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School food environments and the obesity issue: content, structural determinants, and agency in Canadian high schools

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Abstract To understand the phenomenon of the rapidly increasing prevalence of overweight and obese children and youth, it is especially important to examine the school food environment, the role of structural factors in shaping this environment, and the resulting nutrition and health outcomes. The paper examines research on school food environments in the US and Canada. It notes evidence of widespread availability of poor nutrition products in both environments and delineates reasons for the situation, and examines initiatives presently being undertaken in a number of jurisdictions in both countries to encourage healthy eating in schools. Empirical data are presented from a pilot study of high schools in the Canadian province of Ontario. The study documents the extent of student purchasing of nutrient-poor foods and beverages, and the structural factors internal and external to the school that appear responsible for the availability of such products in food environments in this critical institutional sphere. The paper also examines positive local initiatives in high schools that seek to encourage healthy eating in schools.

Keywords Canada · Food environment · Food policy · Nutrition · Obesity · Ontario · Schools

Abbreviations

BMI Body Mass Index
CDC US Center for Disease Control (now: Centers for Disease Control and Prevention)

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Introduction

Canadian society today, as for most developed countries, faces a looming health crisis related to the characteristics of diets and lifestyles as they have evolved over the twentieth century. The prevalence of individuals who fit into categories of "overweight" and "obesity" have reached levels never before seen;[1] as has the prevalence of diseases such as type 2 diabetes, thought to be closely linked to excessive weight (Tremblay and Willms 2000; Statistics Canada 2002; Fontaine and Allison 2004; Katzmarzyk and Ardern 2004).[2] A 2006 national longitudinal survey in Canada ($n = 17{,}276$) measuring 2 years changes in self-reported weights conducted in the 1996–1997 and the 2003–2004 cycles indicated that the trend for adult Canadians to gain weight has continued, albeit at a slower rate than before. Those that did gain weight, however, gained more in the second interval than in the first (Orpana et al. 2006). Over the longer term, the prevalence

[1] Body Mass Index (BMI) has gained wide acceptance as an indicator. The body mass index or BMI—the ratio of body weight to squared height in meters (kg/m^2)—was proposed by the anthropologist Quételet in the nineteenth century. Although BMI is highly correlated with adiposity, it is not a true measure of it (Fontaine and Allison 2004, p. 780). Moreover, it is influenced by age, gender, ethnic background, dietary habits, and physical activity (Ferrera 2005, p. vii). A person's BMI is calculated by dividing his/her weight in kilograms by the square of his/her height in meters [BMI = kg/m^2]. A BMI of 18.5–24.9 is considered normal, while 25–29.9 is considered "overweight" and >30 is considered "obese."

[2] For an extensive recent survey on the science examining the relationship between weight and mortality, see Fontaine and Allison (2004) and Manson et al. (1995, 2004). For recent surveys of literature examining the relationship between obesity and disease, see Manson et al. (ibid.), Saltzman and Benotti (2004), Pi-Sunyer (1993), Pi-Sunyer and Albu 2004), Ko and Lee (2004), and Must and Strauss (1999).

of obese Canadian adults has increased from 14% in 1978–1979 to 23% in 2004 (Tjepkema 2006).

There is particular concern with the increasing prevalence of overweight and obesity among children and adolescents because of the diseases associated with it, and the much higher likelihood that overweight in younger years will lead to life of excess weight in adulthood (see Pyle 2006). With respect to Canadian youth (aged 7–13), the prevalence of obesity more than doubled between 1981 and 1996 (Tremblay and Willms 2000) and is rising relatively faster among children and youth than any other sector of the population (Statistics Canada 2005). The Standing Committee on Health of the House of Commons noted in its 2007 report that "Canada has one of the highest rates of childhood obesity in the developed world, ranking fifth out of 34 OECD countries. Recent data reveal that 26% of young Canadians aged 2–17 years are overweight or obese" (CSPI 2007, p. 10).

Evidence on the diets of children and youth and the influences in the food environment shaping diet are richer in the US context, where it has been observed that few in this age range meet dietary recommendations, with relatively low consumption of fruits, vegetables and milk products; and high consumption of high-fat, sugar, and salt snack products, and soft drinks (Story and Alton 1996; Muñoz et al. 1997; Wilkinson Enns et al. 2002). In the US, Briggs et al. (2003, p. 506) note that only 2% of youth met their Food Guide Pyramid recommendations for all five major food groups, while 84% of school-aged children eat too much fat. About half of this population ate less than one serving of fruit a day, and about 30% ate less than one serving of non-fried vegetables a day. As Taylor et al. (2005) note, there is no comparable data at the national level available for Canada, but more limited studies indicate that similar concerns about children's eating behavior exist north of the border. Canadian studies have found declining consumption of fruits and vegetables over the 1990's among sixth to eighth graders, while soft drink consumption increased (King et al. 1999); and that 70% of children 4–7 years of age do not meet guidelines for fruit and vegetable consumption (Statistics Canada 2006). Evidence linking these consumption trends and childhood obesity are increasingly coming to light (see Ludwig et al. 2001).

Study objectives

This article explores the food environment in a key institutional sphere for young people—the high school—and considers the forces that play major roles in determining the nutritional quality of this food environment. It is based on a pilot study of 10 high schools in one school district in the Province of Ontario, Canada in 2004–2005. The study aimed to provide insight into the kinds of foods purchased in Ontario schools, explore the factors that shape the high school food environment, and to discover what local initiatives may provide a more positive influence on the nutritional quality of food in schools.

