to evaluate them effectively and make sound dietary recommendations, accurate and current data on the eating behaviours of Canadian children and youth are essential. To date, Canadian nutritionists have not had adequate data upon which to base any of these important activities. Although smaller studies have identified some dietary concerns, this review confirms the lack of national nutritional assessment data on dietary behaviours in Canadian children. This was also identified as a gap in knowledge in a recent Health Canada report.<sup>134</sup>

Difficulties in assessing dietary behaviours in children and youth contribute to the challenge of identifying key determinants and in assessing the impact of interventions targeting them. It is encouraging that Canada is currently gathering dietary

intake data through the Canada Community Health Survey (CCHS), Cycle 2.2, Nutrition Focus.<sup>135</sup> Pre-school and school-age children and adolescents are included in the sample.<sup>135</sup> It is hoped that the collection of nutritional indicators will continue as part of the CCHS or other national surveys. Since there is increasing recognition that food intake and eating patterns, rather than specific nutrients, play important roles in health and in disease prevention, monitoring systems should focus more on foods and overall eating patterns and develop further diet quality measures in children<sup>136</sup> in order to develop appropriate dietary guidelines for them.

## CONCLUSIONS

Currently, the lack of Canadian data on both the determinants of healthy eating and dietary behaviours in children and youth are significant barriers to the development of effective policies and programs in Canada. Recognition of the importance of research into the determinants of healthy eating in children and youth, through sustained significant research funding and identification of mentoring opportunities for researchers, are two means by which we can ensure that there are sufficient Canadian researchers in applied nutrition to conduct this important work.

It is intended that this review will become part of the foundation for further examination of the determinants of healthy eating, and inform a broader dialogue among researchers, practitioners and policy makers on research-related priorities in Canada.

## REFERENCES

- Lino M, Basiotis PP, Gerrior SA, Carlson A. The quality of young children's diets. *Fam Econ Nutr Rev* 2002;14:52-60.
- Suitor CW, Gleason PM. Using dietary reference intake-based methods to estimate the prevalence of inadequate nutrient intake among school aged children. *J Am Diet Assoc* 2002;102:530-36.
- Wilkinson Enns C, Mickle SJ, Goldman JD. Trends in food and nutrient intakes by children in the United States. *Fam Econ Nutr Rev* 2002;14:56-68.
- Neumark-Sztainer D, Story M, Resnick MD, Blum RW. Correlates of inadequate fruit and vegetable consumption among adolescents. *Prev Med* 1996;25:497-505.
- Muñoz CA, Krebs-Smith SM, Ballard-Barbush R, Cleveland LE. Food intakes of US children and adolescents compared with recommendations. *Pediatrics* 1997;100:323-29.
- Muñoz CA, Krebs-Smith SM, Ballard-Barbush R, Cleveland LE. Errors in food intake article. *Pediatrics* 1998;101:952-53.
- Levine EL, Guthrie JF. Nutrient intakes and eating patterns of teenagers. *Fam Econ Nutr Rev* 1997;10:20-35.
- King AJC, Boyce WF, King MA. Trends in the Health of Canadian Youth. Ottawa, ON: Minister of Health Canada, 1999.
- Evers S, Taylor J, Manske S, Midgett C. Eating and smoking behaviours of school children in Southwestern Ontario and Charlottetown, PEI. *Can J Public Health* 2001;92:433-36.
- Taylor J, Bradley D, Peacock R. Food Habits Survey of Students in Grades 4 to 9 in the Western School Board. Final Report submitted to the PEI Health Research Program. March 2003.
- Johnson RK, Nicklas TA. Position of the American Dietetic Association: Dietary guidance for healthy children aged 2 to 11 years. *J Am Diet Assoc* 1999;99:93-101.
- Centers for Disease Control and Prevention. Guidelines for school health programs to promote lifelong healthy eating. *J Sch Health* 1997;67:9-26.
- Bronner YL. Nutritional status outcomes for children: Ethnic, cultural, and environmental contexts. *J Am Diet Assoc* 1996;96:891-903.
