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Fruit and Vegetable Consumption Among Children In a Socioeconomically Disadvantaged Neighbourhood

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ABSTRACT

Purpose: Fruit and vegetable (FV) consumption was examined among children aged seven to 10 years in a London, Ontario, neighbourhood. The goal was to determine areas requiring targeted programs to promote healthy lifestyles.

Methods: Data were gathered from 136 students in grades 2 to 4. Each student attended one of four elementary schools within a neighbourhood designated a priority by the City of London Child and Youth Network. The Day in the Life Questionnaire was used to collect the data. Instances of FV consumption were compared with *Eating Well with Canada's Food Guide* (CFG) guidelines.

Results: Ninety-eight percent of participants did not follow the CFG-recommended minimum guidelines; they had fewer than five instances of FV consumption daily. Eighty-seven percent had fewer than two instances of FV consumption daily.

Conclusions: These data support national findings of low FV consumption among children.

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RÉSUMÉ

Objectif. La consommation de fruits et légumes (FL) a été examinée chez des enfants âgés de sept à dix ans provenant d'un quartier de London, en Ontario. L'objectif était de déterminer quels secteurs nécessitaient des programmes ciblés visant à promouvoir un mode de vie sain.

Méthodes. Des données ont été recueillies auprès de 136 élèves de la 2^e à la 4^e année. Chaque élève fréquentait l'une de quatre écoles primaires situées dans un quartier qualifié prioritaire par le Child and Youth Network de la ville de London. Le *Day in the Life Questionnaire* [Questionnaire de rappel d'un jour] a été utilisé afin de collecter les données. La consommation de FL a été comparée aux recommandations du *Guide alimentaire canadien* (GAC).

Résultats. Quatre-vingt-dix-huit pour cent des participants ne suivaient pas les recommandations minimales du GAC; ils consommaient des FL moins de cinq fois par jour. Quatre-vingt-sept pour cent consommaient des FL moins de deux fois par jour.

Conclusions. Ces données soutiennent les conclusions nationales quant à la faible consommation de FL chez les enfants.

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INTRODUCTION

Over the past 30 years, rates of childhood obesity and overweight have risen steadily in Canada (1-3). More recently, results from the Canadian Health Measures Survey indicated that approximately 19% of Canadian children aged five to 17 years are overweight, and approximately 11% are obese (2-4). This finding represents an increase of 70% in the prevalence of overweight since the 1970s, while the prevalence of obesity is now 2.5 times higher (2). The health consequences of obesity, both in childhood and later in adulthood, are well known, and highlight the importance of prevention and treatment (5-10).

A major factor contributing to childhood overweight and obesity is unhealthy eating habits (5). This factor has been studied across the country and worldwide. Results from the 2004 Canadian Community Health Survey (CCHS) indicate that approximately 70% of children aged four to eight years and 65% aged nine to 13 years do not consume the recommended minimum five servings of fruits and vegetables (FV) daily (11). Results from the United States National Health and Nutrition

Examination Survey showed that, among children aged six to 11 years, 74.1% and 83.8% did not meet recommendations for fruit consumption and vegetable consumption, respectively (12). Furthermore, this population's dietary intake was characterized by low-fibre, high total and saturated fat, and higher added-sugar food and beverage choices (13,14). The Health Survey for England 2009 revealed that 78% of girls aged five to 15 years and 79% of boys in this age group were consuming fewer than five servings of FV daily (15). Although national and international data are available, region-specific information on children's eating habits is limited.

Measuring young children's diet quality is challenging. Because developmental stages affect a child's ability to recall and quantify dietary intake accurately (16), age-appropriate tools merit consideration. Twenty-four-hour recalls presented as pictorial questionnaires can increase comprehension, enjoyment, and compliance among younger survey participants (17). Additionally, collection of data related to an indicator of overall diet

quality rather than a detailed comprehensive analysis may be sufficient. Fruit and vegetable consumption has been found to correlate with overall diet quality in a comparison with the Canadian adaptation of the Healthy Eating Index (18). In addition to providing a good indicator of overall diet quality, a focus on FV consumption provides a more realistic and feasible option for assessing children's dietary practices.

PURPOSE

An urgent need exists to collect local data on children's eating practices, as such data will guide the development and targeting of micro-scale interventions to improve children's health in specific regions that may be at greater risk, such as low-income neighbourhoods and/or those with poor geographic access to retailers of healthy foods. In this study, we examined eating habits, specifically FV consumption, of students in grades 2 to 4 in a socioeconomically disadvantaged London, Ontario, neighbourhood. The goal is to use the findings as baseline data for future interventions in this neighbourhood, and to evaluate the efficacy of those interventions.