The study was organized around three research questions: (a) What kinds of foods and beverages are purchased in Ontario schools? (b) What significant factors shape the high school food environment? and (c) What formal and informal initiatives that exist at the school level have had an influence on the nutritional quality of the high school food environment?

The school food environment

The school food environment is a worthy research site for a number of reasons. No other public institution has as much continuous and intensive contact with young people (Carter and Swinburn 2004, pp. 15–16). Moreover, it has been argued that youth today get a large portion of their daily energy needs while at school (French et al. 2004, p. 1507; Story et al. 2006). It is believed that food choices and eating patterns developed at this time of life are likely to influence long-term behavior; and help determine the extent of vulnerability to chronic diseases such as heart disease, certain cancers, and osteoporosis later in life (Center for Disease Control (CDC) 1997). It has been noted that relatively little research has examined factors influencing adolescent eating behaviour (Shannon et al. 2002, p. 229) and particularly in the Canadian context (see Taylor et al. 2005) where there are virtually no national data on what kinds of foods are *actually* being served in schools, nor on what and how much students are actually eating (CSPI 2007, p. 6). Nutritional authorities have argued that the schools can play a key role in reversing the trend towards childhood obesity (Briggs et al. 2003, p. 506). For these reasons it is useful to know more about the role of foods, and nutrient-poor foods in particular, in the school food environment; and to better understand why they are there.

Story et al.'s recent comprehensive review of American school food environments—focused on childhood obesity—discussed a range of studies that documented the widespread availability of high fat, high sugar products in the school food environment. In middle and secondary schools especially, there is evidence that so-called à la carte "competitive foods" are becoming more available over time, while a low prevalence of fruit and vegetable options outside the school lunch program offerings was noted (Story et al. 2006, pp. 114–118). The study also provides useful information of the US federally funded school lunch and breakfast programs. Other studies have

documented a decline in fruit and vegetable consumption by middle school children as the availability of competitive foods increases,, along with an increase in intake of total daily fat and saturated fat (Kubik et al. 2003; Weber Cullen and Zakeri 2004) and decline in the intake of other nutrients (Templeton et al. 2005). Some studies have examined the factors influencing eating behavior in schools (Shannon et al. 2002; Story et al. 2002; French et al. 2004), typically noting the importance of price and taste in food preferences among children and adolescents. Intervention programs in schools designed to encourage healthier eating have been examined, and have been found to be effective from a nutritional perspective (see Veugelers et al. 2005) and cost effective as well (Wang et al. 2003).

In the Canadian context, surveys of all schools conducted in the provinces of British Columbia, Manitoba, Newfoundland and Saskatchewan, provided evidence of a high availability of nutritionally poor beverages and snacks in school vending machines, school stores or canteens, and to a lesser extent in cafeterias, where these existed. This situation was exacerbated in high schools, similar to the US. School fund raising events were also dominated by such products to a very high degree (MCCN 2001; Government of Newfoundland 2001; Berenbaum 2004; Government of British Columbia 2005; Government of Manitoba 2006).

Schools today have increasingly become contested terrain. As major institutions that occupy a sizable portion of government budgets in the developed world, they have borne much of the brunt of cutbacks associated with neoliberal economic policies. In the United States, school food service programs were regular line items in local school district budgets but must now be completely self-supported, while federal reimbursements for lunch programs fell between 1995 and 2000. Selling poor nutrition products have been one of the few ways to relieve this fiscal constraint (Story et al. 2006, pp. 113–114).Chronic funding shortfalls have only been one aspect of this story, of course, but it has been crucial in opening up the schools, from the primary level to the post-secondary level, to elements of the corporate food sector. Multinational beverage and snack food manufacturers have been especially willing to provide money to schools in exchange for the opportunity to gain further beachheads in the public domain and to "cash in" on an increasingly lucrative youth market which they view as pivotal to their profitability (Brody 2002). In the Canadian province of Manitoba about a third of schools reported having sponsorships from a food and beverage company in 2001, with the overwhelming majority of agreements made with a multinational corporation, typically PepsiCo or Coca-Cola (MCCN 2001, p. 17). Recent literature has also documented the influence of multinational soft drink corporations in the school food environment in the form of "pouring rights"[3] in American schools (e.g., Nestle 2000,2002). A notable survey of principals in Minnesota, for example, found that 77% of high schools in the state had signed a contract with a soft drink corporation (French et al. 2002). Another study of a nationally representative sample of schools found that 72% of senior high schools had a contract that gave a company the right to sell its' company's products in the school (Wechsler et al. 2001). About 57% of these schools received incentives, such as cash rewards or equipment once sales reached a certain level, and almost 40% of schools having contracts allowed these companies to advertise in the schools. Indeed, over half of elementary schools and more than 90% of senior high schools allowed students to purchase soft drinks from a vending machine or canteen. The prevalence of products high in fat, sodium and sugars was higher in the upper-level schools, and lowest in the elementary schools.