- Tremblay MS, Willms JD. Secular trends in the body mass index of Canadian children. *Can Med Assoc J* 2000;63:1429-33. Erratum 2001;164(7):970.
- Troiano RP, Flegal KM. Overweight children and adolescents: Description, epidemiology, and demographics. *Pediatrics* 1998;101:497-504.
- Chinn S, Rona RJ. Prevalence and trends in overweight and obesity in three cross sectional studies of British children, 1974-94. *BMJ* 2001;322:24-26.
- Morrison JA, James FW, Sprecher DL, Khoury PR, Daniels SR. Sex and race differences in cardiovascular disease risk factor changes in school children, 1975-1990: The Princeton School Study. *Am J Public Health* 1999;89(11):1708-14.
- Nicklas TA, Webber, L, Srinivasan SR, Berenson GS. Secular trends in dietary intakes and cardiovascular risk factors of 10 year old children: The Bogalusa Heart Study (1973-1988). *Am J Clin Nutr* 1993;57:930-37.
- Ernst ND, Obarzanek E. Child health and nutrition: Obesity and high blood cholesterol. *Prev Med* 1994;23(4):427-36.
- Health Canada. Population Health Promotion: An Integrated Model of Population Health and Health Promotion. February 1996. Available on-line at: <http://www.hc-sc.gc.ca/hppb/phdd/php/php2.htm#Healthy> (Accessed on June 27, 2003).
- Nicklas T, Bao W, Webber L, Berenson G. Breakfast consumption affects adequacy of total daily intake in children. *J Am Diet Assoc* 1993a;93:886-91.
- Drewnowski A. Taste preferences and food intake. *Annu Rev Nutr* 1997a;17:237-53.
- Birch LL. Children's preferences for high fat foods. *Nutr Rev* 1992;50:249-55.
- Skinner JD, Carruth BR, Bounds W, Ziegler PJ, Reidy K. Do food related experiences in the first 2 years of life predict dietary variety in school aged children? *J Nutr Educ Behav* 2002;34:310-15.
- Krebs-Smith SM, Heimendinger J, Patterson BR, Subar AF, Kessler R, Pivouka E. Psychosocial factors associated with fruit and vegetable consumption. *Am J Health Promot* 1995;10:98-104.
- Drewnowski A, Henderson SA, Levine A, Hann C. Taste and food preferences as predictors of dietary practices in young women. *Public Health Nutr* 1999;2:513-19.
- Resnicow K, Davis-Hearn M, Smith M, Baranowski T, Lin LS, Baronowski J, et al. Social-cognitive predictors of fruit and vegetable intake in children. *Health Psychol* 1997;16:272-76.
- Ross S. 'Do I really have to eat that?': A qualitative study of schoolchildren's food choices and preferences. *Health Educ J* 1995; 54:312-21.
- Watt RG, Sheiham A. Towards an understanding of young people's conceptualisation of food and eating. *Health Educ J* 1997;56:340-49.
- Baranowski T, Domel S, Gould R, Baranowski J, Leonard S, et al. Increasing fruit and vegetable consumption among 4<sup>th</sup> and 5<sup>th</sup> grade students: Results from focus groups using reciprocal determinism. *J Nutr Educ* 1993;25:114-20.
- Kirby S, Baranowski T, Reynolds K, Taylor G, Binkley D. Children's fruit and vegetable intake: Socioeconomic, adult child, regional and urban-rural influences. *J Nutr Educ* 1995;27:261-71.
- Shepherd J, Harden A, Rees R, Brunton G, Garcia J, Oliver S, Oakley A. Young people and healthy eating: A systematic review of research on barriers and facilitators. London, England: Evidence for Policy and Practice (EPPI-Centre), 2001.
- French SA, Story M, Hannan P, Breitlow KK, Jeffery RW, Baxter JS, Snyder MP. Cognitive and demographic correlates of low-fat vending snack choices among adolescents and adults. *J Am Diet Assoc* 1999;99:471-75.