METHODS

Study design

The City of London Child and Youth Network Healthy Eating Healthy Physical Activity workgroup determined that the neighbourhood chosen for the study was a priority for healthy eating and healthy physical activity interventions. The Child and Youth Network is a collaboration of more than 100 agencies, which focuses on the health and well-being of children, youth, and families in the city of London. The obesity prevention subcommittee, the Healthy Eating Healthy Physical Activity workgroup, was charged with undertaking research to help inform interventions aimed at improving healthy eating and physical activity among children in the region. The subcommittee selected one "demonstration" neighbourhood in order to pilot test both its research and intervention efforts. The neighbourhood chosen is economically disadvantaged and has a large child and youth population. The average family income was \$72,507, considerably lower than the average of \$84,593 for the city of London as a whole (19). Furthermore, the neighbourhood has a young population; 28% of people are younger than 20 years old, compared with 24% for the city of London (19). In terms of ethnic diversity, the population is very similar to the rest of London (19). The neighbourhood is typically suburban in built form and exhibited many potential barriers to healthy eating and physical activity. For example, the neighbourhood has been identified as a "food desert" because residents do not have easy geographic access to a retailer of healthy, affordable food, such as a grocery store or market (20,21).

Four elementary schools are located within the neighbourhood, and each participated in this study. The schools are from both the local public and Catholic school boards. They ranged from approximately 270 to 430 students in junior kindergarten through grade 8. At the time of the study, all four schools had the traditional school day schedule, which included a 15-minute "recess" or break in both the morning and the afternoon, along

with a lunch in the middle of the day. Three of the four schools had a breakfast, snack, or milk program.

All male and female students who were aged seven to 10 years and in grades 2 to 4 were invited to participate in this study. Students were eligible to participate if they were present the day of data collection, had returned a parent/guardian consent form, and completed a child assent form. Before the assent form was completed, the purpose and procedures of the study were explained to the children, as were the risks and benefits and the option to exclude themselves from the study. In general, children as young as seven years old have been found capable of providing assent, provided they are able to understand the purpose of the study, the protocol of the study, the risks and benefits, and the fact that they are free to withdraw from the study without repercussions (22,23). Explaining the study multiple times allowed several opportunities for questions, as well as withdrawal from the study, and helped protect participants' autonomy.

This study was approved by the research ethics boards of Western University, the Thames Valley District School Board, and the London District Catholic School Board. Packages containing information letters and consent forms were distributed to parents/guardians, along with a parent/guardian demographic/household questionnaire (unpublished data).

Dietary assessment

Data on eating habits related to FV consumption, as well as on activities completed during the previous day, were collected using the Day in the Life Questionnaire (DILQ) (24). The DILQ is a pictorial write-and-draw 24-hour recall that collects data primarily on FV consumption (24). The questionnaire was developed in the United Kingdom and has been validated by comparison with direct observation in students aged seven to nine years (24). The DILQ reports FV consumption in instances rather than portion sizes, because of children's limited ability to recall and estimate portion sizes accurately (24,25). The questionnaire also collects information on other activities completed during the day, as a way to facilitate recall (24).

The questionnaire was modified slightly to substitute words for those that might be unfamiliar to Canadian children. It was presented as a classroom activity during regular school hours. The DILQ is designed around a traditional school day schedule, and therefore reflects food consumption on a single weekday, not a weekend day (23). Researchers were present to help with any spelling or comprehension questions. Participants completed the questionnaire as a group. Throughout questionnaire completion, interaction was permitted among students. The aim was to decrease any stress or anxiety associated with questionnaire completion, and to increase comprehension.

Fruit and vegetable juices were not included as FV consumption, because participants often had difficulty distinguishing among juices, drinks, and juice cocktails.

Data and statistical analysis

Instances of FV consumption were counted and compared with *Eating Well with Canada's Food Guide* (CFG) recommendations (26),

Table 1

Demographic characteristics of study participants

Characteristic	School A	School B	School C	School D	Total
Sex					
Female	11	20	21	22	74
Male	8	16	14	21	59
Unspecified	0	1	2	0	3
Age (years)					
7	3	6	6	4	19
8	6	16	14	16	52
9	4	13	13	18	48
10	6	2	4	5	17

according to children's age and sex. An unpaired Student's *t*-test was used to compare instances of FV consumption between sexes. Analysis of variance was used to compare instances of FV consumption between age groups. Descriptive statistics, including means and ranges, were calculated for data such as participation rate and students' ages. All statistical analyses were performed with the Statistical Analysis System (version 9.1, SAS, Cary, NC, 2004) with $p < 0.05$ being considered statistically significant.