A key difference between the United States and Canada is the presence of federally funded meal programs in the US, and the absence of government funding for these in Canada. Funded meal programs give authorities some control over nutritional standards, because lunch meals and breakfast meals in the US are mandated to provide one-third and one-quarter, respectively, of the recommended daily dietary amounts of protein, calcium, iron, vitamin A, vitamin C and calories. While these funded meal programs are not without problems, they have been found to provide more nutritious offerings than competing food and beverage offerings in schools. Moreover, participation in the federally funded lunch program is almost 100% for public schools (Story et al. 2006, pp. 111–112). In the Canadian context, not only are there no state funded lunch and breakfast programs, but at least in the most populous province of Ontario, policies do not regulate any nutritional content of school nourishment programs other than community volunteer school feeding programs, a small component of food served in schools. (OSNPPH 2004, p. 16; CSPI 2007, p. 22). A survey of food environments in schools in the Province of Manitoba completed in 2001 noted the existence of breakfast and lunch programs in a small minority of schools, but these received no provincial funding and depended upon local financial resources, while school nutrition policies and programs were "few and far between" and only of a local nature (MCCN 2001, p. 21). A survey of all schools in the province of Newfoundland revealed a similar situation (Government of Newfoundland 2001). A recent notable report evaluating school nutrition

[3] The right granted to a beverage company through a contractual agreement to have exclusive access to an institutional food environment, presumably in return for some monetary or non monetary compensation to the granting institution.

policies in Canada estimated that total public support (federal and provincial) for school meals across Canada amounted to a $5.54 per student, an amount *38 times less* than is spent in the US (CSPI 2007, p. 6).

By the end of the 1990s the first signs of organized public resistance to the penetration of the school food environment by fast food and beverage corporations were evident, particularly in the United States (Fried and Nestle 2002). Since that time, professional groups have begun to call for change (see Briggs et al. 2003, p. 509; OSNPPH 2004); activists and celebrity chefs have decried the existing state of affairs; and local healthy eating initiatives have begun to proliferate. Slowly, some governments have begun to take action. State governments in the US (see Simon 2006) and provincial governments in Canada, rather than federal authorities, have been the sites of policy initiatives, generally speaking. Story et al. (2006, pp. 122–123) reported that 23 states have adopted legislation limiting the times and/or types of competitive foods available in schools, while a few major city school districts including Los Angeles, New York, and Chicago have recently moved to ban soft drinks and high-fat snack foods in school vending machines.

In Canada, where provincial governments have authority over education, the response has been limited in terms of concrete legislation, but a few jurisdictions have moved beyond the information gathering stage and have been galvanized into action. The motivations behind such action was not clear, but was likely a combination of warnings from professional dietitians about the poor quality of school food environments (see OSNPPH 2004, p. 4); evidence on the proliferation of poor nutrition products from their own surveys of provincial schools; mounting evidence of high rates of childhood obesity; and in at least one case, the prospect of dire financial costs to government associated with the latter.[4] Several provinces have announced new criteria or guidelines governing school food and beverage offerings. The Province of Nova Scotia has begun a 3-year phase-in of a food and nutrition policy for public schools that requires the majority of food and beverages served to be designated as of "maximum nutrition,"[5]; the elimination of all poor nutrition beverages and their replacement with milk or milk substitutes, 100% juices, and water; and also bans both the use of deep fryers in food preparation and the sale of "junk foods" in school fund raising. The province of New Brunswick has adopted a similar policy, but with an earlier implementation date, (i.e. September, 2007) to eliminate poor nutrition products from school food environments and fund raising activities. In the case of British Columbia, the government has publically committed to eliminating poor nutrition products from schools by 2010 (Government of British Columbia 2005). The same province has initiated a pilot program with some 50 schools where each student receives one serving, twice a week, of local fruit and vegetables (British Columbia Agriculture in the Classroom Foundation 2007). On a more limited scale, the Government of Ontario issued in 2004 a memorandum to school boards on foods and beverages in elementary school vending machines. It stated that boards "should restrict the sale of all food and beverage items in elementary school vending machines to those that are healthy and nutritious" in accordance with recommendations set out in the memorandum that were developed by the Dietitians of Canada (Ontario Ministry of Education 2004, p. 1). It is not known if compliance with these guidelines is or will be monitored and/or enforced. At present (late 2007), the Canadian scene is a patchwork of approaches with some clear weaknesses, including non-enforceable guidelines in some cases, differing standards of nutritional quality, and lack of public information concerning schools' compliance with provincial nutritional criteria (see CSPI 2007, p. 7). I would also point to the failure to address the secondary school food environment, in the case of Ontario, inattention to culinary issues, e.g., making healthy food palatable to young people; and little attention so far to the impact of the food environment adjacent to schools (where students may purchase foods off school grounds during lunch periods).

Alongside these formal government actions there have been a host of more informal, localized initiatives to promote healthy eating in schools. Of particular note is the proliferation of "farm to school" programs, which typically have improvement of the school food environment as one of their objectives. These programs exist throughout the US, Canada, and Britain. One recent survey of them (Marshall 2006) noted around 100 in existence by 2006 (see also Azuma and Fisher 2001; Joshi and Kalb 2006; Rimkus et al. 2004; Soil Association 2003; Vallianatos et al. 2004). Despite the encouraging news these initiatives signify, it would be premature to assume that in total they constitute a strategic defeat for the corporations that have worked so assiduously to penetrate school food environments in recent decades. Indeed, evidence is emerging from the US and Britain that food and beverage corporations have lobbied heavily to defeat, or at least diminish, government attempts to regulate their market penetration of

[4] Rumors circulated for some months during the time of writing among Canadian food analysts about leading politicians in British Columbia being spurred into action there by an analyst's report that the costs of obesity-related diseases would soon be so large that spending on health would soon strip revenues from all other ministries. A conversation with a policy analyst in the provincial Department of Agriculture in June, 2007 confirmed that such a report did exist and that it had had a considerable impact.