- Pirouznia M. The correlation between nutrition knowledge and eating behavior in an American school: The role of ethnicity. *Nutr Health* 2000;14:89-107.
- Pirouznia M. The association between nutrition knowledge and eating behavior in male and female adolescents in the US. *Int J Food Sci Nutr* 2001;52:127-32.
- Edwards JS, Hartwell HH. Fruit and vegetables - attitudes and knowledge of primary school children. *J Hum Nutr Diet* 2002;15:365-74.
- Croll JK, Neumark-Sztainer D, Story M. Healthy eating: What does it mean to adolescents? *J Nutr Educ* 2001;33:193-98.
- Harrell JS, McMurray RG, Bangdiwala SI, Frauman AC, Gansky SA, Bradley CB. Effects of a school-based intervention to reduce cardiovascular disease risk factors in elementary-school children: The Cardiovascular Health in Children (CHIC) study. *J Pediatr* 1996;128:797-805.
- Hart KH, Bishop JA, Truby H. An investigation into school children's knowledge and awareness of food and nutrition. *J Hum Nutr Diet* 2002;15:129-40.
- Hern MJ, Gates D. Linking learning with health behaviours of high school adolescents. *Pediatr Nurs* 1998;24:127-32.
- Keirle K, Thomas M. The influence of school health education programmes on the knowledge and behaviour of school children towards nutrition and health. *Res Sci Technol Educ* 2000;18:173-90.
- Vandongen RV, Jenner DA, Thompson C, Taggart AC, Spickett EE, Burke V, et al. A controlled evaluation of a fitness and nutrition intervention program on cardiovascular health in 10- to 12-year-old children. *Prev Med* 1995;24:9-22.
- Wardle J, Parmenter K, Waller J. Nutrition knowledge and food intake. *Appetite* 2000; 34:269-75.
- Berg MC, Goeteborg U, Jonsson I, Conner MT, Lissner L. Relation between breakfast food

- choices and knowledge of dietary fat and fiber among Swedish schoolchildren. *J Adolesc Health* 2002;31:199-207.
45. Baranowski T, Cullen KW, Baranowski J. Psychosocial correlates of dietary intake: Advancing dietary intervention. *Annu Rev Nutr* 1999;19:17-40.
  46. Noble C, Corney M, Eves A, Kipps M, Lumbers M. School meals: Primary schoolchildren's perceptions of the healthiness of foods served at school and their preferences for these foods. *Health Educ J* 2001;60:102-19.
  47. Perry CL, Stone E, Parcel GS, Ellison RC, Nader PR, Webber LS, Luepker RV. School-based cardiovascular health promotion: The Child and Adolescent Trial for Cardiovascular Health (CATCH). *J Sch Health* 1990;60:406-13.
  48. Reynolds KD, Franklin FA, Binkley D, Raczynski JM, Harrington KF, Kirk KA, Person S. Increasing the fruit and vegetable consumption of fourth-graders: Results from the High 5 Project. *Prev Med* 2000;20:309-19.
  49. O'Dea JA. Why do kids eat healthful food? Perceived benefits of and barriers to healthful eating and physical activity among children and adolescents. *J Am Diet Assoc* 2003;103:497-501.
  50. Reynolds KD, Hinton AW, Shewchuk RM, Hickey CA. Social cognitive model of fruit and vegetable consumption in elementary children. *J Nutr Educ* 1999a;31:23-30.
  51. Berg C, Jonsson I, Conner M. Understanding choice of milk and bread for breakfast among Swedish children aged 11-15 years: An application of the Theory of Planned Behaviour. *Appetite* 2000;34:5-19.
  52. Baranowski T, Cullen KW, Nicklas T, Thompson D, Baranowski J. School-based obesity prevention: A blueprint for taming the epidemic. *Am J Health Behav* 2002;26:486-93.
  53. Lytle LA, Varnell S, Murray DM, Story M, Perry C, Nirnbaum AS, Kubik MY. Predicting adolescents' intake of fruits and vegetables. *J Nutr Educ Behav* 2003;35:170-78.