RESULTS

A total of 136 students participated in the study. The overall participation rate was 31%, with rates ranging from 24% to 48% at individual schools. The rate of return for the consent form was equal to the participation rate, as all children completed the assent form to participate in the study. Participation was fairly equally distributed between boys and girls (43% versus 54%, respectively). The participants were in grades 2, 3, and 4, with a mean age of 8.5 years (range, seven to 10 years). Participant demographics are shown in Table 1.

Among the children surveyed, only three (2.3%) had consumed FV on five or more occasions the previous day. The average daily number of instances of FV consumption was 1.34 for girls and 0.95 for boys ($p = 0.07$). Boys were more likely than girls to report no consumption of FV (44% versus 34%). Eighty-seven percent of participants had consumed FV fewer than three times the previous day. The average daily number of instances of FV consumption was 1.2 (median = 1, mode = 0), which is well below CFG recommendations (26); average FV consumption is shown in Figure 1.

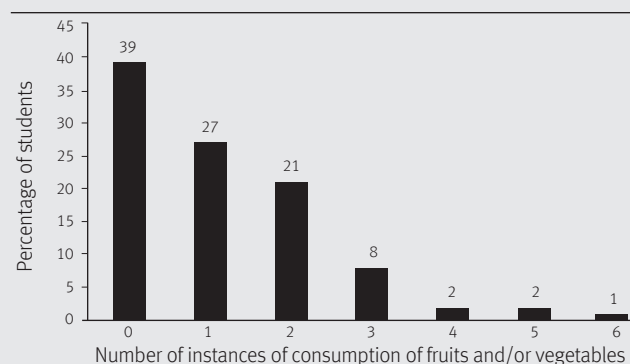
DISCUSSION

Need for interventions

The rates of overweight and obesity among children in Canada continue to rise, stimulating interest in lifestyle factors that contribute to the development of overweight and obesity (1). The development of programs and interventions focusing on healthy lifestyles, including eating habits, is important to help prevent further increases in rates of overweight and obesity. However, accurate and reliable data on current eating patterns are necessary to ensure those programs and interventions are effective and useful to the target population.

Figure 1

Instances of fruit and vegetable consumption over the course of a day



Consumption levels

Our study reveals that the children in this neighbourhood exhibit inadequate FV consumption, a finding consistent with data reported from similar populations in Ontario, Canada, and other countries (6,7,10,23,27-30). The majority of study participants had an FV consumption level well below the CFG minimum recommendations for daily FV consumption (26). Comparable levels have been reported for students in grades 6 to 8 in rural and urban Ontario (27), in grades 2 to 4 in urban southern Ontario (28), in grade 5 in Nova Scotia (29), and in grades 2 to 8 in rural southern Ontario (30). These studies also had comparable participation rates, ranging from 39% to 51% (27-30). National data from the CCHS indicate that, in Canada, the majority of children aged four to 13 years do not consume a minimum of five FV servings daily (11). These findings are disconcerting because eating habits established in childhood can affect eating habits and consumption of FV in adulthood (31,32). Furthermore, many diseases originating in childhood may be influenced by FV consumption (7). Conversely, consuming adequate amounts of FV has been associated with lower rates of overweight and obesity, and may help prevent the development of many chronic diseases (33). This fact, along with the neighbourhood's lack of access to retailers of healthy foods, means an intervention focused on increasing FV consumption is warranted.

Boys' and girls' FV consumption

In the current study, FV intake was not significantly different between the sexes. Yngve et al. (34), however, previously reported that, among 11-year-olds, girls had a significantly higher intake of FV. Galloway similarly reported that girls had higher FV intakes (30). In contrast, Hanning et al. reported that females were less likely than males to meet recommendations for FV consumption (27). The differences in intakes between males and females may suggest that their motivations for consuming FV are different. Preference has been reported as the strongest reason for FV intake differences between the sexes (35,36). Females appear to have a stronger preference for FV; further research is needed to explain the differences in taste preferences between the sexes (35,36). Nevertheless, these results indicate that both sexes need to increase their FV intake.