[5] The new regulations define "maximum nutrition" to be products that are "high in essential nutrients for growth, learning and health … and are low in salt, sugars, sweeteners, and saturated and trans fats" (Government of Nova Scotia 2006, p. 1).

schools and their "right" to advertise to children and youth. In many cases they have been successful according, to their critics.[6]

The present investigation aimed to supplement the relatively meager Canadian research in this area. A review of literature published in 2005 on the determinants of child and youth eating behaviors noted few surveys of Canadian school food environments (see Taylor et al. 2005). Those few that exist mostly date from the early 1990's, and focus on such matters as school nutrition policies and/or what foods and beverages were *available*, rather than what was *actually* purchased and consumed in schools (see Government of Newfoundland 2001; Health Canada 2002; MCCN 2001). Since that time, several provincial governments have conducted more recent surveys in several provinces utilizing self-administered, mail-out questionnaires that were sent to all schools. These provide more up-to-date information on existing food and nutrition policies in schools, and on the availability of poor nutrition products in school food environments (see Berenbaum 2004; Government of British Columbia 2006; Government of Manitoba 2006). While these surveys have made a significant contribution to our knowledge of Canadian school food environments, they have some limitations.[7]

The research reported on here moves beyond documentation of the availability of nutrient poor products in school food environments to report on data on *actual* daily purchasing behavior by students of food and beverages. Moreover, it provides detailed evidence to assess what segment of the school food environment accounts for most purchases of products of minimal nutritional value, for example. It also provides more precise knowledge than existing Canadian surveys because it involved on-site, face-to-face interviews with key respondents who were most intimately involved with the management of school food services. This research provides valuable data on the proximity of fast food outlets to the schools surveyed, and the role the food environment external to the school and other factors can play in determining the nutritional quality of school food offerings.

Study methods

The author and his research assistant undertook a pilot study of public high school food environments in 2004 The study examined public high schools in a school district encompassing three small cities and adjacent rural areas that were approximately a 1-h drive west of Metropolitan Toronto, in the Canadian province of Ontario. This school district was chosen for reasons of proximity but also because it contained urban and rural schools, and because the majority of schools still controlled their cafeteria operations, and thus offered better chances of access than a situation where these operations were largely privatized.[8] Interviews took place in 10 of the 12 high schools in this school district.

Interviewees were either school cafeteria managers, where one existed; or a member of the teaching staff who was assigned to be the school's student activity director, and who managed purchasing of food and beverage products for the school. Some schools had the latter arrangement because of the close relationship between revenue generation from cafeterias and vending machines and the ability to fund student activities in the school.

We used a semi-structured questionnaire to ensure uniformity of the data gathered, but to leave the possibility open for discovering new information and capturing the uniqueness of the food environment in each school. We recorded information about the different kinds of foods and beverages available in cafeterias, the volumes of all food and beverage items purchased on a daily basis in cafeterias, the preparation methods used (e.g., baking versus deep frying), the numbers of students using cafeterias each day, details about any existing school nutrition policies, and information about factors which informants felt affected the types of foods and beverages served. In the findings section we report the mean values for the various nutritional options in each category of serving (i.e., main meals, side dishes, etc.).

We also surveyed all vending machines found in each school and recorded their contents, as well as the contents of any "tuck shops" (in-school, student-run convenience stores heavily oriented to junk food sales) present, because the food environment of high schools includes more than cafeteria fare. Another innovative aspect of this study was

[6] For an in-depth discussion of the battles between food and beverage corporations and those opposed to marketing poor nutrition products in schools, see Simon (2006, especially Chapts. 10 and 11). Critics of the Blair Government's ad ban on junk foods in the UK argue that due to food industry lobbying, the ban does not go far enough in that it does not apply to programs watched by children and youth, but which are not specifically targeted to these audiences (Which? February 22, 2007). Others have argued that the legislation will not control brand advertising but only advertising of specific products; thus will have limited effect (see National Heart Forum, October 26, 2006).

[7] Among these limitations of the mail-in questionnaires that were utilized are low response rates in some cases; lack of control over who answered the questionnaire, and lack of knowledge of their experience base relevant to the issues covered in the survey instrument; and the fact they were largely limited to quantitative data collection. The authors of the surveys readily admit to these limitations in their published reports.

[8] The author was informed early on in the interview process by school principals that it was entirely up to the private operators whether they would consent to be interviewed in schools that had privatized their operations.

that it examined the food environment outside the school, but in close proximity to it. It was decided to survey the external food environment after interviewees indicated that in some schools at least, it was an important determinant of what foods and beverages were sold *in* the schools, and also how these were priced. We thus endeavored to map the existence of food vendors near the school, and the presence of fast food vendors in particular. We recorded all fast food vendors within a twenty minute walk or less of the school, as well as vendors within a five minute drive of the school. For each school, the variety of nearby food vendors and their distance from school property was noted.

Data from cafeteria staff were solicited for units sold of various edible products on a daily basis. Data on items purchased in the school were organized into four basic categories: "main meals" (e.g., pasta plate, hamburger, stir fry, *panzerotti*), "side dishes" (e.g., French fries, cut vegetables, salad), "desserts and snacks" (e.g., cookies, muffins, fresh fruit, fruit salad, brownies), and "beverages" (e.g., soft drink, chocolate milk, white milk, pure fruit juice, juice beverage, water). What we categorized as "side dishes," "snacks," and "beverage" items were almost always offered on a regular daily basis. "Main meals," on the other hand, were typically rotated through the week according to a fixed schedule in nearly all the schools sampled. Calculating units sold per day was not as straight forward as for "main meals." Calculations were made on the following basis: if a pasta dish, for example, was usually offered once a week throughout the school year and typically sold 50 units on that day, we considered this as having sold 10 units per day [50 units/5 days = 10 units/day].