  54. Chapman G, MacLean H. "Junk food" and "healthy food": Meanings of food in adolescent women's culture. *J Nutr Educ* 1993;25:108-13.
  55. Novotny R, Han JS, Biernacke I. Motivators and barriers to consuming calcium-rich foods among Asian adolescents in Hawaii. *J Nutr Educ* 1999;31:99-104.
  56. Basiotis PP, Kramer-LeBlanc CS, Kennedy ET. Maintaining nutrition security and diet quality: The role of the Food Stamp program and WIC. *Fam Econ Nutr Rev* 1998;11:4-16.
  57. Drewnowski A. Fat and sugar: An economic analysis. *J Nutr* 2003;133:838S-840S.
  58. French SA. Pricing effects on food choices. *J Nutr* 2003;133:841S-843S.
  59. Guthrie JF, Lin B-H, Frazao E. Role of food prepared away from home in the American diet, 1977-78 versus 1994-96: Changes and consequences. *J Nutr Educ Behav* 2002;34:140-50.
  60. Peltó GH, Backstrand JR. Interrelationships between power related and belief-related factors determine nutrition in populations. *J Nutr* 2003;133:297S-300S.
  61. Cullen KW, Lara KM, de Moor C. Children's dietary fat intake and fat practices vary by meal and day. *J Am Diet Assoc* 2002b;102:1773-78.
  62. Guillaume M, Lapidus L, Lambert A. Obesity and nutrition in children. The Belgian Luxembourg Child Study IV. *Eur J Clin Nutr* 1998;52:323-28.
  63. Crawford PB, Obarzanek E, Schreiber GB, Barrier P, Goldman S, Frederick MM, Sabry ZI. The effects of race, household income and parental education on nutrient intakes of 9 and 10 year old girls. *Ann Epidemiol* 1995;5:360-68.
  64. Neumark-Sztainer D, Hannan PJ, Story M, Croll J, Perry C. Family meal patterns: Associations with sociodemographic characteristics and improved dietary intake among adolescents. *J Am Diet Assoc* 2003;103:317-22.
  65. Mennell S. The globalization of eating. *Appetite* 2000;35:191-92.
  66. Krondl M, Lau D. Acculturation of food habits. In: Masi R, Mensah LL, MacLeod K (Eds), *Health and Cultures, Vol. 1*. Oakville, ON: Mosaic Press Publishers, 1993;185-94.
  67. Kuhnlein HV, Soueida R, Receveur O. Baffin Inuit food use by age, gender and season. *J Can Diet Assoc* 1995;56:175-83.
  68. Evers S. Dietary intake and nutritional status of Canadian Indians: A review. *Arctic Med Res* 1991;50(Suppl 5):731-34.
  69. Trifonopoulos M, Kuhnlein H, Receveur O. Analysis of 24-hour recalls of 164 fourth- to sixth-grade Mohawk children in Kahnawake. *J Am Diet Assoc* 1998;98:814-16.
  70. Morrison NE, Receveur O, Kuhnlein HV, Appavoo DM, Soueida R, Pierrot P. Contemporary Sahtu Dene/Metis use of traditional and market food. *Ecol Food Nutr* 1995;34:197-210.
  71. Davison KK, Birch LL. Childhood overweight: A contextual model and recommendations for future research. *Obes Rev* 2001;2:159-71.
  72. Oliveria SA, Ellison RC, Moore LL, Gillman MW, Garrahe EJ, Singer MR. Parent-child relationships in nutrient intake: The Framingham Children's Study. *Am J Clin Nutr* 1992;56:593-98.
  73. Nicklas TA, Baranowski T, Cullen KW, Berenson G. Eating patterns, dietary quality and obesity. *J Am Coll Nutr* 2001a;20:599-608.
  74. Hearn MD, Baranowski T, Baranowski J, Doyle C, Smith M, Lin L, Resnicow K. Environmental influences on dietary behaviour among children: Availability and accessibility of fruits and vegetables enable consumption. *J Health Educ* 1998;29:26-32.