Fruit juice

Eating Well with Canada's Food Guide includes 100% fruit juice in the FV food group, but suggests that whole fruit be chosen more often (26). In the current study, fruit juice was excluded because of children's inability to distinguish among 100% fruit juices, fruit drinks, and juice cocktails; this exclusion may have influenced results. Dennison et al. (31) found that fruit juice contributed a significant amount to the total FV intake among children aged two to five years in New York State. However, their results still showed that the majority of participants consumed fewer than the recommended servings of FV (31). Yngve et al. (34) also reported that, after fruit juice was excluded, mean FV intakes were below World Health Organization population goals. Furthermore, Lorson et al. (12) found that, when fruit juice was included as a serving of FV, it was the main contributor to fruit intake. Although discounting fruit juice in the current study may have led to an overall underestimation of FV consumption, it is unlikely to have influenced the results significantly. Finally, consumption of whole fruit rather than fruit juice is encouraged to increase intake of fibre and other nutrients (26).

Predictors of FV consumption

Other studies have shown that predictors of FV intake include availability of vegetables and fruits at home (37), mothers' beliefs about, knowledge of, and intake of vegetables and fruit (38), and neighbourhood factors, such as geographic accessibility to grocery stores and FV availability (39). Socioeconomic status has also been correlated with FV consumption (29,40) and inversely correlated with overweight and obesity (41). At the time of the study, the sample neighbourhood was a "food desert"—a socioeconomically disadvantaged area without easy access to an FV retailer (20,21). Many people in this area rely on public transportation or walking to access larger grocery stores where vegetables and fruit are available. These stores are outside the neighbourhood, which increases the difficulty of securing affordable vegetables and fruit (20). Furthermore, customers typically pay an average 1.6 times more for identical food items purchased at food retailers accessible in their neighbourhood than they would in larger grocery stores (20). These food retailers (i.e., convenience stores) are less likely to carry foods considered part of a healthy diet (i.e., vegetables and fruit) and more likely to carry "unhealthy foods," such as soft drinks and processed foods (20). The lack of FV access may have influenced participants' low FV consumption. Interventions to help increase FV intake among children in this neighbourhood, and elsewhere, need to address the predictors of FV consumption discussed in this article.

Recommendations

In summary, the eating habits of these participants revealed limited consumption of FV. Because FV consumption is correlated with inadequate consumption of fibre and other nutrients, as well as with overall diet quality (18), health professionals and stakeholders must work with children, parents/guardians, and educators to promote initiatives that increase FV consumption. Interventions targeting the home, school, and neighbourhood

environments appear to be most effective in increasing children's FV consumption (37,39).

Study limitations

Data were self-reported, which may have caused inaccuracies in reported consumption levels, particularly because of the participants' young ages. However, children as young as seven to eight years old can estimate their dietary intake accurately (42-44). Furthermore, this specific questionnaire was developed and validated with participants of similar ages (24), and researchers were present to assist participants with recall and provide appropriate prompts.

Participants were allowed to interact with each other during questionnaire completion, which may have introduced some bias into their responses. However, allowing the interaction helped decrease stress and anxiety associated with questionnaire completion. It also increased interaction with the researchers, which may have improved recall (24).

Concerns have been raised about the inability of the DILQ to collect accurate portion sizes, which may limit the determination of habitual FV intake and comparability with CFG recommendations (26). Furthermore, the focus on FV does not provide information on all aspects of the participants' dietary intake, such as the physical and social environment. Fruit and vegetable intake can, however, be used as an indicator of overall diet quality, and it is a feasible and realistic outcome measure to gather directly from children (18).

In addition, collecting data from only one 24-hour recall may not have allowed us to account for the variability in the child's diet; however, the data can be used to estimate the average group intake in a random population (30). The inclusion of other foods consumed and activities completed also may have helped to increase recall and decrease subject bias. Further, the use of a previously validated questionnaire increases the dependability of the results. Results concerning FV intake were also comparable to those from similar studies (27-30).

The relatively low participation rates may have created an inaccurate representation of the community, but the low participation rates may be related to other factors, such as limited return of consent forms. The participation rate was comparable to that in similar studies (27-30).

Despite these limitations, the current study contributes valuable information to the limited body of literature on region-specific eating practices of school-aged children.