These data were organized into three basic nutritional categories suggested by the Ontario Society of Nutrition Professionals in Public Health as guidelines for schools in an important recent report addressing nutrition in Ontario schools. These categories designated foods of "maximum", "moderate" and "minimum" nutrition (OSNPPH 2004, Table 7). Foods of "maximum" nutritional value were good or excellent sources of important nutrients, low in added fat, sugar and/or salt. They consisted generally of whole grains, vegetables and fruit, low fat milk products, and/or lean meats and alternatives. Foods in the "moderate" category were considered to have some positive nutritional value, but also possessed higher than desirable levels of fat, sugar and/or salt, often as a result of processing. Examples of these types of foods were: instant flavored oatmeal, ready-to-eat cereals, white pasta, canned fruit in syrup, popcorn, low fat muffins, higher-fat fluid milk, regular cheese products, frozen yogurt, lean luncheon meats, peanut butter with added sugar and oil, and fried eggs. Those in the "minimal" category are products typically high in fat, added sugar, salt, caffeine and/or calories, and tended to be highly processed and had a low value in most nutritional areas. These would include the usual assortment of junk foods, but also products not typically understood as a junk food, such as pre-sweetened breakfast cereals; granola bars, muffins and dessert breads made from commercially prepared mixes; fruit drinks and punches; deep fried, breaded vegetables; sports drinks; iced tea; processed cheese slices; wieners and luncheon meats; and fish sticks. Categorization of food products purchased by their nutritional content was facilitated by examples of specific food products provided in the OSNPPH report under a wide variety of food and beverage categories. For example, under the broad "grains" category a more limited category such as "cereals" was given. Under this category specific product examples within each of the three nutritional categories were provided (e.g., sugar coated or candied cereal and regular granola were listed as minimum nutrition products under the cereal category).

Our research parallels work done by Carter and Swinburn (2004, p. 16) in the New Zealand context that examined the extent to which primary schools could be considered to be "obesogenic"—that is, obesity promoting. The purpose of their study, which is similar to ours, was to identify and quantify environmental factors that may play a role in the promotion of unhealthy weight gain. Our study differs from their work in that it focuses on high schools, which tend to have a more developed food environment, and it entailed in-depth interviews with food staff in the schools, rather than relying on a mail-in questionnaire for data collection. In addition, their survey was national in scope, while this study was oriented to the level of a regional school district.

Findings

One feature that was unique to this study is that it sought to obtain data on what food was actually purchased (and presumably eaten) in each school (research question #1). This was accomplished via face to face interviews in each school that solicited detailed information from cafeteria personnel regarding the quantities of various kinds of food stuffs and beverages purchased over the course of a week in the school cafeteria. At a minimum this allowed us to estimate the relative proportions of foods and beverages of different nutritional value being purchased by students (seasonal variations in food offerings were also recorded).

In terms of a broad nutritional assessment of the food purchasing patterns at the high schools surveyed, the following came to light. A notable finding was the popularity of purchases high in fat, sugar and salt, such as French fries, cookies, muffins and soft drinks and fruit beverages, all of which were purchased in large quantities relative to

other items in nearly all of the schools studied (see Tables 1–4). These products were judged to be of minimum nutritional value by nutritionists (see OSNPPH 2004). While this may not surprise most observers of adolescent eating behavior, some may be surprised by the high volumes of these kinds of products purchased compared to healthier foodstuffs available. Notably, products of minimal nutritional value were mainly found as side dishes and dessert or snack items if eaten in the school cafeteria. Outside cafeterias, these items were ubiquitous in vending machines found in all schools and available to students at any time of the school day.

Foods judged to be of maximum or moderate nutritional value were most likely to be the main meal items. Cafeteria staff typically made an effort to have nutritional options offered daily for the main meal items. Nevertheless, it was generally the case that staff felt obliged to cater to student demand for fast food items as well (e.g., pizza, hamburgers), particularly when such items were easily available a short walk from the school, as was very often the case. Overall, meals judged to be of moderate or minimum nutritional value were on average 35% of main meal choices.

When it came to side dishes purchased, minimum nutrition choices were favored by students, with 55% of side dishes purchased on average of this type. In four of the schools approximately 70% of the side dish purchases were of a minimal nutrition nature. As might be expected, the snack/dessert category was where the highest proportion of minimum nutrition purchases were made, with an average 80% of purchases in this category for minimum nutrition products such as cakes, cookies, potato chips and the like. These were solely the cafeteria purchases, it should be restated, and did not account for purchases from school vending machines where minimum nutrition products or junk foods were overwhelmingly predominant.

A further finding was that the consumption of fresh fruit and vegetables was extremely low in almost all cases, and particularly so in the case of fruit. For example, in a typical surveyed high school of 1000-plus students, and despite the universal availability of fresh fruit in these school cafeterias, as little as 3–5 pieces of fruit *in total* per day were purchased. It is clear that when other poor nutrition snack and dessert products are available, the vast majority of students opted for them instead of fruit.