  75. Backman DR, Haddad EH, Lee JW, Johnston PK, Hodgkin GE. Psychosocial predictors of healthful dietary behavior in adolescents. *J Nutr Educ Behav* 2002;34:184-93.
  76. Promoting Healthy Eating and Active Living in Children Project. Barriers and enablers to healthy eating and active living in children: Key findings in six Nova Scotia communities. Canadian Diabetes Association, December 2002.
  77. Tibbs T, Haire-Joshu D, Schechtman KB, Brownson RC, Nanney MS, Houston C, Auslander W. The relationship between parental modeling, eating patterns, and dietary intake among African-American parents. *J Am Diet Assoc* 2001;101:535-41.
  78. Skinner JD, Carruth BR, Moran III J, Houck K, Schmidhammer J, Reed A, Coletta F. Toddlers' food preferences: Concordance with family members' preferences. *J Nutr Educ* 1998;30:17-22.
  79. Neumark-Sztainer D. The social environments of adolescents: Associations between socio-environmental factors and health behaviors during adolescence. *Adolesc Med* 1999a;10:41-55.
  80. Gillman MW, Rifas-Shiman SL, Frazier AL, Rockett HRH, Camargo CA, Field AE, et al. Family dinner and diet quality among older children and adolescents. *Arch Fam Med* 2000;9:235-40.
  81. Videon TM, Manning CK. Influence on adolescent eating patterns; The importance of family meals. *J Adolesc Health* 2003;32:365-73.
  82. Fisher JO, Birch LL. Restricting access to foods and children's eating. *Appetite* 1999a;32:405-19.
  83. Birch LL. Psychological influences on the childhood diet. *J Nutr* 1998;128:407S-410S.
  84. Fisher JO, Birch LL. Restricting access to a palatable food affects children's behavioral response, food selection, and intake. *Am J Clin Nutr* 1999b;69:1264-72.
  85. Birch LL. Development of food acceptance patterns in the first years of life. *Proc Nutr Soc* 1998;57:617-24.
  86. Birch LL, Fisher JO. Development of eating behaviors among children and adolescents. *Pediatrics* 1998;101:539-49.
  87. Fisher JO, Mitchell DC, Smiciklas-Wright H, Birch LL. Parental influences on young girls' fruit and vegetable, micronutrient and fat intakes. *J Am Diet Assoc* 2002;102:58-64.
  88. De Bourdeaudhuij I. Family food rules and healthy eating in adolescents. *J Health Psychol* 1997;2:45-56.
  89. Nicklas TA, Baranowski T, Baranowski J, Cullen K, Rittenberry L, Olivera N. Family and child-care provider influences on preschool children's fruit, juice and vegetable consumption. *Nutr Rev* 2001b;59:224-35.
  90. Contento IR, Basch C, Shea S, Guting B, Zybret P, Michela JL, Rips J. Relationship of mothers' food choice criteria to food intake of preschool children: Identification of family subgroups. *Health Educ Q* 1993;20:243-59.
  91. Zive MM, Berry CC, Sallis JF, Frank GC, Nader PR. Tracking dietary intake in white and Mexican-American children from age 4 to 12 years. *J Am Diet Assoc* 2002a;102:683-89.
  92. Gibson EL, Wardle J, Watts CJ. Fruit and vegetable consumption, nutritional knowledge and beliefs in mothers and children. *Appetite* 1998;31:205-28.
  93. Gable S, Lutz S. Nutrition socialization experiences of children in the Head Start program. *J Am Diet Assoc* 2001;101:572-77.
  94. Birch LL. Effects of peer models' food choices and eating behaviors on preschoolers' food preferences. *Child Dev* 1980;51:489-96.
  95. Hendy HM, Raudenbush B. Effectiveness of teacher modelling to encourage food acceptance in preschool children. *Appetite* 2000;34:61-76.