RELEVANCE TO PRACTICE

When targeted nutrition interventions in communities are being created, one should know the characteristics and habitual behaviours of those for whom the intervention is intended. Similarly, baseline measures must be established before targeted interventions are undertaken, as such measures will reveal the efficacy of the interventions. Recognition of the increasing prevalence of obesity among children is widespread in Canada and around the world, while FV consumption is not meeting recommended guidelines. The results of the current study are not surprising, and

they lend support for the argument that nutrition interventions are greatly needed for these children. Because nearly all the children in this study failed to consume the minimal amount of FV recommended by Health Canada, an intervention program targeting increased servings from this food group is a logical first step to improve diet quality and contribute to obesity prevention.

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References

- Katzmarzyk PT. The Canadian obesity epidemic: an historical perspective. *Obes Res.* 2002;10:666-74.
- Shields M. Overweight and obesity among children and youth. *Health Rep.* 2006;17:27-42.
- Roberts KC, Shields M, de Groh M, Aziz A, Gilbert J. Overweight and obesity in children and adolescents: results from the 2009 to 2011 Canadian Health Measures Survey. *Health Rep.* 2012;23(3):3-7.
- Heart and Stroke Foundation of Canada. Overweight, obesity, and heart disease and stroke. Ottawa: Heart and Stroke Foundation of Canada; 2007.
- Reilly JJ, Methven E, McDowell ZC, Hacking B, Alexander D, Stewart L, et al. Health consequences of obesity. *Arch Dis Child.* 2003;88:748-52.
- Van Dyun MAS, Pivonka E. Overview of the health benefits of fruit and vegetable consumption for the dietetic professional: selected literature. *J Am Diet Assoc.* 2000;100:1511-21.
- St-Onge MP, Keller KI, Heymsfield SB. Changes in childhood food consumption patterns: a cause for concern in light of increasing body weights. *Am J Clin Nutr.* 2003;78:1068-73.
- Lakshman R, Elks CE, Ong KK. Childhood obesity. *Circulation.* 2012;126:1770-9.
- DeBoer MD. Obesity, systemic inflammation, and the increased risk for cardiovascular disease and diabetes among adolescents: a need for screening tools to target interventions. *Nutr J.* 2012;29:379-86.
- Nadeau KJ, Maahs DM, Daniels SR, Eckel RH. Childhood obesity and cardiovascular disease: links and prevention strategies. *Nat Rev Cardiol.* 2011;8:513-25.
- Garriguet D. Canadians' eating habits. *Health Rep.* 2007;18(2):17-32.
- Lorson BA, Melgar-Quinonez HR, Taylor CA. Correlates of fruit and vegetable intakes in US children. *J Am Diet Assoc.* 2009;109:474-8.
- Marriott BP, Olsho L, Hadden L, Connor P. Intake of added sugars and selected nutrients in the United States National Health and Nutrition Examination Survey (NHANES) 2003-2006. *Crit Rev Food Sci Nutr.* 2010;50:228-58.
- Troiano RP, Briefel RR, Carroll MD, Bialostosky K. Energy and fat intakes of children and adolescents in the United States: data from the National Health and Nutrition Examination Surveys. *Am J Clin Nutr.* 2000;72(5 Suppl):1343S-53S.
- The Information Centre for Health and Social Care. Health surveys for England 2009; 2010 [cited 2011 Jan 27]. Available from: <http://www.ic.nhs.uk/statistics-and-data-collections/health-and-lifestyles-related-surveys/>
- Dworatzek P, Lenhardt L, He M, Battram D, Murkin E. Measuring fruit and vegetable consumption in 4-9 year olds: a search for a valid and reliable population-based tool. London, ON: PHRED Program, Middlesex-London Health Unit; 2008.
- Montenegro-Bethancourt G, Doak CM, Solomons N. Fruit and vegetable intake of schoolchildren in Quetzaltenango, Guatemala. *Rev Panam Salud Publica.* 2009;25:146-56.
- Garriguet D. Diet quality in Canada. *Health Rep.* 2009;20(3):41-52.
- City of London. Neighbourhood profile—Westminster planning district; 2012 [cited 2012 Nov 4]. Available from: http://www.london.ca/About_London/PDFs/39_Westminster.pdf