Students in surveyed schools were purchasing more products high in saturated fats and hydrogenated fats (trans fats) than desirable because of the popularity of such main meal items as hamburgers that are high in saturated fat and

Table 1 High school cafeteria main meals

High school	Maximum nutrition	Moderate nutrition	Minimum nutrition
1	75.2%	23.0%	1.7%
2	80.2%	15.4%	4.4%
3	56.6%	39.8%	3.6%
4	39.3%	40.4%	20.1%
5	65.1%	34.2%	0.6%
6	63.2%	26.6%	10.1%
7	92.1%	7.8%	0.0%
8	69.0%	22.3%	8.7%
9	67.9%	23.9%	8.1%
10	40.3%	56.1%	3.6%
Mean	64.9%	29.0%	6.1%
Standard deviation	16.5	14.0	6.0

Table 2 High school cafeteria side dishes

High school	Maximum nutrition	Moderate nutrition	Minimum nutrition
1	26.2%	0.0%	73.7%
2	18.7%	0.0%	81.3%
3	50.5%	0.0%	49.5%
4	50.7%	0.0%	49.3%
5	79.9%	0.0%	20.0%
6	7.8%	0.0%	92.0%
7	38.9%	0.0%	61.1%
8	94.7%	0.0%	5.3%
9	51.3%	0.0%	48.6%
10	31.2%	0.0%	68.8%
Mean	45.0%	0.0%	55.0%
Standard deviation	26.8		26.7

Table 3 High school cafeteria snack/dessert items

High school	Maximum nutrition	Moderate nutrition	Minimum nutrition
1	13.7%	17.5%	68.7%
2	0.9%	2.7%	96.3%
3	3.0%	17.8%	79.1%
4	0.6%	1.9%	97.5%
5	1.2%	2.4%	96.3%
6	4.5%	0.0%	95.5%
7	7.5%	10.4%	82.1%
8	2.2%	12.7%	85.1%
9	1.8%	9.8%	88.3%
10	2.7%	18.5%	78.8%
Mean	3.8%	9.4%	86.8%
Standard deviation	4.0	7.2	9.7

Table 4 High school cafeteria beverages

High school	Maximum nutrition	Moderate nutrition	Minimum nutrition
1	64.8%	0.0%	35.1%
2	60.8%	11.2%	28.0%
3	38.3%	14.5%	47.1%
4	44.7%	17.1%	38.0%
5	79.6%	7.1%	13.3%
6	60.0%	14.2%	25.8%
7	50.1%	24.8%	25.1%
8	58.9%	9.0%	32.1%
9	50.1%	3.4%	46.5%
10	86.6%	10.6%	2.7%
Mean	59.4%	11.2%	29.4%
Standard deviation	15.0	7.1	13.8

also the popularity of industrial baked goods (cookies, muffins, brownies, etc.) which were often made with hydrogenated oils. While a number of these schools could have prepared baked goods from scratch on-site utilizing unsaturated, non-hydrogenated oils, they typically did not do so because of staff shortages. Time constraints on staff necessitated the preparation of such items using pre-mixed product that may have been baked on-site.[9] It should be noted, however, that consumption of saturated fats in such perennial favorite side dishes as French fries was reduced because of decisions in most of the schools surveyed not to purchase a deep fryer. These items, and another popular main meal item—hamburgers—were baked in most schools, a healthier option.

Variations in the findings

Some schools did less well in the category main meals because they offered more fast food items that were high in fat and refined carbohydrates (e.g., hamburgers and pizza) and less of the healthier main meals, which tended to be more preparation-intensive as well. With respect to the side dish and snack/dessert categories where minimum nutrition products tended to dominate, two schools did relatively better in nutritional terms. These schools had made the choice not to offer such items as French fries and onion rings, but had placed more emphasis than was typical in offering well-prepared salads, cut vegetables, and such healthier side dish items as egg rolls.

[9] These remarks are based on interviews with respondents overseeing cafeteria and vending machine operations in high schools, a group composed of teachers with special duties as "student activity directors" and/or cafeteria managers depending on the school.

With respect to beverages sold in cafeterias, it should be noted that the relatively high volume of "healthy" beverages sold compared to the less nutritious items was ***not*** an accurate reflection of beverage purchases in the schools. Rather, in nearly all cases a decision had been made not to offer soft drinks in the cafeteria, which in itself is commendable. However, in all but one case, soft drinks were readily available in vending machines outside the cafeteria and in tuck shops, if one existed. The dismal nutritional picture with respect to vending machines is indicated in Table 5, where the results of our survey of vending machines in high schools are illustrated. Vending machines are a major mechanism for junk food manufacturers to market their products in these schools.

Determinants of the high school food environment

How are we to explain the fact that student food purchasing patterns in our study tended to be far from what would, from a nutritional perspective, be considered ideal, with far too many purchases of side dish and snack food and dessert items being in the minimum nutrition category, while high nutrition items such as fresh fruit and plain milk are largely avoided? Examining the determinants of the high school food environment was an important part of this study (research question #2). Part of the explanation would undoubtedly have to include the effects of aggressive mass advertising targeting children and youth, particularly on television and increasingly on the Internet, by the corporate purveyors of junk foods and fast foods, which substantially helps to create demand for these products. In 2005, the ten

Table 5 Nutritional categorization of vending machine products

High school	Food choices		
	Maximum nutrition	Moderate nutrition	Minimum nutrition
1	5%	2%	93%
2	4%	1%	95%
3	5%	7%	89%
4	3%	7%	90%
5	2%	0%	98%
6[a]	5%	10%	85%
7	10%	8%	81%
8	15%	15%	70%
9	12%	9%	79%
10	17%	3%	80%
Mean	8	7.30	84.90
Standard deviation	5	5	11