  96. Marquis M, Dagenais F, Filion YP. The habit of eating while watching television, the frequency of consumption of specific foods and food preferences, as reported by Quebec children. *Can J Diet Pract Res* 2002;63:S104.
  97. Francis LA, Lee Y, Birch LL. Parental weight status and girls' television viewing, snacking, and body mass indexes. *Obes Rev* 2003;11:143-51.
  98. Byrd-Bredbenner C, Grasso D. What is television trying to make children swallow?: Content analysis of the nutrition information in prime time advertisements. *J Nutr Educ* 2000;32:187-95.
  99. Wadsworth LA, MacQuarrie A. Nutrition messages on Saturday morning children's television: 1989-1998. *Can J Diet Pract Res* 2002;63 Supp:105.
  100. Østbye T, Pomerleau J, White M, Coolich M, McWhinney J. Food and nutrition in Canadian "prime time" television commercials. *Can J Public Health* 1993;84:370-74.
  101. Borzekowski DL, Robinson TN. The 30-second effect: An experiment revealing the impact of television commercials on food preferences of preschoolers. *J Am Diet Assoc* 2001;101:42-46.
  102. Hanley AJG, Harris SB, Gittelsohn J, Wolever TMS, Saksvig B, Zinman B. Overweight among children and adolescents in a Native Canadian community: Prevalence and associated factors. *Am J Clin Nutr* 2000;71:693-700.
  103. Berkey CS, Rockett HRH, Field AE, Gillman MW, Frazier AL, Camargo Jr CA, Colditz GA. Activity, dietary intake, and weight changes in a longitudinal study of preadolescent and adolescent boys and girls. *Pediatrics* 2000;105:56.
  104. Field AE, Camargo Jr CA, Barr Taylor C, Berkey CS, Roberts SB, Colditz GA. Peer, parent, and media influences on the development of weight concerns and frequent dieting among preadolescent and adolescent girls and boys. *Pediatrics* 2001;107:54-60.

105. Young LR, Nestle M. Expanding portion sizes in the US marketplace: Implications for nutrition counseling. *J Am Diet Assoc* 2003;103:231-34.
106. Rolls BJ, Engell D, Birch LL. Serving portion size influences 5-year-old but not 3-year-old children's food intake. *J Am Diet Assoc* 2000;100:232-34.
107. Hill JO, Peters JC. Environmental contributions to the obesity epidemic. *Science* 1998; 280:1371-74.
108. Neumark-Sztainer D, Martin SL, Story M. School-based programs for obesity prevention: What do adolescents recommend? *Am J Health Promot* 2000a;14:232-35.
109. Briggs M, Safaai S, Beall DL. Position of the American Dietetic Association, Society for Nutrition Education and American School Food Service Association-Nutrition Services: An essential component of comprehensive school health programs. *J Am Diet Assoc* 2003;103:505-14.
110. Rankine D. Foods Available in New Brunswick Schools. Survey Report 1989-1990. Health Promotion and Disease Prevention Unit, Public Health/Medical Services Division, Department of Health and Community Services. November 1990.
111. Nova Scotia Department of Health, Nova Scotia Nutrition Council. Foods Offered in Schools. Report of a survey of school food provision practices in Nova Scotia. Halifax 1993.
112. Manitoba Council on Child Nutrition. Food and nutrition in Manitoba schools. Survey Report 2001. Available on-line at: <http://www.mast.mb.ca/communications/poverty/MCCN.pdf> (Accessed on July 5, 2002).
113. Taylor JP, Mather SE, McBride TL. Food and nutrition policies and programs in Prince Edward Island schools. Presented at the Second Conference of the International Society for Behavioral Nutrition and Physical Activity (ISBNPA). Quebec City, July 2003.
114. Coalition for School Nutrition. Survey of food and nutrition policies and services in Newfoundland and Labrador. 2001. Available on-line at: [http://www.nlta.nf.ca/html\\_files/coalition/survey.html](http://www.nlta.nf.ca/html_files/coalition/survey.html) (Accessed on July 5, 2002).