- Larsen K, Gilliland J. Mapping the evolution of 'food deserts' in a Canadian city: supermarket accessibility in London, Ontario, 1961-2005. *Int J Health Geogr.* 2008;7:16.
- Sadler R, Gilliland J, Arku G. An application of the edge effect in measuring accessibility to multiple food retailer types in Southwestern Ontario. *Int J Health Geogr.* 2011;10:34.
- Rossi WC, Reynolds W, Nelson RM. Child assent and parental permission in pediatric research. *Theor Med Bioeth.* 2003;24:131-48.
- Johnston TE. Issues surrounding protection and assent in pediatric research. *Pediatr Phys Ther.* 2006;18:133-40.
- Edmunds LD, Ziebland S. Development and validation of the Day in the Life Questionnaire (DILQ) as a measure of fruit and vegetable questionnaire for 7-9 year olds. *Health Educ Res.* 2002;17:211-20.
- Livingstone MBE, Robson PJ, Wallace JMV. Issues in dietary intake assessment of children and adolescents. *J Nutr.* 2004;92(Suppl 2):S213-22.
- Health Canada. Eating Well with Canada's Food Guide. Ottawa: Minister of Health of Canada; 2007.
- Hanning RM, Woodruff SJ, Lambraki I, Jessup L, Driezen P, Murphy CC. Nutrient intakes and food consumption patterns among Ontario students in grades six, seven, and eight. *Can J Public Health.* 2007;98:12-6.
- Moffat T, Galloway T. Food consumption patterns in elementary school children. *Can J Diet Pract Res.* 2008;69:152-4.
- Veuglers PJ, Fitzgerald AL, Johnston E. Dietary intake and risk factors for poor diet quality among children in Nova Scotia. *Can J Public Health.* 2005;96:212-6.
- Galloway T. Gender differences in growth and nutrition in a sample of rural Ontario schoolchildren. *Am J Hum Biol.* 2007;19:774-88.
- Dennison BA, Rockwell HL, Baker SL. Fruit and vegetable intake in young children. *J Am Coll Nutr.* 1998;17:371-8.
- Krebs-Smith SM, Heimendinger J, Patterson BH, Subar AF, Kessler R, Pivonka E. Psychosocial factors associated with fruit and vegetable consumption. *Am J Health Promot.* 1995;10:98-104.
- Bazzano L. The high cost of not consuming fruits and vegetables. *J Am Diet Assoc.* 2006;106:1364-8.
- Yngve A, Wolf A, Poortvliet E, Elmadfa I, Brug J, Ehrenblad B, et al. Fruit and vegetable intake in a sample of 11-year-old children in 9 European countries: the Pro Children Cross-sectional Survey. *Ann Nutr Metab.* 2005;49:236-45.
- Bere E, Brug J, Klepp K. Why do boys eat less fruit and vegetable than girls? *Public Health Nutr.* 2008;11:321-5.
- Brug J, Tak NI, te Velde SJ, Bere E, de Bourdeaudhuij I. Taste preferences, liking and other factors related to fruit and vegetable intakes among schoolchildren: results from observational studies. *Br J Nutr.* 2008;99(Suppl 1):S7-S14.
- Blanchette L, Brug J. Determinants of fruit and vegetable consumption among 6-12 year-old children and effective interventions to increase consumption. *J Hum Nutr Diet.* 2005;18:431-43.
- Gibson EL, Wardle J, Watts CJ. Consumption, nutrition knowledge and beliefs in mothers and children. *Appetite.* 1998;31:205-28.
- Keita AD, Casazza K, Thomas O, Fernandez JR. Neighborhood-level disadvantage is associated with reduced dietary quality in children. *J Am Diet Assoc.* 2009;109:1612-6.
- Phipps SA, Burton PS, Osberg LS, Lethbridge L. Poverty and the extent of obesity in Canada, Norway and the United States. *Obes Rev.* 2006;7:51-12.
- Plotnikoff RC, Bercovitz K, Loucades CA. Physical activity, smoking and obesity among Canadian school youth: comparison between urban and rural schools. *Can J Public Health.* 2004;95:413-8.
- Lytle LA, Nichaman NZ, Obarzanek E, Glovsky E, Montgomery D, Nicklas T, et al. Validation of 24-hour recalls assisted by food records in third-grade children. The CATCH Collaborative Group. *J Am Diet Assoc.* 1993;93:1431-6.
- McPherson RS, Hoelscher DM, Alexander M, Scanlon KS, Serdula MK. Dietary assessment methods among school-aged children: validity and reliability. *Prev Med.* 2000;31(Suppl):S11-33.
- Weber JL, Lytle LA, Gittelsohn J, Cunningham-Sabo L, Heller K, Anliker JA, et al. Validity of self-reported dietary intake at school meals by American Indian children: the Pathways Study. *J Am Diet Assoc.* 2004;104:746-52.