[a] Data for this school under represent the maximum and moderate nutrition options due to the end of school year depletion of these items

largest multinational manufacturers of these products spent a total of $7,616,600,000 on advertising their brands in the US alone, which was 119 times greater than the entire advertising budget for the US Federal Government's Department of Health and Human Services (Advertising Age 2005). As Power (2005) has argued, it is important to examine how the food industry has shaped social norms around eating. Such enormous amounts spent on advertising of products that are questionable from a nutritional standpoint cannot but help to "normalize" the consumption of such products on a regular basis, and indeed it could be argued that this is precisely one of the functions of such advertising. In any case, the role such advertising expenditures play in constituting a major structural barrier to healthy eating has been well covered in the literature.[10] In the context of this study, it must be noted that students do not, of course, cease to be influenced by such advertising once they enter the school. However, our research also brought to light other contributing factors that would seem to reinforce the influence of advertising of nutrient poor products. Salient among these factors are those that shape what food and beverages high schools offer students.

School cafeterias and vending machines, it should be noted, are now expected—given the provincial government cutbacks to education since the mid 1990s—to generate revenues to pay for a host of student activities and equipment needs, and even what might be considered essential parts of school infrastructure. Previous rounds of fiscal restructuring by the provincial government under Conservative Party rule (1995–2003) had largely eliminated monies coming from school boards for such expenses, according to respondents. This helps to explain why in a number of schools a teacher has been assigned to spend a significant part of their time organizing the school food environment and accessing student disposable income. As one of these activity directors told the author, "All the money you need for student activities walks in the door each day, and walks right out again [to purchase food and drinks] unless you can capture it in the school." In other words, as schools are left to fend for themselves to cover a number of their costs, they have been forced to view their students as customers, and cafeterias and vending machines as profit centers, to make up for revenues no longer coming from the school board.[11]

In one of our first interviews it became clear that additional factors shaped the in-school food environment as well. A key one was the food environment found in the immediate area *outside* the school. Once alerted to this by a respondent, we began mapping out this extra-school food environment for all schools studied. We found that most schools, with the exception of two suburban schools and one rural school, were within easy walking distance of several fast food outlets (see Table 6).[12] Estimates by respondents of the numbers of students who availed themselves of such extra school food venues indicated that they were well patronized by students. Our study was not able to determine whether fast food companies explicitly targeted high schools as part of their locational strategies, but it depicts a pattern found in one of the few other studies that has considered the relationship between schools and the fast food industry. As Austin et al. (2005, p. 1578) wrote in their study of fast food outlets and schools in Chicago:

> We found that although fast-food restaurants are located throughout the city, they are clustered in areas within a short walking distance from schools. We estimate that there are 3 to 4 times as many fast-food restaurants within 1.5 km from schools than would be expected if the restaurants were located around the city in a way unrelated to schools. *Nearly 80% of schools in Chicago had at least 1 fast-food restaurant within 800 m.* (emphasis added)

One of our schools sampled, an inner city school in close proximity to several fast food outlets and a deli in a large grocery store, illustrates the effects of nearby off-site food vendors on the in-school food environment. The respondent in this school noted that the school must compete with outside vendors on price and selection in order to capture student disposable income. This had implications for the in-school pricing of junk food and beverages. These items were located primarily in the school tuck shop, and were purposefully priced below that of outside vendors to capture revenue that would otherwise be lost to the latter. Given that research has shown the sensitivity of this age group to price with respect to different food and beverage offerings in schools (see Shannon et al. 2002), skewing the prices of unhealthy food and beverages in this manner likely influences food purchasing patterns in the schools and contributes to unhealthy eating in a significant manner.

Another factor that emerged as a notable determinant of the in-school food environment was the cafeteria staff reductions that most schools had faced due to provincial under-funding of schools within the last 10 years or so. Most respondents reported that staff reductions made it more difficult or even impossible to prepare meals, side

[10] For a review of this literature see Winson (2004, 2007) and McGinnis (2006).

[11] One respondent in charge of food services argued the need to maintain the level of revenue provided by junk food sales in vending machines because he did not want to give the school board any further reason to privatize food services in his school.

[12] Walking distance is key, because with the elimination of grade 13 in Ontario schools, only a relatively small percentage of the school population is now of driving age and able to bring a vehicle to school.

Table 6 Extra school food environments

School #	No. of fast food outlets and distance from school				
	0–5 min	6–10 min	11–15 min	16–20 min	5 min drive
1	0	0	0	1	2
2	0	7	0	0	0
3	6	3	0	0	0
4	4	4	0	0	0
5	0	7	0	0	0
6	0	3	3	0	5
7	2	0	0	0	5
8	1	1	0	0	0
9	0	0	0	0	0
10	3	0	0	0	5
Mean	1.6	2.5	0.3	0.1	1.7
Total	17.6	25	3.3	1.1	11.7

dishes, and desserts from scratch, and led to a dependence on prepared or semi-prepared industrial foods instead. When this occurred, nutrition was sacrificed to some degree.[13] When a school relied more on an outside supplier of a main dish, it was almost always a "finger food" type of item (panzerotti, pizza) of only moderate nutritional value. With desserts prepared or semi-prepared off-site, the issue was excess trans-fats and saturated fats in the products.[14]

It must be recognized that this was only an exploratory study; therefore, the study has some weaknesses. The size of the sample was small relative to the number of high schools in the province. While the sample contained non-urban schools, their numbers also were small. It also did not survey schools with for-profit privatized food services, or schools in the Catholic School Board (which in Ontario also receive public funding). Finally, it must be recognized that not all students depend heavily upon school food offerings, and the proportion of students sourcing food elsewhere appears to vary seasonally and by school location (for example, rural versus urban location).