115. Health Canada. Scan of Canadian Nutrition Programs for School-Aged Children. Ottawa, ON: Childhood and Youth Division, Health Canada, 1998.
116. Luepker R, Perry C, McKinlay SM, Nader PR, Parcel GS, Stone EJ, et al. Outcomes of a field trial to improve children's dietary patterns and physical activity: The Child and Adolescent Trial for Cardiovascular Health (CATCH). *JAMA* 1996;275:768-76.
117. Tarasuk V, Beaton G. Household food insecurity and hunger among families using food banks. *Can J Public Health* 1999a;90:109-13.
118. Tarasuk VS, Beaton GH. Women's dietary intake in the context of household food insecurity. *J Nutr* 1999b;129:672-79.
119. McIntyre L, Glanville NT, Raine KD, Dayle JB, Anderson B. Do low-income lone mothers compromise their nutrition to feed their children? *CMAJ* 2003;168:686-91.
120. Hamelin AM, Habicht JP, Beaudry M. Food insecurity: Consequences for the household and broader social implications. *J Nutr* 1999;129:525S-528S.
121. Badun C, Evers S, Hooper M. Food security and nutritional concerns of parents in an economically disadvantaged community. *J Can Diet Assoc* 1995;56:75-80.
122. Pliner P. Development of measures of food neophobia in children. *Appetite* 1994;23:147-63.
123. Pliner P, Stallberg-White C. "Pass the ketchup, please.": Familiar flavours increase children's willingness to try novel foods. *Appetite* 2000;34:95-103.
124. De Bourdeaudhuij I, Van Oost P. Family members' influence on decision making about food: Differences in perception and relationship with healthy eating. *Am J Health Promot* 1998;13:73-81.
125. Alderson TSJ, Ogden J. What do mothers feed their children and why? *Health Educ Res* 1999;14:717-27.
126. Cullen KW, Lara KM, de Moor C. Familial concordance of dietary fat practice and intake. *Fam Community Health* 2002c;25:65-75.
127. Fried EJ, Nestle M. The growing political movement against soft drinks in schools. *JAMA* 2002;288:2181.
128. Kuribayashi A, Roberts MC, Johnson RJ. Actual nutritional information of products advertised to children and adults on Saturday. *Child Health Care* 2001;30:309-22.
129. Lytle LA, Eldredge AL, Kotz K, Piper J, Williams S, Kalina B. Children's interpretation of nutrition messages. *J Nutr Educ* 1997;29:128-36.
130. McQuaid S, Allen T, Smith N. A review of the labor market status of home economists in PEI. A report prepared for the PEI Home Economics Association and the University of Prince Edward Island. November 2001.
131. Reynolds KD, Franklin FA, Binkley D, Raczynski JM, Harrington KF, Kirk KA, Person S. Increasing the fruit and vegetable consumption of fourth-graders: Results from the High 5 Project. *Prev Med* 2000;20:309-19.
132. Domel SB, Baranowski T, Davis H, Thompson WO, Leonard SB, Riley P, et al. Development and evaluation of a school intervention to increase fruit and vegetable consumption among 4<sup>th</sup> and 5<sup>th</sup> grade students. *J Nutr Educ* 1993;25:345-49.
133. Lytle LA, Fulkerson JA. Assessing the dietary environment: Examples from school based interventions. *Public Health Nutr* 2002;5:893-99.
134. McAmmond D. Promotion and support of healthy eating. An initial overview of knowledge gaps and research needs. Final report prepared for the Office of Nutrition Policy and Promotion, Health Canada, March 2001.
135. Statistics Canada. The Canadian Community Health Survey. Cycle 2.1. Available on-line at: [http://www.statcan.ca/english/concepts/health/cycle2\\_1/cchinfo.htm](http://www.statcan.ca/english/concepts/health/cycle2_1/cchinfo.htm) (Accessed on March 30, 2003).
136. Contento IR, Randell JS, Basch CE. Review and analysis of evaluation measures used in nutrition education intervention research. *J Nutr Educ Behav* 2002;34:2-25.