The emerging struggle for healthy eating

Another research question we hoped this study would address concerns the formal and informal initiatives that influence the nutritional quality of the high school food environment (research question #3). In the absence of any broader initiative from government in this province to deal with serious nutritional issues in high schools, it was left to local initiatives to improve the situation. Our research indicated that these were largely informal in nature. The decisions of staff in most of the schools surveyed which resulted in actions not to purchase a deep fryer in the interests of avoiding the health perils of deep fried food is one area of informal initiative. Indeed, in one of the few schools where deep fryers were present, these had been purchased by the school board because the latter deemed it would be a necessary part of the culinary training offered to certain students in this school.

Local school initiatives to promote a healthier diet varied, with the boldest initiative being the elimination in one school of all soft drinks. This required the purchase of new vending machines, a considerable expense, so that healthier beverage options could be offered (because the soft drink supplier had provided vending machines and withdrew them when the contract was not renewed). Interestingly, the respondent at this school reported that no complaints had been received from students over the year since this change was made, though he did note difficulties in sourcing truly healthier snack food options for the vending machines. Revenues from vending machine sales had declined, but only to a minor degree. The fact that vending machines are typically provided by the company that supplies the products that fill them suggests one potent reason why changing the mix of products in them was no simple matter, and why other schools had not pursued this course of action. To do so would require not only the initiative to source alternative products, but also the pursuit of funds to buy new machines to replace the one supplied "free" by the junk food suppliers.

Other informal nutritional policies included concerted efforts made by staff in a few schools to promote salad and vegetable options to students, and to minimize junk foods in the cafeteria. Unfortunately these efforts to expand healthy eating in the schools were undermined by other factors, such as the perceived need to employ revenue-generating vending machines to cover a host of student activity expenses, and even the cost of basic infrastructure. Another key factor appearing to undermine healthier eating in schools was the corporate food environment surrounding most schools.

Conclusions

School food environments are presently in a tremendous state of flux, buffeted by powerful forces with conflicting objectives. On the one side, community activists, parents,

[13] On-site inspection by the author in some locations verified that hydrogenated oils were used in some pre-prepared products. It was not possible to check all pre-prepared products in all locations, however.

[14] In one school, for example, vending machine revenues were used to fund purchases of new school clocks and completion of the parking lot. Vending machine revenues can be considerable it would seem, as one respondent noted that annual revenues were in the range of $17,000–$20,000.

teachers and more recently provincial governments seek to remake them into sites for healthy eating. On the other side corporate food and beverage manufacturers and vendors fight to keep schools as lucrative markets while reinventing their product mix to provide ostensibly healthier options so as to retain a beachhead they have gained in the schools and expand their influence in future. Surveys of food availability in a number of Canadian provinces have confirmed that school food environments were fairly saturated with products of minimal nutritional value, and have been for some time. This may change, at least in some jurisdictions, although the jury is out on how thorough going the change impelled by sweeping new guidelines will ultimately be.

The present study offers evidence on school food environments that is more rigorous and detailed, though limited in scope, compared to recent school surveys in Canada. The study confirms that the widespread availability of nutrient poor foods in schools, as documented by research in both the US and Canada, is accompanied by widespread student purchases of products high in fat, sugar, and salt in the schools, despite the availability of more nutritious offerings. The study also suggests that side dishes, desserts, and snacks were the nutrient poor products most heavily purchased. Although the OSPPN guidelines for classifying foods according to their nutritional value proved very useful for this study, future research would benefit from an even more rigorous schema to aid the classification of hard-to-categorize foods.

The study suggests that key factors shaping the high school food environment include (a) funding shortfalls from the Ministry of Education, which encouraged the use of vending machines to make up needed revenue; (b) kitchen staff shortages, which encouraged the use of saturated and trans-fats laden baked goods prepared off-site, and prevented the more widespread preparation of healthier options from scratch; and (c) the presence of fast food outlets and vendors of low nutrition products in close proximity to most schools, which informants told us affected both the types of foods that schools could offer in order to compete effectively for students' disposable income, and also the prices charged for junk foods available in school tuck shops where those existed.

Remaking school food environments along the lines envisioned by policy makers in a number of jurisdictions would be a very positive step. However, a more thoroughgoing reversal in the current unhealthy eating patterns of youth, and the obesity-associated disease burden, will require policies that deal with such matters as the ubiquitous presence of multinational fast food operations in close proximity to schools. Policies will also have to firmly deal with the aggressive saturation advertising of products high in fat, sugar, and salt presently directed to children and adolescents outside of schools. The example of Britain (Ofcom 2006), where a ban on advertising of all such products on television and other media directed to children and youth is currently being implemented,[15] shows what can be done were the political will exists.

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[15] Critics of the Blair Government's ad ban on junk foods in the UK argue that due to food industry lobbying the ban does not go far enough because it does not apply to programs watched by children and youth that are not specifically targeted to these audiences (Gibson and Smithers, November 18, 2006). Others have argued that the legislation will not control brand advertising but only advertising of specific products and thus have limited effect (see National Heart Forum, October 26, 2006).

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